April 11, 1967 E. MARCINIAK 3,313,096

DEVICES FOR DRIVING BODIES REVOLVING AT HIGH SPEEDS, AND IN PARTICULAR FALSE TWIST SPINDLES IN CRIMPING MACHINES

Filed April 16, 1964 2 Sheets-Sheet 1

Fig. 1.

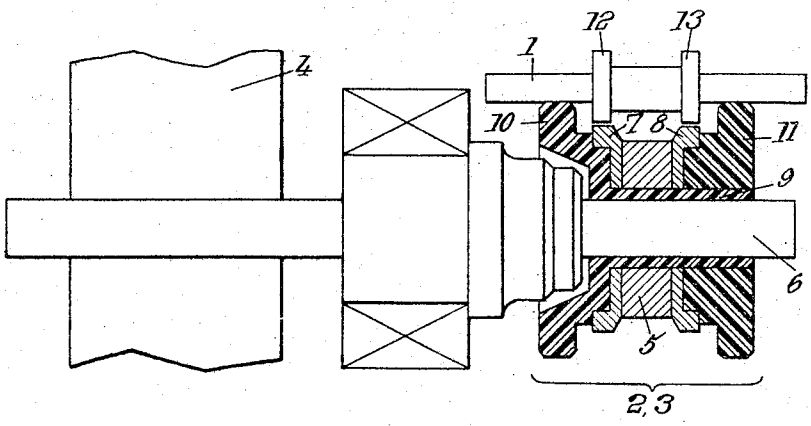

Fig. 2.

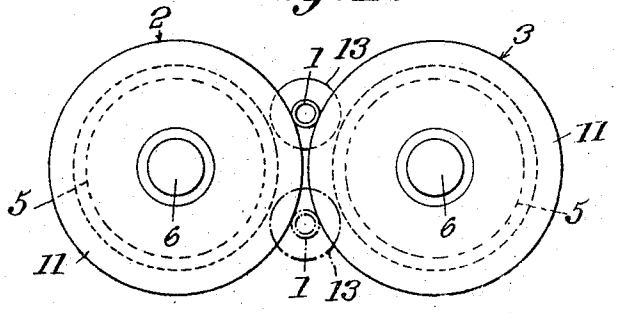

Fig. 3.

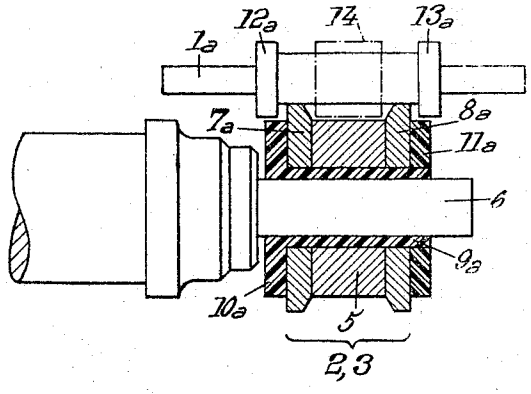

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Fig. 4.

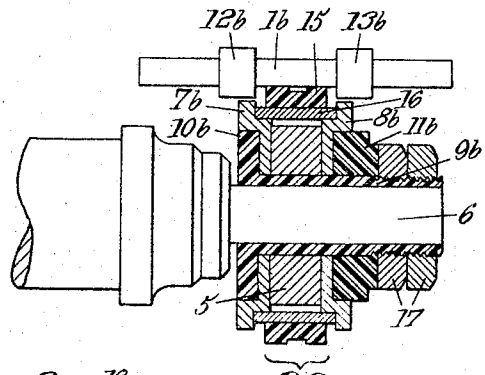


Fig. 5.

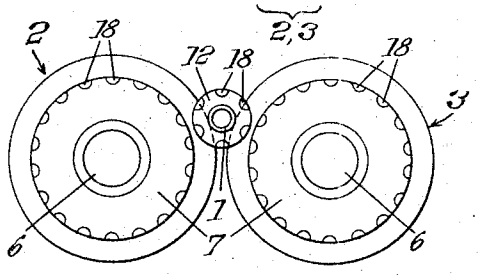


Fig. 6.

