Sept. 4, 1956 H. A. GEORGE 2,761,630

COIL WINDING APPARATUS WITH INTEGRAL TENSION MEANS

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Fig. 1.

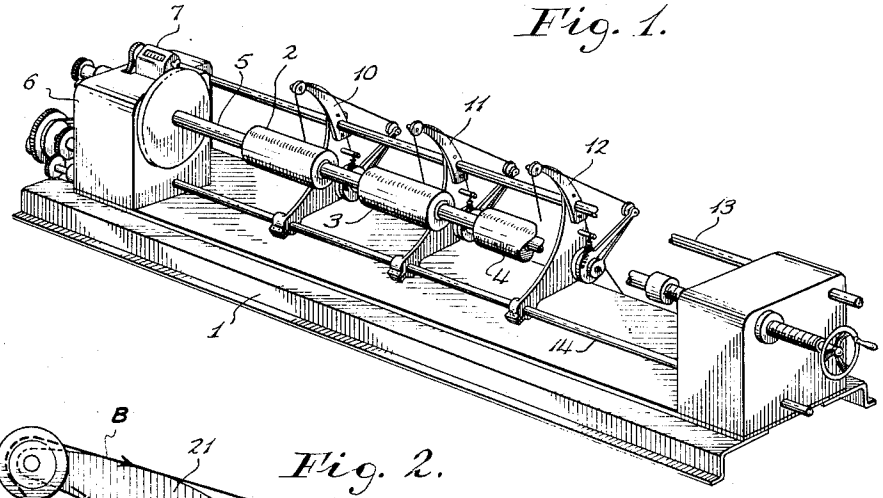


Fig. 2.

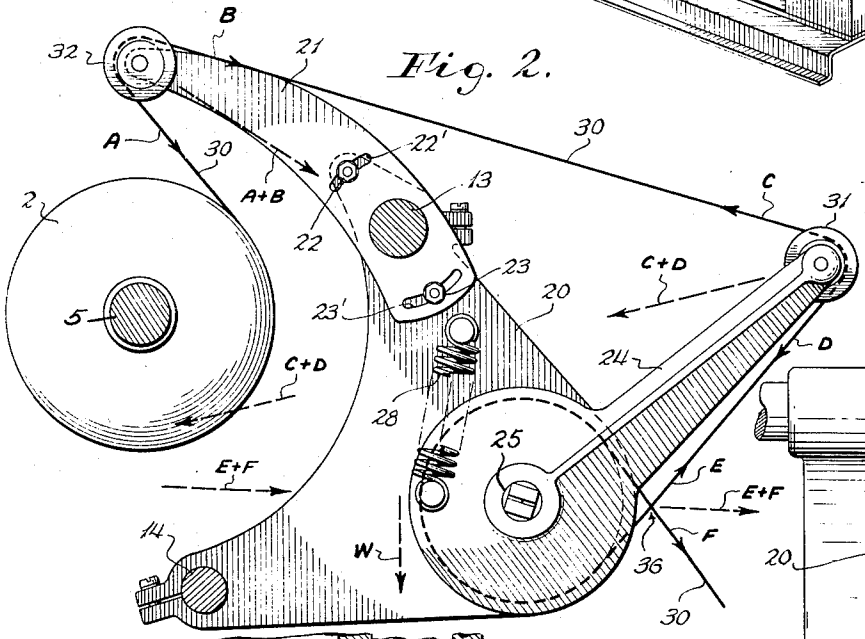


Fig. 3.

