April 10, 1962 M. MARTINEZ 3,029,039

APPARATUS FOR COILING WIRE

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Fig. 1.

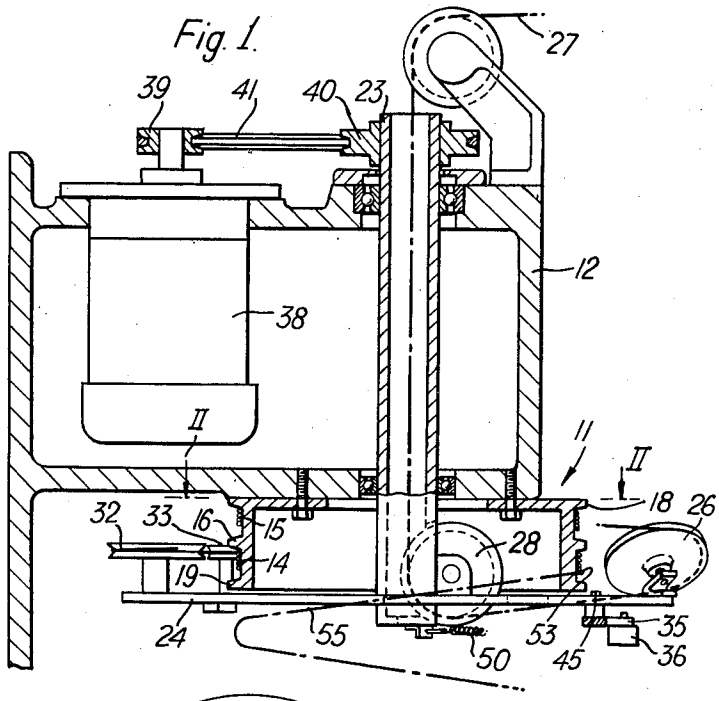


Fig. 2

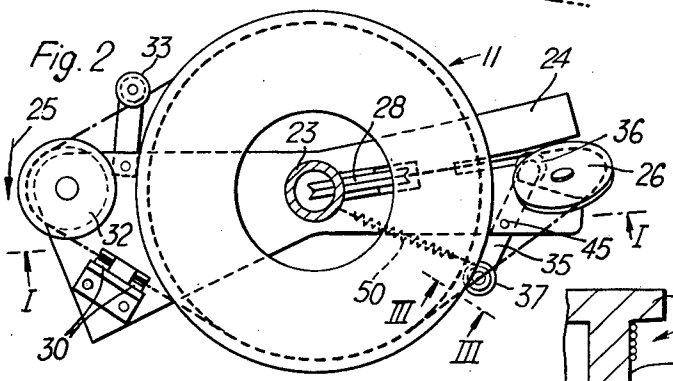
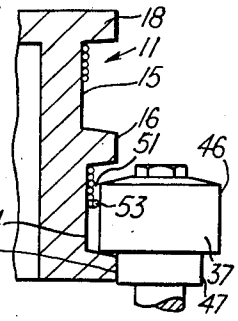


Fig. 3.



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Fig. 4.

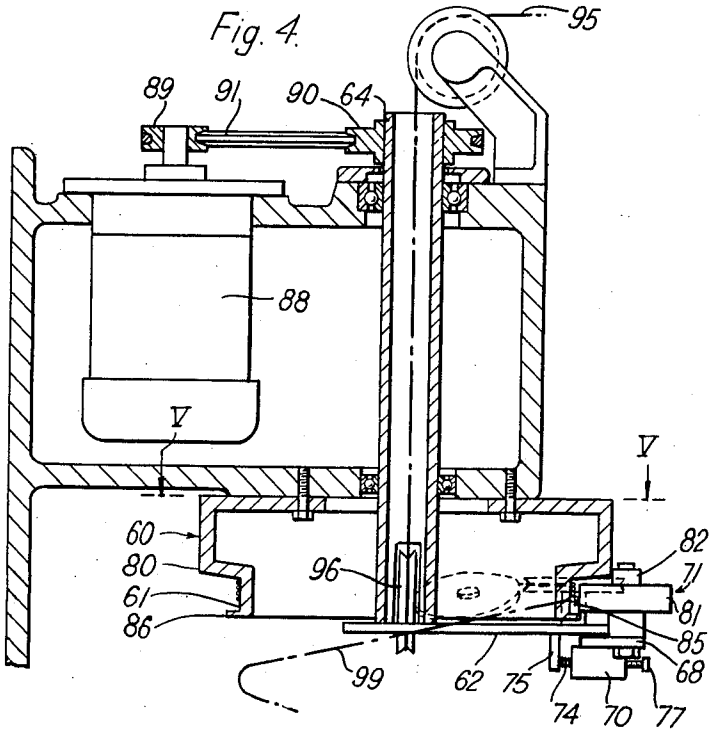
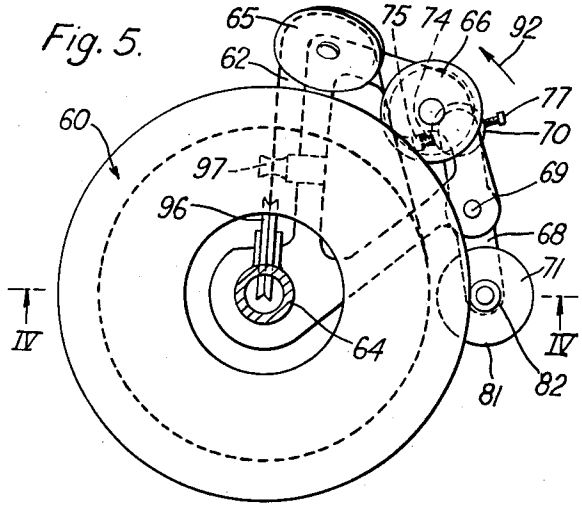