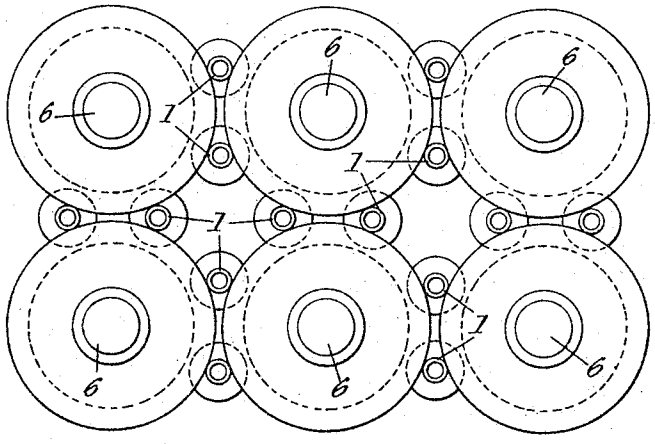


Fig. 7.

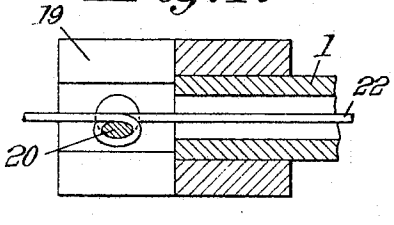
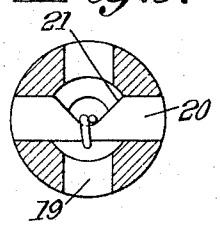


Fig. 8.



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3,313,096

DEVICES FOR DRIVING BODIES REVOLVING AT HIGH SPEEDS, AND IN PARTICULAR FALSE TWIST SPINDLES IN CRIMPING MACHINES

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6 Claims. (Cl. 57—77.45)

The present invention relates to a device for imparting a fast rotation movement to a body of revolution, and in particular to a false twist spindle in a crimping machine for textile yarn. The body of revolution to be driven is supported by two parallel driving circular members adjacent to each other and it is driven by at least one of said members against which it is applied by the magnetic field produced by a permanent magnet.

The invention is characterized in that the permanent magnet is in the form of a body of revolution coaxial with at least one of said members and rotating together therewith.

Preferred embodiments of the present invention will be hereinafter described with reference to the appended drawings, given merely by way of example, and in which:

FIG. 1 shows, partly in axial section and partly in elevational view, a driving device for a false twist spindle in a textile yarn crimping machine, said driving device being made according to the present invention;

FIG. 2 is a cross section of the device of FIG. 1;

FIG. 3 is a view similar to FIG. 4 showing another embodiment of the invention;

FIG. 4 is a view similar to FIGS. 1 and 3 and illustrating still another embodiment of the invention;

FIG. 5 is a view analogous to FIG. 2 showing a modification;

FIG. 6 is a view analogous to FIGS. 2 and 5 and relating to a simplified device according to the invention for driving a plurality of spindles;

FIG. 7 is an axial sectional view of a tubular false twist spindle made according to the invention;

FIG. 8 is a cross section corresponding to FIG. 7.

In existing textile machines including false twist spindles, the bearings in which the spindles are mounted are not capable of working at speeds of rotation higher than a given limit, whereas the present tendency is to increase this limit speed in order to improve efficiency.

It has been proposed to have the spindle supported by two driving discs **2** and **3** of great diameter, having parallel respective axes and the respective peripheries of which are sufficiently close to each other, or even are made of several discs offset axially and overlapping one another, so that the spindle is supported simultaneously by the peripheries of said discs on which it is thus journalled.

One of the discs may turn freely about its axis and serve merely as support for the spindle, whereas the other transmits the rotation movement.

Use was made of the magnetic field of a permanent magnet to apply the spindle against the driving discs, this magnetic field extending between the spindle and a stationary member mounted between the two driving discs on the frame that supports them.

Such a device, due to the presence of said fixed member, occupies a considerable volume and on the other hand it gives rise to important Foucault currents which produce a considerable heating.

According to the present invention, in order to obviate these drawbacks the permanent magnet is in the form of a body of revolution coaxial with the driving disc and rotating together with it.

In the embodiment of the invention illustrated by FIGS. 1 and 2, spindle **1** is supported by two bearings **10** and **11** consisting of two large diameter discs **10** and **11** (corresponding to the above mentioned discs **2** and **3**) mounted on respective shafts **6**. One of said shafts is driven through a belt **4**.