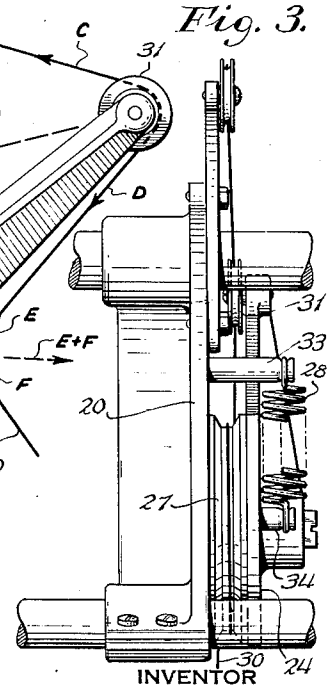
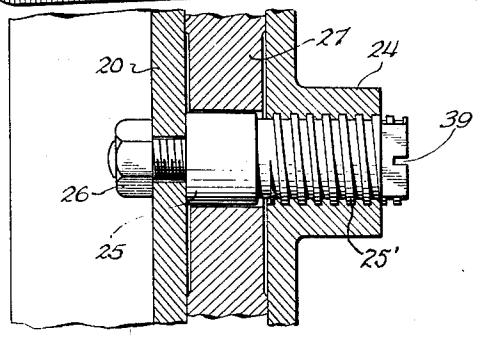


Fig. 4.



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COIL WINDING APPARATUS WITH INTEGRAL TENSION MEANS

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3 Claims. (Cl. 242—9)

This invention relates to tension adjusting means and more particularly to such means for coil winding machines.

In the handling or feeding of wires, for instance in coil winding machines, it is necessary that a constant tension be applied to the wire being wound on the coil form so that the coil may be uniformly, strongly and neatly wound. There will be frequent changes in tension especially if the coil form is not round but is square or rectangular. If the tension varies erratically the windings on the coil will not be uniformly spaced, and may become very loosely wound and have loops and crossovers. This problem may be visualized by anyone who has ever wound a fishing line by hand about a reel. Furthermore, in the coil winding machine, the feeding apparatus should preferably be moved transversely along the coil form in order to lay the wire on the form in parallel arrangement. This is especially true in the case of fairly long coil forms.

In winding coils of wire, the coil will apply a considerable amount of force to the tensioning device. If the tensioning device is mounted externally to the coil winding machine, this results in a large and erratic force which tends to pull over the coil winding machine. This external tensioning arrangement therefore requires very heavy mountings for both the machine and the tensioning device in order to withstand this varying force on the winding machine.

The present invention incorporates a novel tensioning device as an integral part of the coil winding machine apparatus being designed so that there is little or no force tending to displace the coil winding machine. Since the tensioning device of the present invention is an integral part of the coil winding machine, the various force vectors may be arranged to substantially cancel each other out so that there is a minimum resultant force on the coil winding machine. Therefore, since the entire apparatus is integral, it may be accurately balanced and adjusted so that there is no need of very heavy mountings or very heavy components in the apparatus.

Accordingly, a principal object of the invention is to provide new and improved tensioning apparatus for feeding wires and the like.

Another object of the invention is to provide a coil winding machine having integral tensioning apparatus whereby the force vectors, due to the tension of the wires, are confined within the machine so that there is a minimum resultant force tending to displace the machine itself.

Another object of the invention is to provide new and improved coil winding apparatus having tensioning means integral therewith to provide a substantially, completely balanced wire handling system which may be built of light weight components.

Another object of the invention is to provide new and improved coil winding apparatus.

Another object of the invention is to provide new and improved coil winding apparatus including tensioning means which are integral with the coil winding machine and also adapted to move transversely with respect to the coil form wound.

Another object of the invention is to provide tensioning apparatus for a coil winding machine comprising a mounting bracket, a shaft member having a threaded stud on one end, said stud being adapted to bolt said shaft member to said mounting bracket; a pulley brake member rotatably mounted on said shaft, said shaft being threaded at its other end and a tensioning arm tapped to receive said other threaded end of said shaft member, whereby when the tensioning arm is moved by the tension on the wires it will move along the shaft member and vary the braking pressure against the brake member to compensate for the variation in tension.

