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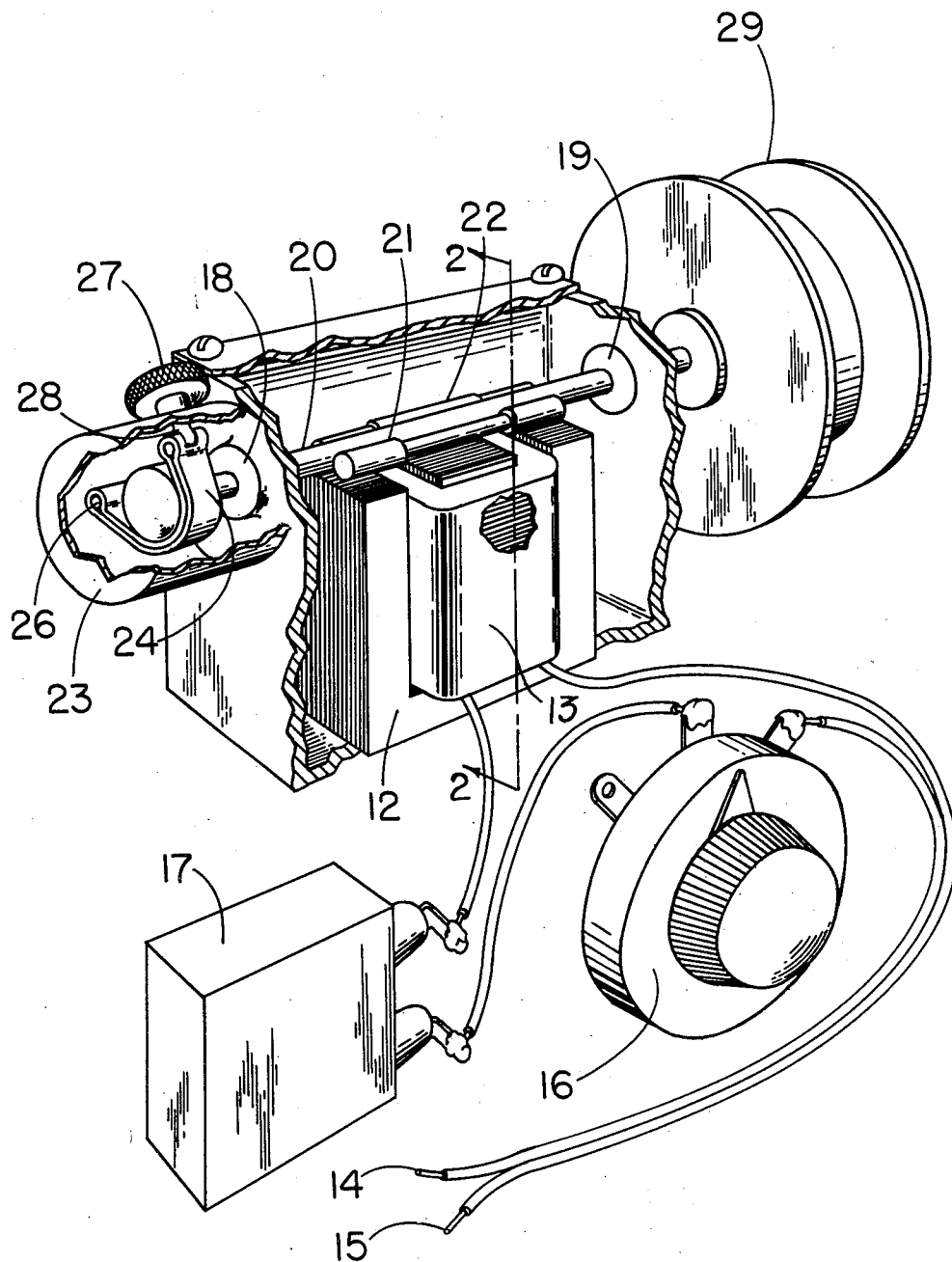
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ROTATION RETARDING DEVICE FOR A REEL CARRYING SHAFT

