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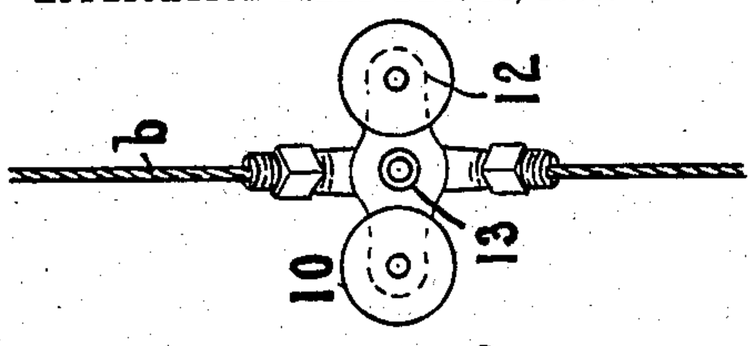
C. S. McCONNAN.

FLIER FOR SPINNING, TWISTING, WINDING, BALLING, OR LIKE MACHINERY.

APPLICATION FILED DEC. 11, 1900.

NO MODEL.

FIG. 2.



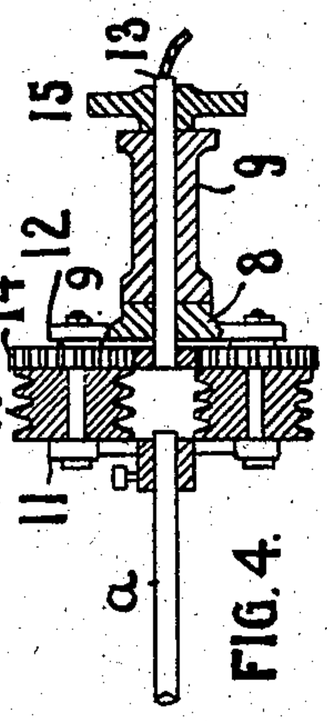


FIG. 4.

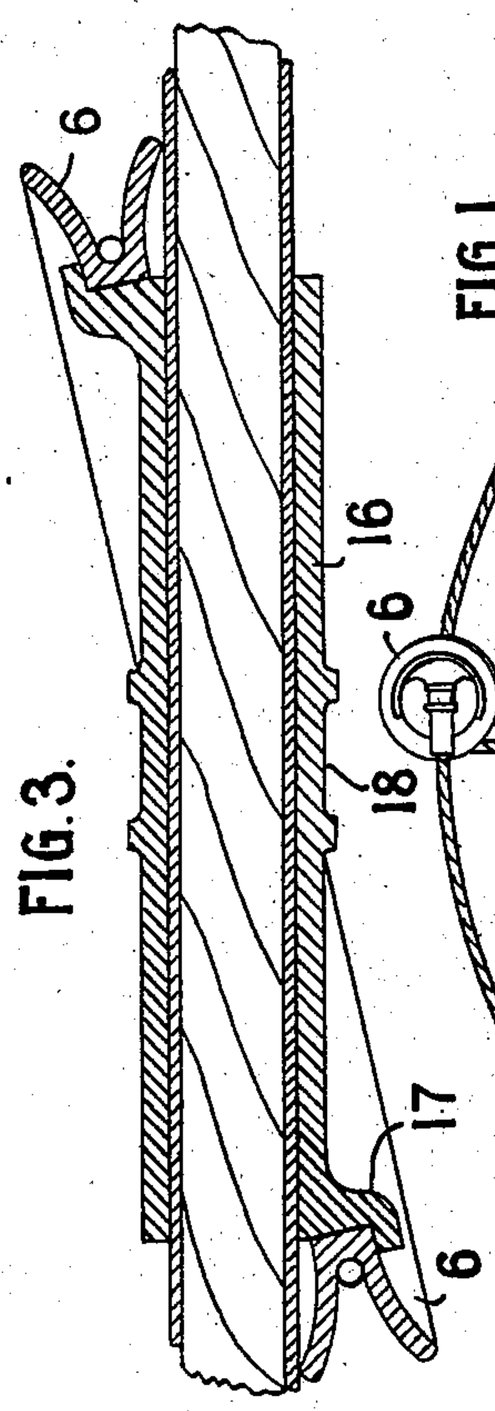


FIG. 3.

FIG. 1.

Witnesses

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CHARLES STODART McCONNAN, OF LIVERPOOL, ENGLAND.

FLIER FOR SPINNING, TWISTING, WINDING, BALLING, OR LIKE MACHINERY.

SPECIFICATION forming part of Letters Patent No. 721,457, dated February 24, 1903.