Another object of the invention is to provide new and improved tensioning apparatus having a spring loaded tensioning arm and braking means for said tension arm connected and adapted to compensate for changes in tension of the material being fed.

These and other objects of the invention will be apparent from the following specification and drawings of which:

Figure 1 is a perspective view of a coil winding machine having transversely mobile tensioning devices.

Figure 2 is a section view of a tensioning device embodiment of the present invention.

Figure 3 is a front view of the embodiment of Figure 2.

Figure 4 is a detail view of the embodiment of Figures 2 and 3 illustrative of the braking operation.

Referring to Figure 1, there is shown a coil winding machine mounted on a main bracket **1**. The coils to be wound **2**, **3** and **4**, are mounted on a rotatable shaft **5**, which is adapted to be turned by suitable conventional driving means mounted in the control assembly means **6**. The tensioning devices **10**, **11** and **12** are mounted on rod members or shafts **13** and **14**, which are adapted to move transversely to the coils being wound in a conventional manner. The apparatus for transversely moving the rods **13** and **14** may be entirely conventional and is included in the control box **6**. The specific means for moving the rods **13** and **14** transversely may be, for instance, a rack and pinion or screw arrangement or other conventional means. Only one of the rods need be driven since they are clamped together by the tensioning device. The control unit **6** also contains a counter **7**, which is connected to count the number of turns applied to the coils.

The tensioning devices themselves, as shown in Figure 2, comprise a mounting bracket **20** which is mounted on the rods **13** and **14** of the coil winding machine. Extension arm **21** is fixedly mounted to the mounting bracket **20** by means of the bolts **22** and **23**. The extension arm has slots **22'** and **23'** to provide for an adjustable mounting.

Referring particularly to Figure 4, we will now describe how the tension arm **24** is operatively connected. A shaft member **25** has a stud connected thereto at one end which is bolted to the mounting bracket **20** by the nut **26**. A pulley **27** preferably of a plastic material such as Bakelite, or equivalent material, is rotatably mounted on the shaft **25**. The other end of the shaft member **25** is threaded, the threads **25'** having a fairly large pitch and is slotted at the end to provide a screw driver adjustment. The tension arm **24** is tapped and adapted to engage the large pitch threads of the shaft member **25**. It will be seen that, as the tension arm is rotated about the shaft member **25** in one direction, it will advance on the shaft and squeeze the plastic pulley member **27** between the tension arm **24** and the mounting bracket **20**, thus providing friction braking means for

controlling the tension with the wire. Alternatively, wafers of brake lining material may be inserted on either side of the pulley which may then be of metal.

The wire **30** is fed on to the pulley **27** of the tensioning device and wrapped around the pulley **27** one or more times, then around the guide pulley **31** mounted at the free end of the tension arm **24**, thence around guide pulley **32** mounted at the free end of the extension arm **21** from which it is applied to the coil **2**. The tension arm absorbs temporary shocks, for instance when the coil form is rectangular.

The operation of the brake arm is as follows:

As the wire is not being fed fast enough, the coil **2** will cause a force on the tension arm **24** tending to turn the tension arm counter-clockwise. As the tension arm turns counter-clockwise, it will loosen the braking i. e. unsqueeze the pulley **27**, thereby permitting the wire to pass more freely. The tension arm **24** is spring loaded by spring **28** which tends to return the tension arm **24** in a clockwise direction for the purpose of keeping the wire from becoming too slack between the guide pulley **31** and **32**. Stated differently, as the coil **2** is rotated, it pulls the wire **30** off the pulley **32** and if there is too much drag on the wire, the tension arm will rotate counter-clockwise against the spring **28** pressure to thereby loosen the friction brake comprising the pulley **27** which is squeezed between the mounting bracket **20** and the tension arm **24**.