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

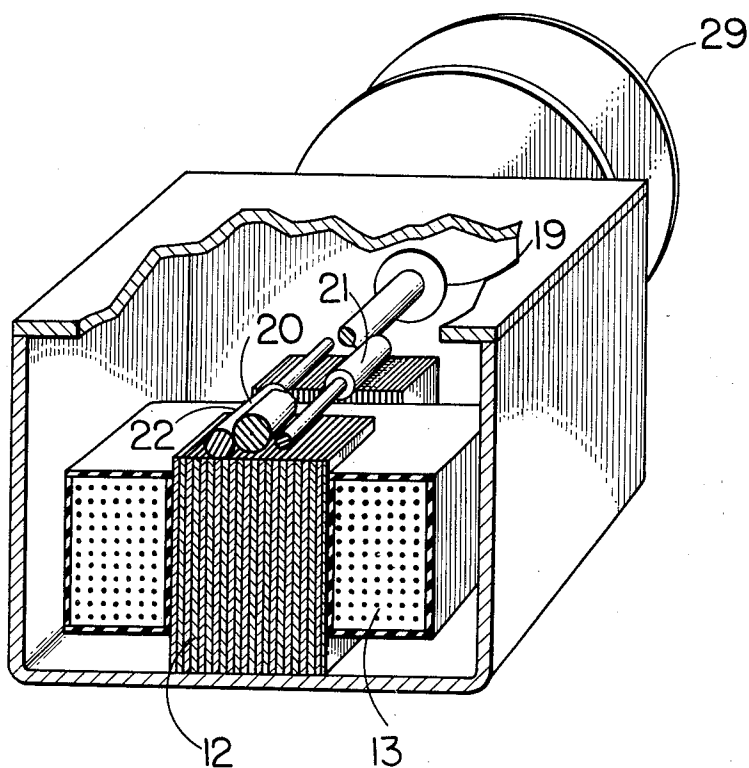


FIG. 2

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ROTATION RETARDING DEVICE FOR A REEL CARRYING SHAFT

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3 Claims. (Cl. 188—164)

This invention relates in general to devices for the control of shaft rotation and in particular to the control of tension on products wound on such a shaft.

Automatic machinery for handling wire, cable, paper, film, or other products which are dispensed or collected on reels often requires that the wire or other material be subject to a prescribed tension. In the electronic arts, especially in the manufacture of tubes where wire of very small diameter is generally used, the tension on a wire being wound or processed to form tube elements must be held very closely to insure uniformity of output. Furthermore, when it is desired to form tube elements having different characteristics, it is often necessary to vary the tension placed on the wire. A device which is capable of placing any desired amount of tension on a wire and holding that amount within narrow limits has long been recognized as a definite need by the tube industry.

Considerable effort has been expended to overcome the tension problem. The usual approach has been to brake the shaft supporting the reels in some fashion or to exert lateral force against the wire. Much of the effort has been directed along mechanical lines and several reasonably adequate devices have been developed. The mechanical devices for the most part depended upon suitably chosen weights bearing on pivoted reels which contain the wire, or alternatively, the wire was passed over spring-loaded pulleys. These devices were unsatisfactory for a variety of reasons. After a certain amount of use, they became unreliable because of fatigue of the spring members or because of friction built up in worn bearing surfaces. Too, they lacked flexibility when it became necessary to vary the tension being applied to the wire, much dismantling being required to shift weights and change pulleys.

Some effort has also been made to develop suitable electrical tension devices, the most common device being a small A. C. motor to which direct current is applied. By mounting a reel of wire to be held under tension on the motor shaft and applying a direct current to the motor, the motor tends to resist rotation at each set of poles producing a substantial amount of tension on the wire. Some disadvantages attendant upon use of this system are, first, the relatively great expense of power supplies to provide the desired direct current and, second, due to the high currents built up, the motor windings have a relatively short life compared to that which would be had in normal operation. Perhaps the greatest objection to the system is the fact that pulsations occur as each set of poles passes through the area of strongest field. These pulsations destroy the uniformity of the tension applied to the wire.

Therefore, it is an object of the present invention to provide a simple inexpensive braking device for use on rotating members.

It is another object to provide a device for use on reels or spools of wire or other material which is to be placed under tension.

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It is a further object of the present invention to provide a tension device which is capable of maintaining either steady state or dynamic control over uniform amounts of tension being applied to a wire.

It is a still further object to provide a device which consumes little power and requires no special power supply, other than conventional line voltage.

In general, the invention consists in an E-shaped core member on which a suitable coil is wound about the center leg. The coil is energized from either alternating or direct current sources. A steel shaft, rotatably mounted, completes the flux path across the open side of the E-shaped core and extends beyond the core. This shaft is displaced slightly from the core and carries a reel on its extension. Parallel to the shaft are two other steel members which extend from one outer leg of the E to the other. A rheostat is provided to vary the amount of voltage applied to the coil and hence the flux density. By varying the rheostat either manually or automatically, fine control of the variation of the resistance to rotation of the shaft is effected. Rough control is obtained by an adjustable friction drag on the shaft. For a better understanding of the invention, together with other and further objects, features, and advantages, reference should be made to the following description which is to be read in connection with the accompanying drawing, in which Fig. 1 is a perspective view, partly cut away, of a preferred embodiment of the present invention and Fig. 2 is a cross-sectional view of the coil and roller assembly shown in Fig. 1 taken through the plane 2—2.

Referring now to the drawing there is shown a container which actually holds all the units shown in the drawing but which is broken away to facilitate understanding of the invention. An E-shaped laminated iron core 12 similar to a standard choke frame is mounted in the container. On the center leg of the core, a coil 13 is wound. Voltage, which may be conventional line voltage, is supplied from terminals 14 and 15. A rheostat 16 is connected serially in the line from terminal 14 with a condenser 17 and coil 13. The purpose served by condenser 17 is explained hereinbelow.