Fig. 5.



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Fig. 6.

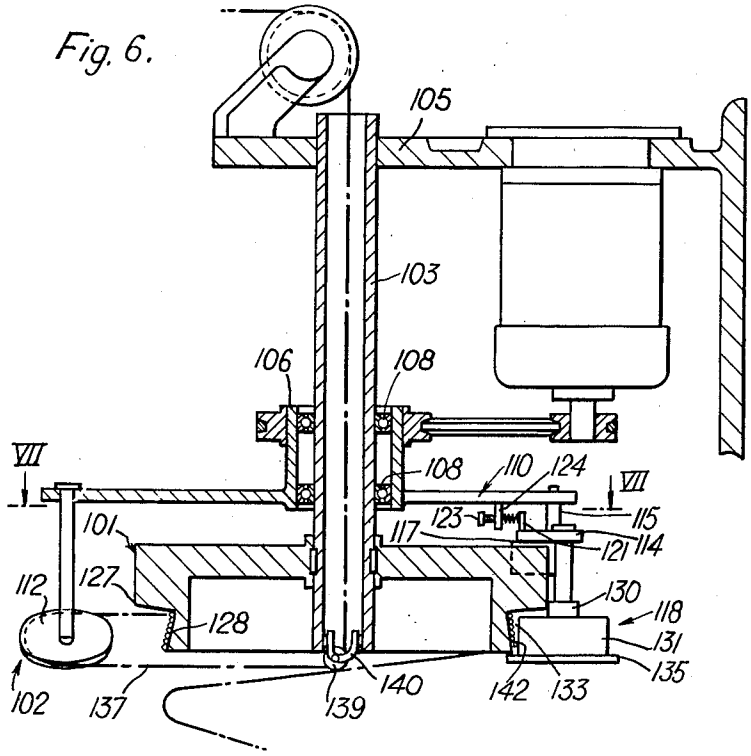
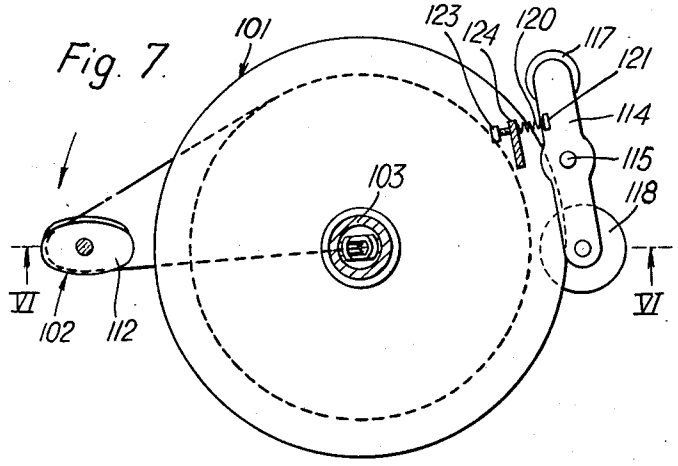


Fig. 7.



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Fig. 8.

