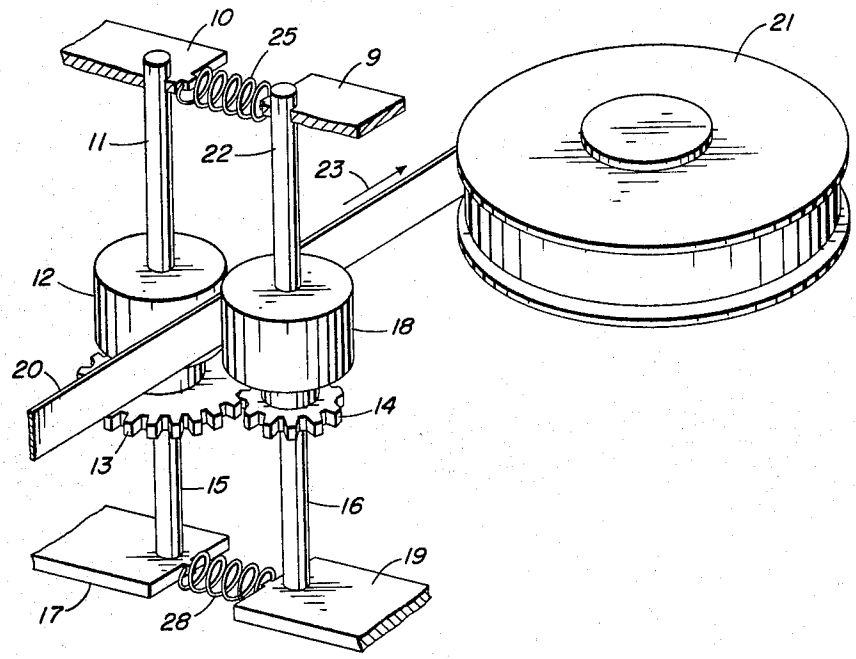
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TAPE TENSIONING DEVICE

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TAPE TENSIONING DEVICE

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This invention relates generally to tape tensioning devices and more particularly to a simplified tape tensioning device which provides an adjustable drag for a tape, such as magnetic tape, which is pulled through said device.

There are in the prior art many structures which function to provide a drag for a tape such as a magnetic tape. Many of these prior art devices employ two rollers which are spaced apart and over which the tape is caused to pass. The two rollers are constructed to rotate at different angular velocities so as to provide a slippage effect on the tape. Since the angular velocities of the two rollers are different there must be slippage between the tape and at least one of the rollers. Such slippage provides a drag on the tape so that some tension is produced between a capstan or take-up reel and the two rollers. It should be noted that in such prior art devices, the two rollers are spaced apart from each other so that the tape passes over each of the two rollers, but does not pass between the two rollers. In other words, the two rollers do not form a bite therebetween to grip the tape as it passes therebetween. In some prior art devices the mechanism for providing different angular velocities for the two rollers is relatively complex and, further, the amount of slippage is sometimes difficult to maintain at a constant value with the result that the drag on the tape is difficult to maintain at a constant value.

An object of the present invention is to provide a simplified structure for providing drag on a tape.

A further object of the invention is to provide an inexpensive and reliable structure for providing drag on a tape which drag remains relatively constant.

A third object of the invention is to provide a mechanism comprising two rollers which are geared together so as to have different angular velocities and which provide a bite on a tape passed therebetween to cause a drag on said tape.

A further object of the invention is the improvement of tape tensioning devices generally.

In accordance with the invention, there is provided a pair of rollers whose rolling surfaces contact each other and which have axes of rotation parallel with one another. The two rollers are geared together by a pair of gears having a gear ratio such that the circumferential velocities of the two rollers are necessarily different. A tape pulled between the two rollers, which are spring-loaded against each other, cause the two rollers to rotate but at different circumferential velocities determined by the aforementioned gear ratio. This difference in circumferential velocity or surface speed of the rollers results in a drag on the tape as it passes between the rollers.

A feature of the invention lies in the fact that because the slippage velocity between the tape and the two rollers can be made small, the wear on the tape can be maintained at a minimum value.

Another feature of the invention is that no drive is required for either of the two rollers since the tape itself, as it passes between the two rollers, provides the necessary drive to the rollers; the different circumferential velocities of the two rollers providing the desired tape drag.

The above-mentioned and other objects and features of the invention will be more fully understood from the following detailed description thereof when read in conjunction with the drawing, which shows a perspective view of the invention.

