S. Z. DE FERRANTI.

APPARATUS FOR SPINNING, DOUBLING, AND THE LIKE.

APPLICATION FILED MAY 12, 1905.

930,848. **Patented Aug. 10, 1909.**

4 SHEETS—SHEET 1.

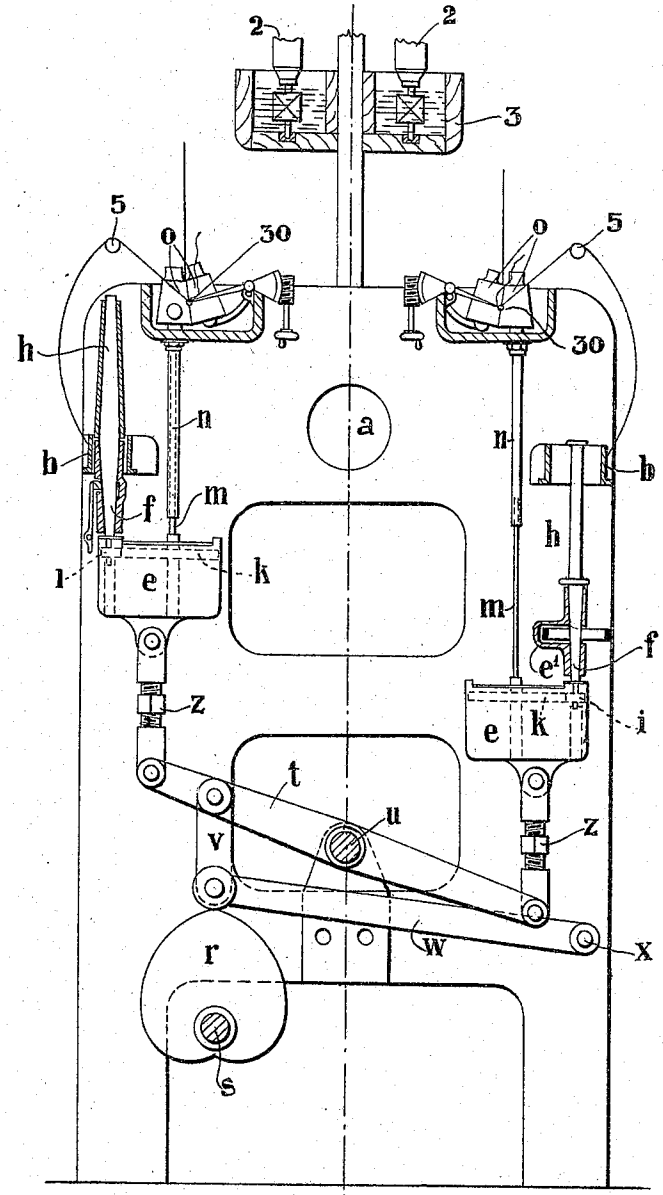


Fig. 1.

ATTEST.

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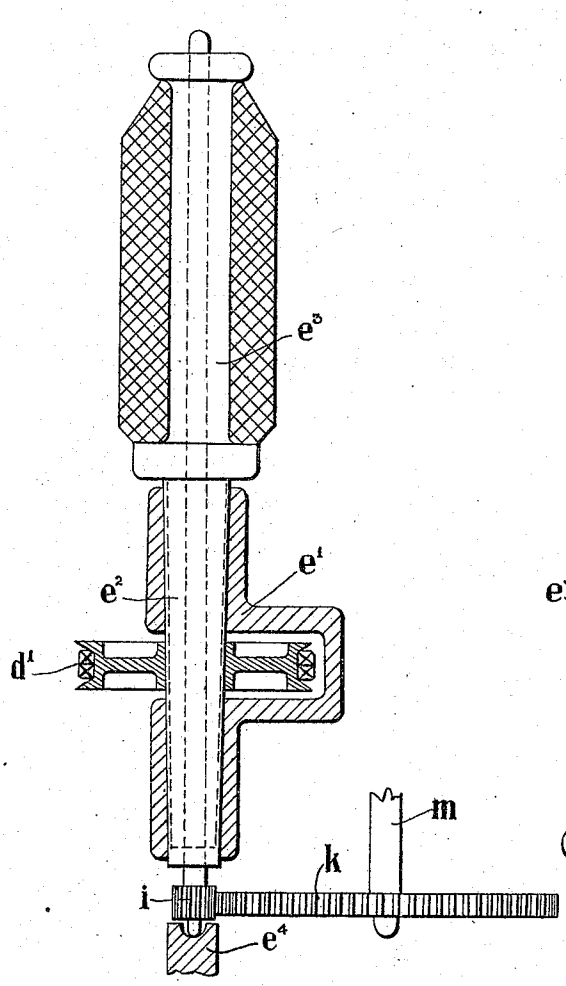