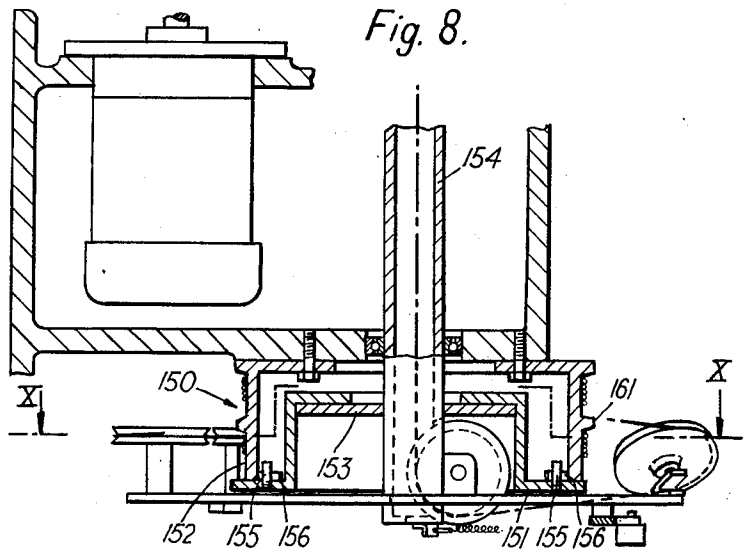


Fig. 9.

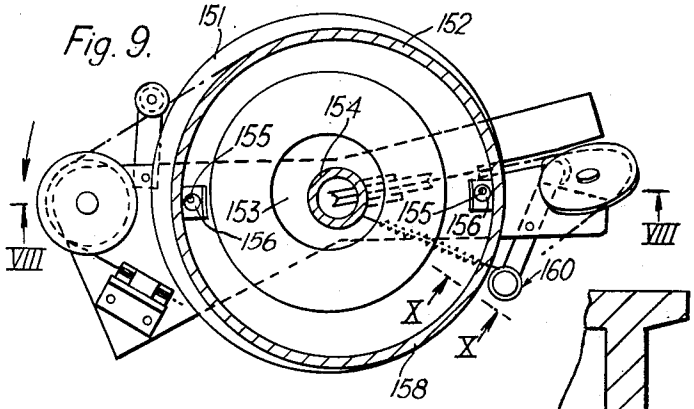
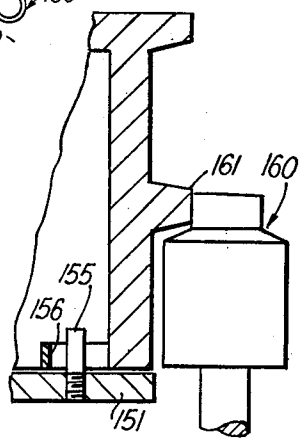


Fig. 10.



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3,029,039

APPARATUS FOR COILING WIRE

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Filed Jan. 8, 1960, Ser. No. 1,383
Claims priority, application Great Britain Jan. 13, 1959
17 Claims. (Cl. 242—82)

This invention relates to an improved method of and apparatus for coiling wire, and is applicable to both rotating and stationary drum wire drawing and/or coiling machines, particularly to those machines in which the drum axis is vertical.

In wire drawing and/or coiling machines in which in operation, wire is coiled on one end of the drum and delivered in coiled form from the opposite end, the coils of wire at the delivery end of the drum tend to become slack, and there is a danger that this slackness will be transmitted to all the coils which should be tight on the drum, so that these coils no longer grip the drum and further coiling operation of the machine is brought to a stop.

It is one object of the invention to provide an improved method and apparatus for coiling wire in a wire coiling and/or drawing machine in which any loose coils are tightened.

According to the invention there is provided a method of coiling wire in a wire coiling and/or drawing machine, comprising coiling wire on one end of the drum of the machine, and applying a frictional force to the outer surfaces of one or more slack coils on the drum in such a direction as to tend to tighten them round the drum, and delivering coiled wire from the drum at the end thereof opposite said one end.

Also according to the invention, there is provided a wire coiling and/or drawing machine in which in operation wire is coiled on one end of a drum and delivered in coiled form from the opposite end, including a member which is so disposed and arranged as to engage the outer surfaces of one or more coils of wire which during operation become slack on the drum, and means serving in operation to cause the engagement surface of the member to move relative to said slack coils so as to produce a friction force which acts on said outer surfaces in such a direction as to tend to tighten such slack coils round the drum.