Application filed December 11, 1900. Serial No. 39,473. (No model.)

To all whom it may concern:

Be it known that I, CHARLES STODART McCONNAN, rope manufacturer, a subject of the King of Great Britain, residing at Liverpool, in the county of Lancaster, England, (whose post-office address is 305 Edge Lane, Liverpool, aforesaid,) have invented certain new and useful Improvements in Fliers Applicable for Spinning, Twisting, Winding, Balling, or Like Machinery, of which the following is a specification.

This invention relates to fliers applicable for use in operations such as spinning, twisting, winding, and balling yarn or other material, and has more especially for its object the attainment of a higher speed, together with a steadier motion, than is possible with fliers of the usual construction.

I consider my invention most applicable and with the greatest advantage in speed to spinning, twisting, or like operation of the heavier classes of yarn, such as in twine manufacture, and very applicable to the spinning and twisting of rope-yarns, harvesting-twine, and other similar operations in cordage manufacture.

In the accompanying drawings, Figure 1 is an elevation, partly in axial section, of my flier for spinning rope-yarns. Fig. 2 is a transverse section of the flier at x^2 in Fig. 1, being substantially an end view of loose or free extremity of the flier, showing one way of attaching the capstans; Fig. 3, a detail view showing mode of attachment of the guide-sheave to the wire cord of the flier. Fig. 4 is an axial section at line x^4 in Fig. 2, showing the hollow spindle of the flier.

My present invention is exemplified by the ballooning action of the cotton thread, such as takes place in the ring and traveler system of spinning, or by the centrifugal action of a yarn or thread spreading itself outward by reason of the centrifugal force developed throughout its length by reason of its own weight. Further, the invention is exemplified by the centrifugal action of a child's skipping-rope, in which by rotating or driving one end and allowing the other end to be capable of free rotation the rope balloons outward and assumes a peculiar curve by reason of its centrifugal force. In the flier forming the subject of this application the same principle is utilized, as by rotating or driving one end and allowing the other end to be capable of free rotation the arms of the flier balloon outward and assume a curve by reason of the centrifugal force, thus setting up a tension in the arms which keeps them in a circle of given radius and forms a flier which is absolutely rigid so long as rotation is continued.

In the accompanying drawings, *a* is the spindle, and *b c* one or more flexible arms or lateral springy wires or cords, each charged or supplied with sheaves 6, adapted to move somewhat after the manner of a conical pendulum in a circular path around the spindle *a*. Each arm *b* is tied by a flexible springy arm *c*, forming a closed flier. It is obvious that one arm *b c* may be used, or the flier may be perfectly balanced by having two oppositely-fixed arms, as shown in the figures. The arms *b* are attached at one end to the projecting arms 9 of a hollow sleeve *g*, revolving loosely in the bearing 3 on a hollow spindle or axis 13, on which latter a pulley 15 is mounted. The stay cords or arms *c* connect the sheaves 6 with the arms of a tubular sleeve *m*, to which latter is fixed a rotary sleeve *l* and through which the traverse-tube 2 and the spindle *a* pass. One extremity of the flier is thus loose on the axis 13 and the other extremity is fixed rigidly to the part *m*, surrounding the axis *a*, so that it can be driven by the pulley *h*. The tubular sleeve *m* and the tubular sleeve *g* are located at a suitable distance apart and are each mounted in bearings 3 and 4 on the rails 22 and 19. The projecting pieces of the sleeve *m*, to which the arms *c* are attached, are made in two halves, one part, 8, fitting on the other part, 9, as shown.

i is the material being twisted and wound onto the bobbin. This is introduced through the hollow spindle 13 to the hauling-off capstans 10, which are carried on arms 11 and 12, attached, respectively, to the spindle *a* and the parts 8 of the loose end, which, with the other part, 9, forms an attachment for the arms *b*. The tube 13 drives the capstans 10 by means of toothed wheels 14. 15 is the driving-pulley for these capstans. The yarn

is then conducted from the capstans to the sheave 6, from which it is led to the bobbin on the spindle *a*.

To enable the material being twisted and wound to pass from the capstans to the bobbin 7 without any danger of slipping off the guide-sheave, I so arrange said sheave in a plane which is diagonal to the plane of the flier-arms, so as to guide and deliver the material to the bobbin in the most efficient manner. This sheave 6 is really a ring and is as light as possible—say of hard wood or something very light. The ring-sheave is mounted on a split circular support 16, having a groove 17, in which the ring-sheave 6 revolves. The supporting-piece is made in two halves, which fit onto the flier-arms. These two halves where they fit on the flyer-arm are dovetailed together, the part of the flange of one half being rabbeted or spliced into the flange of the other half and then fastened by clips placed in the groove 18.