Fig. 2.

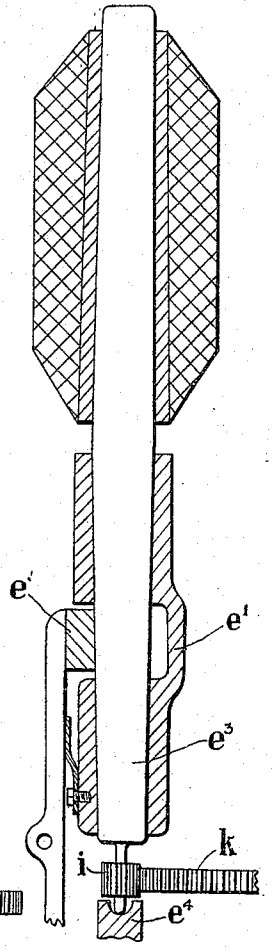


Fig. 3.

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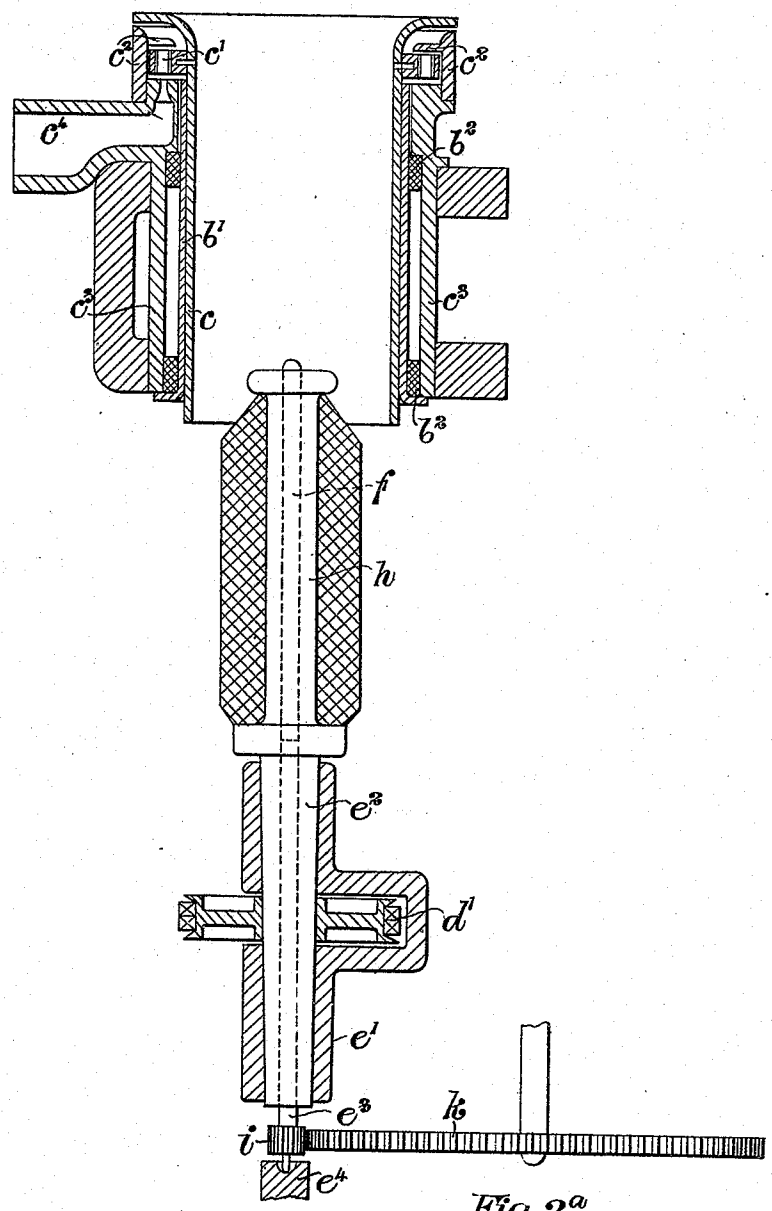


Fig. 2ª.