Preferably, the arrangement of the member is such that it will engage only the outer surfaces of coils which become slack. Thus the action of said member may often be intermittent in that it will only act on coils which become slack, generally one or more coils at or near the delivery end of the drum. The size and position of the member will be such that the distance between the engagement surface of the member and the surface of the drum is greater than the diameter of the wire being coiled. The slack coils will of course, have a coil diameter greater than the diameter of the drum, and as has been stated, the member must be so disposed and arranged as to be able to engage the outer surfaces of one or more slack coils of wire on the drum.

One particularly important application of the present invention is to machines having a drum whose axis is vertical. Machines of this kind are generally preferred since coiled wire can drop vertically off the end of the drum instead of along an arcuate path as is necessary in machines whose drum axis is horizontal. However, there is the major difficulty of preventing the coils of wire on the drum from falling off the delivery end of the drum as soon as they become slack.

In order to solve this difficulty, preferably, in machines whose drum axis is vertical, the diameter of the

drum at the delivery end thereof is greater than the diameter of the drum where wire is wound on the drum, said member serving in operation to prevent the coil diameter of coils on the drum from exceeding the diameter of the drum at the delivery end. Thus even though the coils on the drum should become slack, they are prevented from falling off the delivery end of the drum by maintaining their coil diameter less than the drum delivery end diameter.

Preferably, the increased diameter at the delivery end of the drum is provided by an outwardly projecting flange. Although this is satisfactory for normal operating speeds, it may be desirable to avoid the use of a flange for example with high speed machines, and one possible alternative is to taper the drum outwardly towards the delivery end thereof.

If the machine is a rotating drum machine, the member will normally be fixed in position relative to the drum. The engagement surface of the member which is adapted to engage the slack coils may be driven for example, through a gear train from the drive to the drum, but preferably, said surface of the member is movably driven by the drum or a part fixed thereto.

If the machine is a stationary drum machine having guide means rotatable about the drum to wind the wire thereon, preferably said member is arranged to rotate round the drum synchronously with the guide means, for example, by mounting the member on the guide means. The movement of said engagement surface of the member may be derived in any convenient way. It is preferred, however to derive such movement from the rotation of the member round the drum relative to a stationary surface concentric with the drum. This stationary surface may advantageously form part of the circumference of the drum, although alternatively, for example, a stationary annular internal gear concentric with and surrounding the drum can be used.

In order to control the delivery of coiled wire from the drum, preferably either the drum or the member has a surface which in operation, so overlaps the other, i.e. the member or the drum, at the delivery end of the drum, that coils of wire on the drum cannot slip off at the location of the member unless the member is first separated from the drum. The drum and the engagement surface of the member can be considered as forming a slot through which in operation, the coils of wire extend, and the overlapping surface between the drum and said engagement surface closes the slot at the delivery end thereof.

The member can be a continuous flexible band or chain so mounted on two spaced pulleys as to be adapted to engage the outer surfaces of one or more slack coils on the drum over a portion of its length intermediate the pulleys. Preferably, however, the member is a roller rotatably about its own axis.

One simple way of deriving drive for the roller regardless of whether the machine is a stationary or rotating drum machine, is to provide both the roller and the drum with two parts of different diameter, which parts are so dimensioned and arranged that when the part of smaller diameter of the roller rolls on the part of larger diameter of the drum, the part of larger diameter of the roller is adapted to engage said outer surfaces of slack coils of wire, the wire being coiled on the part of smaller diameter of the drum.

There will now be described by way of example only some preferred embodiments of a stationary drum wire coiling machine according to the invention with reference to the accompanying drawings in which:

FIG. 1 is a diagrammatic vertical cross-sectional view of a first embodiment taken on the line I—I of FIG. 2.

FIG. 2 is a diagrammatic cross-sectional plan view taken on the line II—II of FIG. 1.

FIG. 3 is an enlarged view taken on the line III—III of FIG. 2 showing details of a roller engaging a flange on the drum.

FIG. 4 is a diagrammatic vertical cross-sectional view of a second embodiment taken on the line IV—IV of FIG. 5.

FIG. 5 is a diagrammatic cross-sectional plan view taken on the line V—V of FIG. 4.

FIG. 6 is a diagrammatic vertical cross-sectional view of a third embodiment taken on the line VI—VI of FIG. 7.

FIG. 7 is a diagrammatic cross-sectional plan view taken on the line VII—VII of FIG. 6.

FIG. 8 is a diagrammatic vertical cross-sectional view of a fourth embodiment taken on the line VIII—VIII of FIG. 9.

FIG. 9 is a diagrammatic cross-sectional plan view taken on the line IX—IX of FIG. 8, and

FIG. 10 is an enlarged view taken on the line X—X of FIG. 9.