The spring **28** is mounted on post **33** connected to mounting bracket **20**, and post **34** connected to tension arm **24** as may be clearly seen in Figure 3. Figure 3 also shows how the wire **30** is wound around the pulley **27** and thence around the guide pulleys **31** and **32**. The wire preferably has one or more turns around the pulley **27** and is led in at a small angle to the plane of the pulley, so that it does not rub against itself at the point **36**, Figure 2.

The wire is shown led in and wound counter-clockwise around the pulley **27**. It therefore exerts a clockwise torque on tension arm **24** which bucks the force due to the coil **2** on the tension arm.

If the wire **30** is wound oppositely on pulley **27**, its torque on tension arm **24** will aid the force on arm **24** from coil form **2**. This mode of operation provides self-energizing braking and permits higher speed but has poorer regulation than the arrangement shown.

The tension arm may be adjusted loosening nut **26** and inserting a screw driver in the slot **39** of studded shaft **25**. When adjusted the nut **26** is again tightened.

We will not discuss force vectors existing in the tension apparatus. There are two vectors (A & B) acting on guide pulley **32**, the resultant of which is the vector $(A+B)$ which passes through the support shaft **13**. Therefore, this resultant vector $(A+B)$ will not cause any twisting of the tension device on the coil winding machine. The vectors (C & D) act on the guide pulley **31** producing the result of vector $(C+D)$ which acts to provide a counter-clockwise twisting about the shaft **14**. The vectors (E & F) provide a resultant vector $(E+F)$ which acts to provide a clockwise moment about the shaft **14**.

The vectors $(C+D)$ and $(E+F)$ have been projected adjacent shaft **14**. From this it will be seen that if the vector $(E+F)$ is somewhat larger than $(C+D)$ there will be a minimum of twisting moment exerted by the tension device on the coil winding machine. There is

also a weight vector W which acts to turn the tensioning apparatus clockwise about the shaft **14** and assist the vector $(E+F)$. The weight vector W passes through the shaft **13** and so has no turning moment with respect thereto.

From the foregoing vector analysis, it can be seen that the tensioning device may be designed for a particular application so that there will be no substantially turning force exerted by the tensioning device against the coil winding machine. Since the vector forces substantially cancel each other out, and the resultant forces may be overcome by relatively small and light weight components, also the coil winding machine does not have to be heavily built or mounted on very heavy table or support. It is therefore seen that the present invention is a great advantage over external tensioning devices which are very difficult to adjust the which must be very securely mounted and also require larger and heavier structural members.

I claim:

1. A coil winding machine comprising means to rotatably mount at least one coil form on a first rotatable shaft, a pair of shafts operatively mounted on said coil winding machine and adapted to be moved transversely to said first coil form holding shaft, tension adjusting means mounted on said pair of transversely moving shafts, means responsive to wire tension to vary said tension adjusting means, said tension adjusting means comprising a mounting member fixedly connected to said pair of shafts, a brake shaft member bolted to said mounting member, a pulley rotatably mounted on said brake shaft, said brake shaft being threaded at its other end and a tension arm screwed on to said threaded end whereby rotation of said tension arm about said brake shaft member in one direction will loosen said pulley between said mounting bracket and said tension arm to thereby compensate for too much tension on the wire.

2. A coil winding machine comprising means to rotatably mount at least one coil form on a first rotatable shaft, a pair of shafts operatively mounted on said coil winding machine and adapted to move transversely to said first coil form holding shaft, tension adjusting means mounted on said pair of transversely moving shafts, said tension apparatus comprises a mounting member fixedly connected to said pair of shafts, a brake shaft member bolted to said mounting member, a pulley rotatably mounted on said brake shaft, said brake shaft being threaded at its other end, and a tension arm screwed on to said threaded end whereby rotation of said tension arm about said brake shaft member in one direction will squeeze said pulley between said mounting bracket and said tension arm to tighten the pulley to thereby compensate for slackness on the wire.

3. Apparatus as in claim 2 wherein the wire to be wound on said coil is wound on said pulley so as to rotate said tension arm against the force due to said coil form.

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