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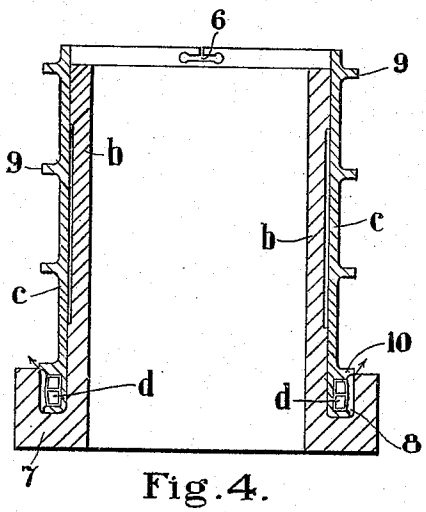


Fig. 4.

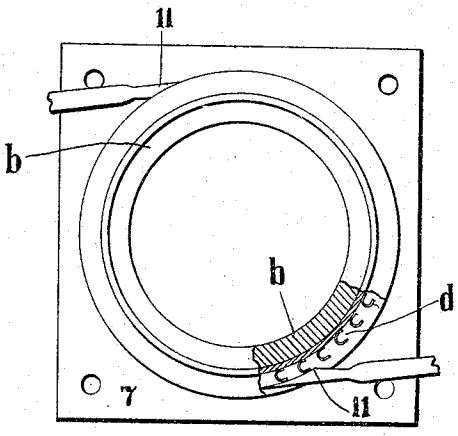


Fig. 5.

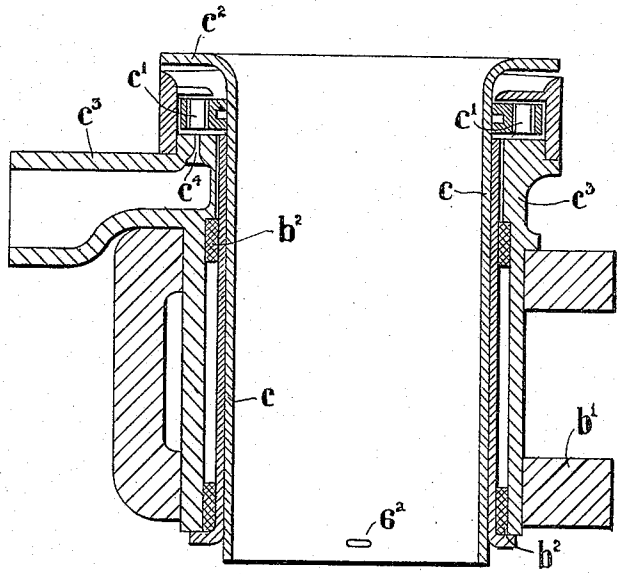


Fig. 7.

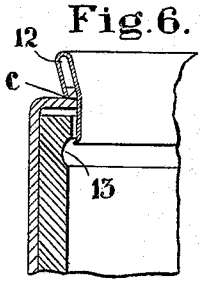


Fig. 6.

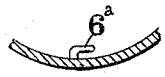


Fig. 8.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR SPINNING, DOUBLING, AND THE LIKE.

No. 930,848. Specification of Letters Patent. Patented Aug. 10, 1909.

Application filed May 12, 1905. Serial No. 260,120.

To all whom it may concern:

Be it known that I, SEBASTIAN ZIANI DE FERRANTI, a subject of the King of Great Britain and Ireland, and residing at 31 Lyndhust road, Hampstead, London, N. W., England, have invented certain new and useful Improvements in Apparatus for Spinning, Doubling, and the Like, of which the following is a specification.

My invention relates to improvements in apparatus for doubling, spinning and like operations, and has for its object to enable higher rates of production and better work to be obtained than is possible with present machinery.