In the first embodiment shown in FIGS. 1, 2 and 3 the drum **11** is fixed to the frame **12** of the machine with the drum axis vertical. The surface of the drum **11** is provided with two annular portions **14**, **15** the lower portion **14** having a slightly greater diameter than the upper portion **15** (see FIG. 3) and being separated therefrom by a flange **16**. There is also an upper flange **18** above the upper annular portion **15** and a lower outwardly projecting flange **19** below the lower annular portion **14**.

A hollow spindle **23** is rotatably mounted coaxially in the drum **11** and a member **24** extending on opposite sides of the spindle **23** is secured thereto below the drum and is rotated in operation by the spindle **23** in the direction of the arrow **25**. The member **24** extends outwardly beyond the drum **11**, and a guide pulley **26** is rotatably mounted at one end thereof, which guide pulley **26** is so disposed and arranged as to guide onto the upper end of the upper portion **15** of the drum, wire **27** which has passed down through the spindle and over the pulley **28** to whose circumference the spindle axis is tangential.

At the opposite end of the member **24**, there are some casting rolls **30** known per se and two pulleys **32** and **33**, wire being drawn in operation from the lower end of the upper portion **15** of the drum, through the casting rolls **30** and over the pulleys **32** and **33** onto the upper end of the lower portion **14** of the drum.

An arm **35** which is disposed approximately tangential to the drum, is pivotally mounted on the member **24** adjacent the guide pulley **26**, and carries at one end a counterweight **36** and at the other, a rotatably mounted roller **37**. The counterweight **36** is so chosen that in operation on rotation of the spindle **23** by the motor **38** by way of pulleys **39**, **40** and pulley belt **41**, the centrifugal forces acting on the roller **37** and the counterweight **36** having equal moments about the pivot point **45** of the arm i.e. the centre of gravity of the arm **35** with the roller **37** and counterweight **36** on it is coincident with the pivot point **45**. The roller **37** comprises two parts **46**, **47** of different diameter, the upper part **46** being the larger, and the upper and lower parts **46** and **47** being disposed respectively opposite the lower annular portion **14** of the drum, and the lower flange **19** of the drum. An adjustable tension spring **50** is connected to the pivoted arm **35** and urges the end of the arm carrying the roller **37** inwardly so that the part **47** of the roller cooperates with the lower flange **19** of the drum. The tension spring **50** controls the operative bearing pressure between the roller and the lower flange **19** of the drum. When the roller **37** is in its cooperating position, as shown in FIG. 3 the upper side of the lower flange **19** of the drum so extends into the step between the parts **46** and **47** of the roller **37** that wire cannot enter between the lower flange **19** and the roller **37**. Thus the lower flange **19** of the drum constitutes an overlapping surface between the drum **11** and the roller **37**, which overlapping surface closes one end of a slot **51** which extends between the part **46** of the roller and the lower annular portion **14** of the drum, the slot **51** being wider than the diameter of wire to be coiled.

In operation, the spindle **23** is rotated, by the motor **38**, thereby causing the member **24** and the parts mounted thereon to rotate in the direction of the arrow **25** (FIG. 2). The spindle **23** and the connected parts are dynamically balanced to avoid undue stresses on the bearings of the spindle.

As the guide pulley **26** rotates round the drum **11**, winding wire onto the upper annular portion **15** thereof, the casting rolls **30** and the second pulley **32** synchronously transfer the lowest coil from the upper annular portion **15** to the upper end of the lower annular portion **14** of the drum which is of slightly larger diameter than the upper portion **15**. The coils of wire on the lower annular portion are, therefore, under a greater tension than the coils on the upper annular portion, which factor assists in forming a good coil. Furthermore, the coils on the lower annular portion **14** extend through the slot **51** formed between the lower annular portion **14** and the part **46** of the roller.

The member **24** is so shaped as to allow the lowest coil **53** on the lower annular portion **14** of the drum to be continuously withdrawn therefrom over the lower flange **19** of the drum in synchronism with rotation of the spindle **23**.