Spindle **1** is applied against discs **10** and **11** by two permanent magnets **5** each consisting of a sleeve fixed on a shaft **6**, respectively, coaxially therewith.

The magnetic flux of each magnet **5** is parallel to the axis of the shaft **6** supporting said disc.

For this purpose, magnet **5** consists of a tube mounted between two rings **7** and **8** of ferro-magnetic material forming pole pieces at the respective ends of said tubular magnet **5**. These rings **7** and **8**, chamfered at their peripheries, are located respectively opposite collars **12** and **13** of spindle **1** so that the magnetic flux of magnet **5** closes through said collars **12** and **13** and spindle **1**. Thus said spindle **1** is magnetically drawn against annular flanges **10** and **11** carried by a sleeve **9** tightly held between each shaft **6** and the corresponding tubular magnet **5**. Sleeve **9** and flanges **10** and **11** are made of a non-magnetic material such as aluminum, bronze, or a suitable alloy of plastic material.

Thus, when spindle **1** is resting upon flanges **10** and **11**, collars **12** and **13** are positioned opposite rings **7** and **8** and maintain, under the influence of the magnetic field of magnet **5**, spindle **1** in the position it occupies. Said spindle **1** is thus prevented from moving in the axial direction with respect to discs **2** and **3** during the operation of the machine.

According to another embodiment, illustrated by FIG. 3, rings 7_a and 8_a are of a diameter greater than that of flanges 10_a and 11_a and serve directly to support spindle 1_a. For this purpose, said spindle 1_a is provided with collars 12_a and 13_a located at a distance from each other greater than the distance between rings 7_a and 8_a on which the spindle is bearing.

According to a modification, shown in dot-and-dash lines, there is a single collar **14**, preferably of a non magnetic material, located between rings 7_a and 8_a.

This embodiment (FIG. 3) has the advantage of avoiding the existence, between the permanent magnet and tube 1_a of any gap reducing the magnetic force with which tube 1_a is kept applied against the peripheries of the discs.

According to still another modification, illustrated by FIG. 4, each of the bearings of spindle 1_b consists of a part **15** of non magnetic material surrounding the corresponding magnet **5** between rings 7_b and 8_b, this part **15** having a diameter greater than that of said rings.

On either side of part **15**, spindle 1_b is provided with a collar 12_b, 13_b. The axial distance between these collars is greater than the width of part **15** and corresponds to the distance between rings 7_b and 8_b so that, when spindle 1_b rotates on its single rolling path **15**, collars 12_b and 13_b are located opposite rings 7_b and 8_b, respectively, under the effect of the magnetic field which, from these rings, closes through spindle 1_b and collars 12_b and 13_b.

Part **15** may consist of a sleeve of plastic material force fitted on a ring **16** of a non magnetic metal bearing upon shoulders provided in rings 7_b and 8_b. Ring **16** is held, together with magnet **5**, between rings 7_b and 8_b, through flanges 10_b and 11_b, flange 10_b being integral with sleeve 9_b on which flange 11_b is slidable. Said flange 11_b is pushed toward the left by two nuts **17** screwed on sleeve 9_b.

In some cases, it may be advantageous to provide, at the periphery of the rings such as **7** and **8** and of the collars such as **12** and **13** (or in the embodiment of FIG. 3, directly upon spindle 1_a), magnetic reluctance areas which vary cyclically along the periphery respectively of

the disc and of the spindle, which areas may be created either by a local removal of ferro-magnetic material or by the insertion of portions of non magnetic material as shown for instance at **18** in FIG. 5.

Owing to the fact that no cumbersome fixed permanent magnets are used, it is possible thus to drive, through a relatively small number of discs **2** and **3**, a great number of spindles **1**. For instance, as shown by FIG. 6, it is possible by means of only six discs **2** or **3**, to drive fourteen tubular spindles **1**.

Concerning more particularly tubular spindle **1**, it is advantageous, as shown by FIGS. 7 and 8, to fix at the end thereof an extension provided with a slot **19** in which is fitted a diametral cross member **20** provided with a V-shaped notch **21** the bottom of which is located along the axis of rotation of said tubular spindle. Owing to this notch it is possible to ensure a perfect centering, with respect to the spindle, of the yarn **22** to be treated by causing said yarn to pass around cross member **20** along the bottom of the notch **21** thereof.