The present invention relates only to machines in which are employed spinning, twisting or doubling units each having a leading and a lagging part with independent drives of the leading or lagging parts, or both.

Referring now to the accompanying drawings, which form part of the specification:— Figure 1 shows an end elevation partly in section of a form of spinning machine taken as a whole. In this figure for the purpose of simplification of the drawings, I have shown in the left hand side a doubling unit in which the inner part, *i. e.*, the spindle or bobbin carrier lags, and the outer part leads, while in the right hand side I have shown a doubling unit in which the inner part, *i. e.*, spindle or bobbin carrier, leads, and the outer part lags. Fig. 2 shows a sectional elevation of a turbine driven air borne spindle enlarged from the right hand side of Fig. 1; Fig. 2ª shows a form in which the lagging part is motor assisted. Fig. 3 shows a sectional elevation of an air borne spindle enlarged from the left hand side of Fig. 1; Fig. 4 is a sectional elevation through an air borne ring; Fig. 5 being a plan of the same, and Fig. 6 a detail view of a protector for the upper part of the bearing. Fig. 7 shows a turbine driven air borne ring flier. Fig. 8 shows a detail of the thread stroke shown in Fig. 7.

I wish it to be understood that the drawings are of a diagrammatic nature merely, and are not to be taken as working drawings.

Where desirable, the same reference characters are used to denote similar parts in the different figures.

In carrying my invention into effect, according to one form, as applied in a spinning or doubling machine, in which air is the motive power, I construct the machine (see Fig. 1) with a large horizontal air supply pipe *a*, carried by a suitable frame on each side of which are arranged the stationary parts, *b*, of the air bearing of each of the units of the machine. The figure thus shows a vertically disposed air bearing disposed on each side of the pipe *a*, preferably, the stationary part of the air bearing is a fixed cylinder, on the outside of which a cylindrical rotating part *c*, forming a ring driven by the turbine *d*, is adapted to rotate with very small clearance; details of a suitable bearing of this type are described hereafter, in this specification, with reference to Figs. 4, 5, and 7. Below each row of bearings is provided a rail *e*, in the form of a trough, which carries by bearings *e'* suitably supported by lugs a series of spindles or bobbin carriers *f*, on which bobbins *h* are mounted, projecting upwardly within the stationary air bearing *b*, the spindles or bobbin carriers being arranged at a convenient height for manipulation.

In some cases the bobbins *h* may be omitted, and the material wound directly on the rotating part itself provided the same is suitably shaped.

For the purpose of driving the feed, or feed and draw rolls as the case may be, I provide a gear wheel *i* (see Fig. 2) on the bottom of the spindle, which transmits power through another gear wheel *k*, to a vertical shaft *m*, running at a correspondingly lower speed. This shaft may be square in cross section and slide telescopically in the hollow shaft *n*, co-axial with and driven by it, this hollow shaft having mounted on it one of the feed or drawing rolls *o*, which are disposed on a part of the machine above the corresponding spindle. The telescopic connection described serves to allow for the rising and falling of the rail *e*, carrying the spindles.

Suitable means which however form no part of the present invention are provided for giving a traverse motion to the rails, in order to allow the material to be laid evenly on the bobbins. According to the form shown in Fig. 1, a heart shaped cam *r*, is fixed on the shaft *s*, which is driven for in-

stance by a separate motor of any suitable type, since the speed of the shaft does not need to bear any definite fixed relation to that of the spindle. The cam r in contact with the roller or bowl serves to rock a lever t pivoted at u by way of the link v, the necessary constraint being given to the motion of the bowl by means of the second link w pivoted at x to the frame of the machine. The rails e carrying the spindles are connected respectively one at each end of the rocking lever t by way of the adjusting link z. It will thus be seen that a continuous revolution of the shaft s causes an up and down motion to be transmitted to the spindles.

The feed rolls o draw from one or more cops, bobbins or the like 2, supported in a fluid within the longitudinal trough 3, disposed at the top of the machine, means being provided in connection with each of the bobbins or cops to produce the right amount of hydraulic retardation in a manner to be described.