The operation of the roller **37** is as follows: Since the part **47** of the roller **37** cooperates with the lower flange **19** of the drum, as the member **24** is rotated by the spindle **23**, this part **47** of the roller rolls on the lower flange **19**. Thus the part **46** of the roller of larger diameter has a greater circumferential velocity than the part **47** of smaller diameter, so that the circumference of the part **46** has a velocity relative to the outer surfaces of the coils, whether tight or slack on the lower annular portion **14** of the drum. If some of the coils on the lower annular portion become slack e.g. such as coil **53**, they spring outwards and if at the location of the slot **51** they come into contact with the circumference of the part **46** of the roller, the relative velocity and the contact pressure produce a friction force which acts on the outer surfaces of the contacting slack coils in the opposite direction relative to the drum to the direction in which wire is being wound thereon by the guide pulley **26**. This friction force therefore, tends to counter further slackening of the slack coils on the lower annular portion **14** of the drum, and can effect a tightening action on the slack coils round the drum. The overall effect of the action of the roller **37** is that even though coils of wire at the delivery end of the drum do become slack, they are maintained tight enough to prevent them from dropping past the lower flange **19** on the drum and from losing their grip on the drum. At the location of the roller **37**, of course, the overlapping surface of the lower flange **19** of the drum prevents any coils from dropping off the drum. It will be understood that the coil being withdrawn leaves the drum beyond this location as indicated by the coil **55** in FIG. 1.

Furthermore, it will be appreciated that with this type of machine, if the lower flange **19** was not provided on the drum, slack coils which dropped off the delivery end of the drum would come into contact with the rotating member **24** and this member, by virtue of its direction of movement, would then tend to increase the slackness of the coils on the drum.

The second embodiment shown in FIGS. 4 and 5 is generally similar to the first, the drum **60** having only one annular portion **61** of uniform diameter on which wire is coiled, and the casting rolls **30** and the pulleys **32** and **33** shown in FIGS. 1 and 2 being omitted.

The member 62 secured to the spindle 64 extends outwardly with respect to the drum, and two guide pulleys 65, 66 are mounted on the end of the member 62. An arm 68 which is approximately tangential to the drum 60 is pivotally mounted at 69 on the member 62 adjacent to the pulleys 65, 66, and as previously, carries at one end a counterweight 70, and at the other end a rotatably mounted roller 71, the counterweight 70 serving the same purpose as described above in connection with the first embodiment. The roller 71 is urged towards the drum by a compression spring 74 which extends from a stop 75 secured to the member 62, into a hole (not shown) in the counterweight 70. The compression of the spring 74 is adjustable by means of a screw-threaded bolt 77 extending into the hole of the counterweight 70 from the opposite side thereof relative to the compression spring.

Above the annular portion 61 of the drum 60 on which wire is coiled, there is an annular collar 80 of larger diameter than said annular portion 61. The roller 71 has two parts 81, 82 of different diameter, the upper part 82 being of the smaller diameter, and the parts 82, 81 of the roller are disposed respectively opposite the collar 80 and the annular portion 61 of the drum. The compression spring 74 in operation urges the part 82 of the roller into contact with the collar 80, and when the roller is in this position, a slot 85 which is wider than the diameter of wire to be coiled, is formed between the part 81 of the roller and the annular portion 61 of the drum. At the lower end of the annular portion 61 of the drum, there is a flange 86 which overlaps part of the lower face of the roller 71, and is adjacent thereto, so that wire cannot pass between said lower face and the flange 86 unless the roller 71 is first separated from the drum 60. The flange 86, in effect, closes the lower end of the slot 85.

As previously, the spindle 64 and the parts connected thereto may be dynamically balanced by securing to the spindle a counterweight (not shown) so that the counterweight lies within the drum.

In operation, the spindle 64 is rotated by the motor 88 by way of the pulleys 89, 90 and pulley belt 91 in the direction of the arrow 92 (FIG. 5), and wire 95 is drawn down the interior of the spindle, round a pulley 96 to whose circumference the spindle axis is tangential, over a rotatable flanged roller 97 mounted on the member 62, round the outside of pulley 65, under the pulley 66 and onto the upper end of the annular portion 61 of the drum. The action of coiling wire on the upper end of the annular portion 61 of the drum causes the coils already wound thereon to move axially down the drum so that they enter the slot 85 between the part 81 of larger diameter of the roller and the annular portion 61 of the drum.

The part 82 of smaller diameter of the roller 71 rolls on the collar 80 of the drum, thus causing the roller to rotate about its own axis. It is believed that the action of the roller will be apparent from the description that has already been given with reference to the first embodiment. As previously the lowest coil of wire is withdrawn continuously from the drum past the flange 86 thereon in synchronism with rotation of the spindle 64 as indicated by the coil 99 in FIG. 4.