Mounted in the container adjacent the outer legs of core 12 are ball bearings 18 and 19 having their outer races affixed thereto. A main shaft 20 passes through the inner races of bearings 18 and 19 is affixed thereto. Main shaft 20 is so mounted in the container that it is spaced from core 12 by a matter of a few thousandths of an inch. Parallel to and contacting main shaft 20 are two auxiliary shafts 21 and 22 which are in actual contact with core 12, shaft 21 contacting only the end legs of core 12 and shaft 22 contacting only the center leg of core 12. Thus, a flux path is defined through one end of shaft 21 to main shaft 20 to the central portion of shaft 22 to the center leg of core 12 and a second flux path is defined through the second end of shaft 21 to main shaft 20 to the central portion of shaft 22 to the center leg of core 12. Such structure of main and auxiliary shafts is not necessary to proper operation of the device but adds a measure of smoothness of control in adjusting amounts of tension and inhibits possible overheating of the device.

Main shaft 20 extends beyond the container on each end. At one end, a cylindrical housing 23 is attached to the container and encloses the extrusion of main shaft 20. A friction drag 24 bears on an enlarged portion of main shaft 20. Friction drag 24 is anchored to housing 23 at point 26 and is adjustable in position by means of thumb screw 27 which is relatively freely rotatable in housing 23 but threadably connected to member 28 which is affixed to the free end of drag 24.

The other end of main shaft 20 extends beyond the container and carries a reel 29 which is keyed to shaft

20 and rotatable therewith. Reel 29 carries a quantity of wire which is to be held under tension.

In operation, wire is drawn from reel 29 by any desired method. The amount of tension to be placed on the wire is then determined by the amount of resistance to rotation exhibited by reel 29. Since reel 29 is fixed to shaft 20, the resistance of shaft 20 to rotation is determinative of the tension on the wire.

Shaft 20 is dependent upon the amount of flux in the path which it completes for its relative freedom to rotate. As rheostat 16 is adjusted, the flux is varied and control of shaft 20 is achieved. In the embodiment shown, condenser 17 is chosen to be of a value sufficient to resonate with coil 13 at line frequency, thus providing a greater measure of control over flux density. If the power source for coil 13 were direct current, condenser 17 would be unnecessary, but control of the rotation of shaft 20 would still be effected by variation of rheostat 16.

Where it is desired to change the range of the fine tension control provided by adjustment of rheostat 16, thumb screw 27 may be turned to cause drag 24 to bear more lightly or heavily on the enlarged portion 25 of main shaft 20.

It will be apparent to those skilled in the art that automatic means such as a servo system could easily be added to the invention as shown and described to provide automatic maintenance of tension within any reasonable predetermined limits. It is also obvious that the principles disclosed are applicable to any braking device wherein it is desired to limit or control the speed of rotation of a shaft.

For example, in the manufacture of textiles or paper, the product is carried on spools which in turn are shaft supported. Braking of the shaft in these instances using the concepts of the present invention could be accomplished by mere mechanical skill.

The invention should not be limited to the exact details disclosed but only by the spirit and scope of the appended claims.

What is claimed is:

1. A rotation retarding device for a main shaft comprising, a laminated iron core having a substantially E-shaped cross-section, a source of constant frequency alternating voltage, a rheostat, a condenser and a coil in series circuit relationship, said condenser and said coil being of proper values to resonate at the frequency of said applied voltage, said coil being wound about the center leg of said E-shaped core, a ball bearing mounted adjacent each of the end legs of said E-shaped core, the main shaft passing through said bearings and being normally free to rotate therein, said bearings being so disposed that said main shaft is displaced laterally from the legs of said coil by several thousandths of an inch, a pair

of auxiliary shafts parallel to and on either side of said main shaft, one of said auxiliary shafts being in contact with the main shaft and the end of the legs of said core, the other of said auxiliary shafts being in contact only with the main shaft and the center leg of said core, adjustment of said rheostat providing variation of the voltage applied to said coil causing variation of the flux density and of the resistance to rotation of said shaft.

2. A rotation retarding device comprising, a core of magnetic material having a substantially E-shaped cross-section, a coil wound about the center leg of said core, a source of voltage, means connected between said source and said coil for varying the voltage supplied thereto, a rotatable main shaft supported in proximity to and along the open side of said E-shaped core, and first and second auxiliary rotatable shafts disposed on opposite sides of and parallel to said main shaft, said first auxiliary shaft contacting the end legs of said E-shaped core and said main shaft adjacent its ends, said second auxiliary shaft contacting the center leg of said E-shaped core and said main shaft adjacent its center, whereby a flux path is defined through said main and auxiliary shafts, rotation thereof being variably retardable by said means for varying said voltage.

3. A braking device comprising, a main shaft, a core of magnetic material having a substantially E-shaped cross-section, a coil wound about the center leg of said core, a source of constant frequency voltage, a condenser of sufficient capacity to resonate with said coil at said constant frequency, and a rheostat in series circuit relationship, said main shaft extending across the open side of said E-shaped core but displaced therefrom, two auxiliary shafts parallel to said main shaft, one of said auxiliary shafts connecting the ends of said main shaft to the end legs of said core, the other of said auxiliary shafts connecting the center leg of said core to said main shaft, magnetic flux being passed through said shafts in amounts determined by the voltage supplied to said coil in accordance with the setting of said rheostat.

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