The wire-rope arms *b c* are composed of many individual wires twisted together and having high tensional resistance. They are preferably made of steel wire of the strongest kind, this material being known to have the greatest tensile resistance possible.

Now when the flier is at rest the arms *b c* will be in a position of collapse; but if the sleeve *m* be rotated at high speed the sheaves, (which constitute weight,) by the centrifugal force developed in them by such high speed, will spread or fly outward to their extreme limits and describe a circular path around the spindle and put a tension on the arms or cords which keep the guide-sheaves revolving in a circle of unalterable radius, as any tendency to spread farther apart is prevented by the arms or cords. This force is of course arranged to exceed the inward pull of the material *i* as it is guided onto the bobbin or spindle—that is to say, the centrifugal force of my flier pulling outward exceeds the drag of the thread tending to pull the sheaves inward. The centrifugal force of the arms plays as important a part in forming a rigid flier as the sheaves 6 do, the arms being made very flexible. The latter will balloon outward, as shown, and form a rigid, correct, and symmetrical curve that is due to centrifugal force, and I am thus able by this arrangement to obtain a light flier capable of running at very high speed without any tendency to distortion, which will also run very freely and with as little friction as is possible to make it run. The tubular sleeve *g* runs loose. The sleeve *l*, however, to which the sleeve *m* is attached, has a pulley *h* for receiving a driving-band, by means of which the sheaves 6, with their cords or arms, are rotated at a high speed in a circular path around the spindle *a*, the tubular sleeve *g* being turned around quite easily by the circular travel of the ropes *b c*—that is to say, by driving one end 4 of this flier and allowing the opposite end 5 to be loose and free the combined centrifugal force of the sheave 6 and the arms *b c* of this flier during rotation creates a rigid flier, so that the said loose and free extremity *g* is pulled around by means of the action of this aforesaid centrifugal force.

My flier is stiff and rigid when rotating only and collapses and is flexible when at rest, and there is no permanent set when the flier becomes skewed or twisted, because so soon as it is rotated its centrifugal force sets it square again. To fill the bobbin 7, a longitudinal reciprocating motion is imparted to the traverse-tube 2, so as to change the relative longitudinal positions of the flier and spindle.

In present fliers a very small portion of the available tensile strength of the arms of the flier is made use of, and the advantage of this valuable factor is neglected, the limit of speed being that speed when undue expansion of the said legs or arms approaches to a dangerous extent and at which point the tensile strain longitudinally with their length is practically *nil*. In my "balloon flier" on account of its construction and form its speed may be increased beyond the same said maximum speed of present fliers until the tensile strain acting along the flexible wires or equivalents, due principally to the centrifugal force of the guide-sheave and the centrifugal force of said flexible or other wires themselves, shall amount to and be equal to the safe working tensile load which the material composing the flexible or other wires is capable of sustaining. Hence my balloon flier being closed at both ends—*i. e.*, being what is known as a "closed" flier—no detrimental expanding effect takes place, and the limit of speed is not a question of flier expansion, as in present fliers, but a question of tensile strength of the flier-arms. Hence the wires will preferably be composed of material having the greatest tensile strength possible—such as, for instance, piano-wire.

Among the advantages secured by the use of this invention may be mentioned the following: The advantage of the volume swept by the flexible wires or equivalents of my balloon flier, which may easily be considerably larger than that volume swept either by the present fliers or contained by the ring in ring-spinning, thus enabling a much larger quantity of the twisted material to be held at one time by the spindle, bobbin, or tube previous to doffing. Now the volume swept by the arms or legs of present-used fliers is considerably restricted by the expansion of these fliers, which are generally "closed fliers," and also on account of their form or shape and construction.

Having thus described my invention, I claim—

1. A flier having flexible arms which assume when the flier is rotating at a high velocity the rigid, correct and symmetrical shape or form that is due to the centrifugal force generated on such rotation, each of said arms ro-

tating concentrically around a common axis and provided with a guide for the thread, and each arm secured at one end to the rotated part and freely connected at its other end.

2. A flier having flexible arms which assume when the flier is rotated at a high velocity, the rigid, correct and symmetrical shape or form that is due to the centrifugal force generated by such rotation, each of the said arms being provided with a guide for the thread and with capstans at its free end each arm being secured at one end to the rotated part and freely connected at its other end.

In witness whereof I have hereunto signed my name, this 23d day of November, 1900, in the presence of two subscribing witnesses.

CHARLES STODART McCONNAN.

Witnesses:

G. C. DYMOND,

JOHN McLACHLAN,