The retardation is preferably regulated by altering the level of the liquid in the trough. It will be understood that similar arrangements of mechanism are provided on the opposite sides of the air pipe for the corresponding opposite pairs of leading and lagging parts. The material to be operated upon thus passes from the bobbin 2, around guides, down through a guide eye (30) between the feed rolls o, and thence over another guide 5 to the rapidly rotating ring c, through a notch 6 (see Fig. 4) in which it passes to the bobbins h, which as before stated are on the right hand side of the figure shown as leading parts and on the left hand side shown as lagging parts.

With regard to the external leading and lagging parts, of these, the external one is always air borne the internal may be air borne, or may be supported on suitable self-adjusting oil lubricated bearings of the now well-known type, such as are indicated in my specification, Serial No. 221295, with reference to Fig. 4 thereof. I prefer to construct the cylindrical stationary part b of the bearing (see Figs. 4 and 5) with a bottom flange 7, of some width and depth, and in this flange I provide an annular recess 8, within which is disposed the turbine motor d fixed to the ring flier c, which is preferably made of very thin and light material, stiffened by circumferential external ribs 9. The ring c, is made of considerable axial length in relation to its diameter, the clearance between it and the stationary portion b of the bearing being of the order of one and a half thousandths of an inch each side. The length and diameter of the ring may thus be nearly equal, and the upper end of the ring projects slightly above the upper end of the stationary part of the bearing. In the projecting part of this ring notches 6 are provided of suitable shape for catching and retaining the threads or doubling. I prefer to make the motor d work in an annular space as described, and to form a flange or shoulder 10 on the ring, just above the motor, which ring practically closes the annular space 8. The turbine blades which may be of any suitable type are impinged upon by one or more jets issuing from the nozzles 11, formed in or passing through the outer wall of this annular recess or chamber, there being preferably two nozzles disposed tangentially at opposite ends of a diameter. The turbine wheel thus runs in a chamber 8, which forms practically a balancing chamber, the flange 10 on the ring above the motor forming a balancing flange, so that the ring has to float to some extent in order to permit of the air from the turbine discharging in the manner indicated by the arrows. In this manner, therefore, the weight of the ring is balanced. Only one jet may be used; but it is preferable, especially in starting, to use at least two oppositely disposed as shown, so as to insure a balanced starting torque till the static or low speed resistance has been overcome.

It will be understood that by suitably shaping the stationary part of the bearing the proper conduits can be obtained connecting with the central air pipe without any complication of connecting pipes. It will be understood also that the air bearing might be reversed, if desired, and the ring made to rotate inside the stationary part but I prefer the external ring.

In order to prevent chafing of the material as it passes from the notch 6, over the edge of the stationary portion of the bearing, I may modify it as shown in Fig. 6. Thus the ring c is bent over at the top, and has pressed on to it the cap or protector 12, which returns a short distance within the stationary part of the bearing in which a groove 13 is formed to receive the lower end of the cap. In this way, in addition to preventing chafing of the thread, the cap also acts to prevent dust or dirt entering the bearing.

Now with reference to the air borne leading and lagging parts disposed internally to their respective external lagging and leading parts, I show in Fig. 2 an example of an air borne leading part enlarged from the right hand side of Fig. 1. Within the fixed bearing e' a conical tube e^2 fits in the manner required for an air bearing, viz., with a diametral clearance of about 3/1000 of an inch, and this conical tube carries a turbine d'. Within the tube is suitably mounted a bobbin carrier or spindle e^3 on the bottom of which is carried the pinion i. The weight of the bobbin carrier may be supported by a pivot bearing e^4. I show in

Fig. 3 an air borne lagging part enlarged from the left hand side of Fig. 1. In this a fixed bearing e' is employed, as before but the turbine motor is omitted, and the bobbin carrier takes the form of a hollow tube, oppositely tapered from its center, and carries at its bottom end a short spindle e^3, carrying the pinion i. Here again the weight of the bobbin carrier is supported on a step bearing e^4. Further, a brake e^5 is shown applied to the bobbin carrier at the center of the bearing e'. In this case the material is shown wound on a thin paper bobbin, but it may be wound on the bobbin carrier direct, when the material is so wound that it can be lifted off without collapsing, so as to be unwound without being taken off as a whole.