In the third embodiment shown in FIGS. 6 and 7, the machine operates according to the same principle of operation of the two previous embodiments, that is, the drum 101 is stationary and has a vertical axis, and wire is drawn in operation through the drum and over a guide means 102 onto the drum by rotation of the guide means round the drum, the coiled wire being drawn off the lower end of the drum in synchronism with rotation of the guide means. The principal difference in this embodiment lies in the means of rotating the guide means.

The drum 101 is maintained stationary by securing it to a hollow shaft 103 whose upper end is secured to the frame 105 of the machine. Surrounding the shaft, there is a sleeve 106 which is rotatably mounted on the shaft

by bearings 108, and a member 110 which extends outwardly with respect to the drum is secured to the sleeve 106. At one end of the member 110, there is a rotatably mounted pulley 112, and at the other end of the member 110, there is an arm 114 which is pivotally mounted at 115 on the member and which as previously carries at one end a counter weight 117 and at the other end a rotatably mounted roller 118. The arm 114 is approximately tangential to the drum 101, and the counterweight 117 serves the same purpose as has been mentioned previously. The roller 118 is urged towards the drum by a compression spring 120, one end of which bears against a lateral projection 121 of the arm 114, and the other end of which is adjustable by a bolt 123 which extends through a screw-threaded hole in an anchor plate 124 connected to the member 110. Thus, the degree of compression of the spring 120 can be adjusted by turning the bolt 123.

On the drum 101, there is an upper flange 127, and beneath the flange, the drum tapers sharply inwardly and then more gradually outwardly (over a portion 128) to the termination of the drum, the greatest diameter of this portion 128 being less than the diameter of the flange 127. The degree of taper of portion 128 has been shown exaggerated in FIG. 6 for clarity.

The roller 118 is provided with two parts 130, 131 of different diameter, the upper part 130 being the smaller, and these parts 130, 131 are disposed respectively opposite the flange 127 and the tapered portion 128. When the roller 118 engages the flange 127 on the drum, a slot 133, which at its narrowest part is wider than the diameter of wire to be coiled, is formed between the part 131 of the roller and the tapered portion 128 of the drum. At the bottom of the roller, there is a flange 135 which overlaps part of the end of the drum and is adjacent thereto so that wire cannot pass between said end of the drum 101 and said overlapping flange 135 unless they are first separated. The flange 135, in effect, closes the lower end of the slot 133.

In operation the member 110 which is secured to the sleeve 106 is rotated by a motor which is drivingly connected to the sleeve by a pulley-belt drive. The guide pulley 112 on the member 110 serves to guide wire 137 onto the upper end of the drum adjacent the flanges 137 thereof, which wire is drawn through the hollow stationary spindle 103 and round a pulley 139 which is rotatably mounted in a bracket 140 which is itself rotatably mounted in the end of the stationary spindle 103, the wire then passing outwardly with respect to the drum to the guide pulley 112.

Since the roller 118 coacts with the flange 127 on the drum, when the member 110 rotates, the roller 118 is forced to rotate about its own axis. It is believed that the operation of the roller 118 will be apparent from the description that has already been given. As the guide pulley 112 rotates round the drum 101 winding wire on the upper end thereof, the wire coils on the drum are forced down the tapered portion 128 into the slot 133 between the roller 118 and the drum, the taper of the portion 128, and the roller 118 serving to counter the slackening tendency of the coils. The lower coil 142 is continuously withdrawn from the bottom end of the drum, and the flange 135 on the end of the roller which overlaps the end of the drum serves to ensure that the coils of wire can only be withdrawn from the drum in synchronism with rotation of the guide means 102 round the drum.

The fourth embodiment which is shown in FIGS. 8, 9 and 10 is a modified form of the first embodiment (FIGS. 1, 2 and 3), so reference will only be made to those parts that are additional to or differ from the corresponding parts of the first embodiment.

As shown in FIG. 8, instead of the drum 150 having a fixed flange at its delivery end (see 19 FIG. 1), a separate flange member 151 of slightly larger diameter than

the drum portion **152** is provided which is arranged so that its circumference is adjacent the delivery end of the drum. The flange member **151** is supported in position by a disc **153** which is secured eccentrically relative to the spindle **154** so as to be rotatable therewith, the disc **153** being rotatable within and relative to the flange member **151**. The flange member **151** is prevented from rotating by means of two pins **155** secured thereto which extend into respective orifices **156** in the drum **150**. These orifices **156** are larger than the diameter of the pins **155** so that when the spindle **154** rotates, the disc **153** causes the flange member **151** to move so that the point **158** on its periphery which projects least outwardly of the drum moves round the drum lagging a short distance behind the roller **160**.