Referring now to the figure, there is shown a pair of rollers **12** and **18** which rotate, respectively, on shafts **11** and **22**. At one end the shafts **11** and **22** rotate in plates **9**, **10** with suitable bearings (not specifically shown). At the other ends the shafts **11** and **22** rotate respectively in the supporting surfaces **17** and **19**, which are equipped with suitable bearing structures, again not specifically shown. The supports **9**, **10**, and **17**, **19** are spring-loaded by tension springs **25** and **28** which hold the rollers **12** and **18** together with a predetermined force, determined by the tension of springs **28** and **25**. Also mounted upon shafts **11** and **22** and designed to engage each other are the gears **13** and **14**. Said gears **13** and **14** are fixed securely to the rollers **12** and **18**, respectively, and will of course rotate therewith.

The gear ratio of the gears **13** and **14** is such that the circumferential velocity of the rollers **12** and **18** are different. More specifically, assume for purposes of discussion, that the diameter of rollers **12** and **18** are the same. Then, to cause the circumferential velocity of roller **12** to be less than that of roller **18**, the gear **13** is constructed to have a larger diameter than gear **14** and, consequently, to have more teeth than gear **14**.

The rollers **12** and **18** can be of any suitable material necessary to produce the desired drag on a given tape. For example, rollers **12** and **18** can be of metal, plastic, or a rubber compound.

In the operation of the structure, a tape **20** is pulled through rollers **12** and **18** in the direction of the arrow **23** by suitable means, such as a capstan (not shown) or a take-up reel **21**. It is apparent that other rollers and capstans may be positioned between take-up reel **21** and the two rollers **12** and **18**. However, for purposes of simplicity of explanation, they are omitted and only the take-up reel **21** is shown. The difference in angular velocity of the two rollers **12** and **18** produces a slippage between the surface of at least one of the rollers and the surface of the tape **20** as the tape is pulled between the rollers. Such slippage and the drag produced thereby is determined by the force with which the two rollers are held together by springs **28** and **25**, the difference in circumferential velocity of rollers **12** and **18**, and the surface friction between the rollers **12** and **18** and the tape **20**. By varying one or more of the above-mentioned factors, tape drag can be varied over a considerable range.

As will be apparent, some wear will be produced on the tape inasmuch as slippage is present. However, by proper design the wear on the tape can be kept at a minimum. One of the principal factors determining wear is the difference in circumferential velocity of rollers **12** and **18**. By keeping such difference velocity small, the wear on the tape **20** can be kept small.

An alternative way of increasing the drag on the tape is to increase the tension of the spring **28** (rather than increasing the difference in circumferential velocity between rollers **12** and **18**). Increasing the drag by means of adjusting the spring tension is quite effective and produces relatively little increase in tape wear. It is evident, however, that some difference in angular velocity is essential to provide drag on the tape.

Another factor entering into the determination of the amount of drag on the tape is the angle of wrap of the tape around either the roller **12** or **18**. If, for example, the tape is wrapped around a substantial portion of roller **18**, the roller **18** will tend to rotate at a circumferential velocity equal to the linear velocity of the tape **20** and the slippage will occur between the tape **20** and the roller **12**. The roller **12** has a smaller circumferential velocity than the roller **18**, thus providing the drag on the tape.

If the tape were wrapped around a substantial portion of the roller **12**, then there would be no slippage between the roller **12** and the tape **20**; the slippage occurring between the tape **20** and the roller **18**. However, if no slippage occurs between the roller **12** and the tape **20**, this would mean that the roller **18** which has a higher circumferential velocity than roller **12** would tend to push the tape out ahead of the two rollers **12** and **18** towards the take-up reel **21**. Obviously, such a condition is unstable since the take-up reel would immediately take up any such slack. In actuality, there is some drag on the tape under such conditions since the tape itself tends to hold back the circumferential velocity of roller **18**. Since roller **18** is geared to roller **12**, the circumferential velocity of roller **12** tends to be retarded, thus producing a drag on the tape.

It is to be noted that the form of the invention shown and described herein is but a preferred embodiment thereof and that various changes may be made in the design thereof without departing from the spirit or the scope of the invention.

I claim:

1. Tape tensioning means comprising:

first and second unpowered roller means positioned side by side with their axes of rotation parallel to one another,

means for pressing the circumferential perimeters of said rollers together to grip a tape positioned therebetween,

coupling means constructed to maintain a fixed ratio, other than unity, of the circumferential velocities of said first and second rollers, when either of said rollers is caused to rotate by a tape being pulled therethrough,

and means for pulling said tape between said rollers.

2. Tape tensioning means in accordance with claim **2** in which:

the axes of said rollers each comprises shaft means,

supporting means for supporting said shaft means,

and in which said coupling means comprises gear means secured on said shaft means of said rollers and having a gear tooth ratio to provide said fixed ratio of circumferential velocities.

3. Tape tensioning means in accordance with claim **2** in which said means for pressing said rollers together comprises spring means constructed to force one of said rollers towards the other roller.

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