A yarn crimping machine according to the present invention has, over machines of the same kind including in the magnetic circuit thereof a fixed member for keeping the spindles applied against their driving discs, many advantages and in particular the following ones:

There is a considerable reduction of the volume occupied by the machine, which may permit of replacing, in existing machines, the direct drive spindles by spindles and driving discs according to the present invention;

The heating of the spindle is greatly reduced, which permits of reducing the wear and tear of spindles of this type and to improve the quality of the yarn that is obtained;

The power necessary for driving the spindles is greatly reduced; and

The drive is much more efficient, especially when every disc is provided with its own magnet and the risks of slipping are greatly reduced.

In a general manner, while the above description discloses what are deemed to be practical and efficient embodiments of the present invention, said invention is not limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the invention as comprehended within the scope of the appended claims.

What I claim is:

1. A device for driving at high speed a spindle of a ferro-magnetic material, which comprises, in combination, two parallel circular members having their respective axes parallel to the axis of revolution of said spindle and forming bearings for said spindle, means including one of said members, for driving said spindle in rotation about its axis, at least one tubular permanent magnet coaxial with one of said members and fixed with respect thereto, and two rings of a ferromagnetic material fixed at the respective ends of said tubular magnet coaxially therewith, said rings having an outer diameter greater than that of said tubular magnet and constituting magnetic pole pieces for it, said rings extending toward said spindle to close, together therewith, a magnetic circuit for urging said spindle against said circular members.

2. A device for driving at high speed a spindle of a ferro-magnetic material, which comprises, in combination, two parallel circular members having their respective axes parallel to the axis of revolution of said spindle, at least one tubular permanent magnet coaxial with one of said members and fixed with respect thereto, two rings of a ferro-magnetic material fixed at the respective ends of said tubular magnet coaxially therewith, said rings having an outer diameter greater than that of said tubular magnet and constituting magnetic pole pieces for it, said rings extending into contact with said spindle to close, together therewith, a magnetic circuit for urging said spindle against said circular members, the rings of both of said members forming bearings for said spindle, and means, including one of said rings, for driving said spindle about its axis.

3. A device for driving at high speed a spindle of a ferro-magnetic material, which comprises, in combination, two parallel circular members of non magnetic material having their respective axes parallel to the axis of revolution of said spindle, each of said members including a pair of flanges forming bearings for said spindle, means, including one of said members, for driving said spindle in rotation about its axis, at least one tubular permanent magnet coaxial with one of said members and fixed with respect thereto, two rings of a ferro-magnetic material fixed at the respective ends of said tubular magnet coaxially therewith, said rings being located between the flanges of said two pairs, said rings having an outer diameter greater than that of said tubular magnet and constituting magnetic pole pieces for it, and two collars carried by said spindle coaxially therewith at an axial distance from each other equal to the distance between said two rings, said two collars cooperating with said two rings to form, together therewith, a magnetic circuit for urging said spindle against said circular members.

4. A device for driving at high speed a spindle of a ferro-magnetic material, which comprises, in combination, two collars carried by said spindle coaxially therewith at an axial distance from each other, two parallel annular members having their respective axes parallel to the axis of revolution of said spindle and forming bearings for said spindle between said collars, means, including one of said members, for driving said spindle in rotation about its axis, at least one tubular permanent magnet coaxially located inside one of said members and fixed with respect thereto, two rings of a ferro-magnetic material fixed at the respective ends of said tubular magnet coaxially therewith, said rings having an outer diameter greater than that of said tubular magnet and constituting magnetic pole pieces for it, said rings extending toward said spindle opposite said collars, respectively, to close together therewith, a magnetic circuit extending through said spindle for urging it against said annular members.

5. A device according to claim **1** wherein the cooperating ferro-magnetic portions located respectively on said spindle and on said magnet have magnetic reluctance areas varying cyclically along their periphery.

6. A device according to claim **1** wherein said spindle is provided with a slot at one of its ends, further comprising a substantially diametral cross member provided with a V-shaped notch, the bottom of the V extending substantially along the axis of rotation of said spindle.

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