In some cases in addition to having a motor on the leading part, *e. g.*, on the air borne flier or spinning ring c, in the particular example described, with reference to the left hand side of Fig. 1, I may construct the lagging part as shown in Fig. 2 with a motor d', for the purpose of assisting this lagging part when spinning fine counts. This combination of parts is shown in Fig. 2^a and it will be evident that the tension in the yarn induced by dragging around the lagging part is very much reduced in comparison with those cases where the material is solely relied upon to perform this operation. On the other hand, it is in some cases desirable to produce an actual retardation of the lagging part which may be done in any well known manner.

The arrangement I prefer is an air borne flier as the lagging part, which for fine work may be motor assisted so as to diminish the drag; for ordinary doubling, however, and the heavier kinds of work, the motor is preferably omitted.

With reference to the feed of the material according to my present invention, I drive the feed rollers from either (*a*) the lagging part, (*b*) a lagging part internally disposed in relation to the leading parts, (*c*) the leading part. In the machine above dealt with, I have shown and described gearing between the spindle and the shaft m through which motion is transmitted to the feed rolls o, disposed above. On the left hand side of Fig. 1, I have shown an internally disposed lagging part driving the feed rolls. On the right side of the same figure I have shown an internally disposed leading part driving the feed rolls.

It will be understood that when the lagging part is motor assisted, the feed or feed and draw rolls will not stop on the breakage of the material, but will slow down only. In this case, and also when I drive the feed or feed and draw rolls from the leading part, I may employ any well-known automatic stop device, either to remove one of the elements of the friction drive or apply a brake, thus effecting the stop required. It will be understood that when I use the form of feed drives a and b above indicated, a brake may be preferably applied to secure quicker stopping of the lagging part.

As described in my specification Serial Number 221,295, the units of a machine to which my present invention is applied can be slowed down for convenience in piecing and handling. I have in this specification frequently used the term "air borne", and use it in the sense that the bearing is air lubricated, and not in the limited sense that the weight of the rotating part is necessarily air supported.

I have found in working out my present invention that certain precautions are desirable to enable the most satisfactory practical result to be obtained, and these precautions I will now indicate with reference to Fig. 7, for the purpose of disclosing the best means at the present known to me of using my present invention.

First, I find it important to efficiently shield the turbine, and for this purpose it is convenient to employ a Laval type turbine, completely shrouded over the blades. This I carry on the air borne ring flier c. The turbine is shown at c', and is inclosed in a closely fitting chamber formed between the flanged ring c^2 and the top of the fixed bearing c^3 through which the air is led in by suitable nozzles c^4. The flange of the ring c^2 has openings in it for the discharge of the exhaust fluid into a further chamber, which bears up the ring flier c. The turbine is thus well shielded, and the power required for driving the ring flier much reduced.

Secondly, the air supplying the motor should be warmed to prevent the condensation of moisture in the air bearing, and preferably the air should be filtered to avoid dust.

Thirdly, ballooning is a factor limiting the speed at which the material can be worked, and should be guarded against. I therefore instead of the eye 6 in Fig. 4, at the top of the ring flier, form an internal hook 6^a or the like, at the bottom of the flier, Figs. 7 and 8, so that the flier itself contains the yarn or the like, and acts as an anti-ballooning device.

Fourthly, I find that difficulties tend to arise with air bearings at very high speeds, owing to the tendency of the high speed rotating parts to run on the vertical axis through its center of mass, which may not absolutely coincide with its constrained axis of rotation. This is obviated by supporting the stationary part of the air bearings flexibly, *e. g.*, the stationary bearing b' (Fig. 7) carrying the flier o, is itself supported on yielding rings b^2 top and bottom in the fixed outer part c^3.

Having thus described my invention what

I claim as new and desire to secure by Letters Patent is:—

1. In a twisting apparatus, the combination of a leading and a lagging element, forming a twisting unit together with co-acting air lubricated surfaces for said unit.

2. In a twisting apparatus, the combination in a twisting unit of a leading and a lagging element together with co-acting air lubricated surfaces for said unit and separate motor means for driving the same.