As shown in FIG. 10, the roller **160** is driven so as to rotate about its own axis by engaging the flange **161** of the drum **150**.

In operation, as the spindle **154** rotates, the lowest coil of wire on the portion **152** drops off the drum at the point **158** as the latter moves round the drum, i.e. the wire drops off the drum in synchronism with the rate at which it is wound on the drum. The operation of the roller **160** is the same as that previously described.

I claim:

1. A wire coiling mechanism in which wire is coiled on one end of a drum and delivered in coiled form axially off the opposite end, including a member spaced from the periphery of said drum a distance greater than the diameter of the wire being coiled to engage the outer surfaces of any coils of wire which become slack on the drum, and means to cause the surface of the member adjacent said wires to move relative to said coils so as to produce a friction force thereon which acts on said outer surfaces in such a direction as to tend to tighten such slack coils round the drum.

2. A mechanism as claimed in claim 1 in which the drum axis is vertical, the diameter of the drum at the delivery end thereof being greater than the diameter of the drum where wire is wound on the drum, said member serving in operation to prevent the coil diameter of coils on the drum from exceeding the diameter of the drum at the delivery end.

3. A mechanism as claimed in claim 2 in which the increased diameter of the delivery end of the drum is provided by an outwardly projecting flange thereof.

4. A mechanism as claimed in claim 1 in which the drum axis is vertical, a separate flange member being provided adjacent the delivery end of the drum as to prevent coils of wire which are maintained tight on the drum by said member from being released from the drum except at a release point defined by the said flange member, said flange member being laterally movable relative to the drum so that in operation, said release point traverses round the drum circumference in synchronism with the rate of winding wire on the drum.

5. A mechanism as claimed in claim 4 in which said flange member is eccentrically mounted relative to the drum axis and has a greater diameter than the diameter of the drum, the flange member being non-rotatable relative to the drum but mounted for limited lateral translational movement relative thereto sufficient to permit said release point to traverse round the drum.

6. A mechanism as claimed in claim 1 in which the machine is a rotating drum machine, said member being fixed in position relative to the drum and the wire-engaging surface of the member which is adapted to engage slack coils being movably driven by the drum.

7. A mechanism as claimed in claim 1 in which the mechanism is a stationary drum machine having guide means rotatable about the drum to wind the wire thereon, the member being arranged to rotate round the drum synchronously with the guide means.

8. A mechanism as claimed in claim 7 in which the movement of the wire-engaging surface of the member is produced by the rotation of the member round the drum relative to a stationary surface concentric with the drum.

9. A mechanism as claimed in claim 8 in which said stationary surface forms part of the circumference of the drum.

10. a mechanism as claimed in claim 1 in which the drum and the member are provided with overlapping surfaces at the delivery end of the drum, so that coils of wire on the drum cannot slip off at the location of the member unless the member is first separated from the drum.

11. A mechanism as claimed in claim 1 in which the member is a roller rotatably mounted about its own axis.

12. A mechanism as claimed in claim 11 in which both the roller and the drum have two parts of different diameter, which parts are so dimensioned and arranged that when the part of smaller diameter of the roller rolls on the part of larger diameter of the drum, the part of larger diameter of the roller is adapted to engage said outer surfaces of slack coils of wire, the wire being coiled on the part of smaller diameter of the drum.

13. A mechanism as claimed in claim 12 in which the part of larger diameter of the drum is located at the end opposite the delivery end thereof.

14. A mechanism as claimed in claim 12 in which the part of larger diameter of the drum is located at the delivery end thereof and forms the overlapping surface between the drum and the member.

15. A mechanism as claimed in claim 11 in which the roller is mounted on a pivoted arm which is urged by means of a spring in such a direction as to bring the roller and the drum into coacting relationship.

16. A mechanism as claimed in claim 15 in which the arm is provided with a counterweight and is pivoted intermediate the roller and said counterweight whereby if the roller is rotated about a stationary drum, the counterweight counterbalances the roller on the arm so that the bearing pressure between the roller and the drum is independent of the rate of rotation of the roller about the drum.

17. A mechanism as claimed in claim 1 in which the mechanism is of the type having a stationary drum whose axis is vertical, wire being drawn in operation through the drum and over a guide means onto the drum by rotation of the guide means round the drum, the coiled wire being drawn off the lower end of the drum in synchronism with rotation of the guide means, and the latter being rotatably supported adjacent one end of the drum.

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