3. In apparatus for twisting fibrous material the combination in a twisting unit of a leading and a lagging element; co-acting air lubricated surfaces for said unit; means for feeding the material together with separate motor means for driving said unit and a driving connection between one of said elements and said feeding means.

4. In a twisting apparatus, the combination of a leading and a lagging element one of which takes the form of a ring flier, together with air lubricated bearings for said flier.

5. In a twisting apparatus, the combination of an air lubricated ring flier as leading element; a co-acting lagging element on which said material is wound together with a rotary driving motor carried by said flier.

6. In a twisting apparatus, the combination of a leading element; a lagging element, said elements being arranged so that one surrounds the other, together with air lubricated bearing surfaces on one of said elements.

7. In a twisting apparatus the combination of a leading element, a lagging element, said elements being arranged so that one surrounds the other; air lubricated bearing surfaces on one of said elements together with a motor on said lubricated element.

8. In apparatus for twisting fibrous material, a plurality of twisting units, each comprising a leading and lagging element; and each comprising also means for feeding said material together with a driving connection between one of said elements and said feeding means.

9. In apparatus for twisting fibrous material, a plurality of twisting units, each comprising a leading element; each comprising a lagging element internally disposed with regard to said leading element; and each comprising also means for feeding the material together with a driving connection between said lagging element and said feeding means.

10. In a twisting apparatus the combination in a twisting unit of a leading and a lagging element; co-acting air lubricated surfaces for said unit, together with elastic fluid motor means for driving said unit and fluid means for supporting the dead-weight of certain rotatable parts of said unit.

11. In a twisting apparatus, the combination in a self acting unit of a twisting element, air lubricated bearings for the same and independent motor means for driving said unit.

12. In a twisting apparatus, the combinations of a twisting element; air lubricated bearings for the same and a rotary motor mounted on said element.

13. In a twisting apparatus, the combination of a twisting element; air bearings for the same and a turbine mounted on said element.

14. In a twisting apparatus, the combination of a rotatable twisting element and a bearing member therefor said element and said member having co-acting air bearing portions with intermediate portions disposed clear of one another between adjacent air bearing portions.

15. In a twisting apparatus the combination of an air lubricated twisting element, elastic fluid motor means for driving said element together with means for supporting said element, said means including the exhaust fluid from said motor.

16. In a twisting apparatus the combination in a twisting unit of a leading and a lagging part, co-acting air lubricated surfaces for said unit, together with motor means for driving said unit and means for supporting deadweight of certain rotatable parts of said unit.

17. In a twisting apparatus, a spinning unit comprising the combination a leading and a lagging element, the first of which is motor driven and the second motor assisted.

18. In a twisting apparatus, a spinning unit comprising the combination of a leading and a lagging element together with a rotary motor mounted on each of said elements.

19. In apparatus for twisting fibrous material the combination in a twisting unit of a leading and a lagging element; co-acting air lubricated surfaces for said unit; means for feeding the material together with separate fluid motor means for driving said unit and a driving connection between one of said elements and said feeding means.

20. In apparatus for twisting fibrous material the combination in a self acting unit of a leading and a lagging element; co-acting air lubricated surfaces for said unit; means for feeding the material together with separate elastic fluid motor means for driving said unit and a driving connection between one of said elements and said feeding means.

21. In apparatus for twisting fibrous material the combination in a self-acting unit of a leading and a lagging element; co-acting air lubricated surfaces for said unit; means for feeding the material together with separate motor means for driving said units

on each of said elements and a driving connection between one of said elements and said feeding means.

22. In apparatus for twisting fibrous material the combination in a twisting unit of a leading and a lagging element; co-acting air lubricated surfaces for said unit; means for feeding the material together with separate elastic fluid motor means for driving said units on each of said elements and a driving connection between one of said elements and said feeding means.

23. In apparatus for twisting fibrous material the combination of a leading and a lagging element forming a twisting unit, separate motor means for driving said unit, means for feeding fibrous material to said unit, a driving connection between one of said elements and said feeding means, and means for holding twisted material on one of said elements together with means common to a plurality of said units for laying the twisted material on said holding means.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

SEBASTIAN ZIANI DE FERRANTI.

Witnesses:

ROBERT MORRISON NEILSON,

VIVIAN ARTHUR HUGHES.