June 25, 1968 H. KÜHL 3,389,547

FLIER FOR ROVING MACHINES

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FIG. 1

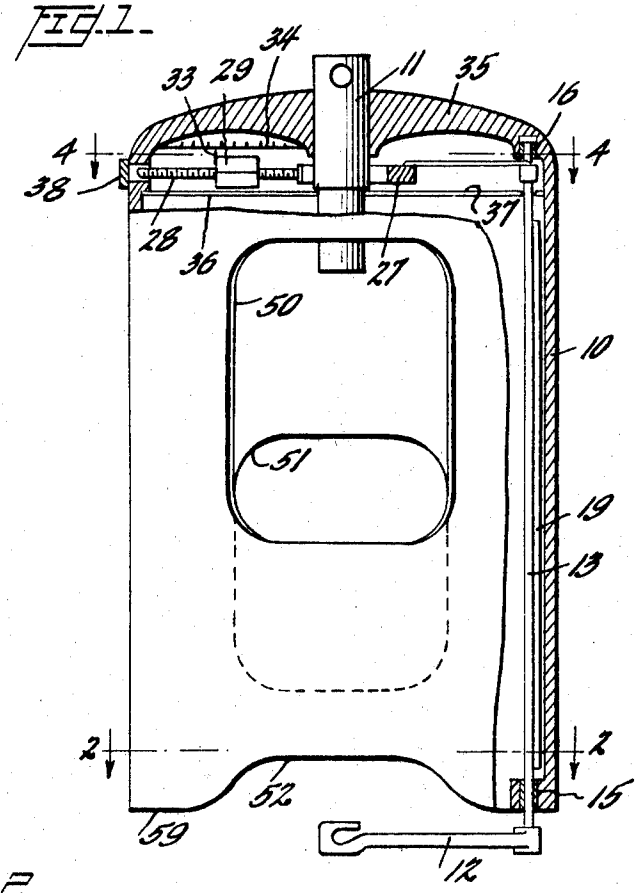


FIG. 2

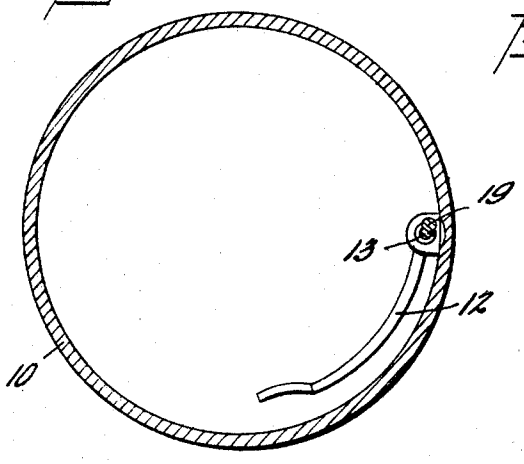
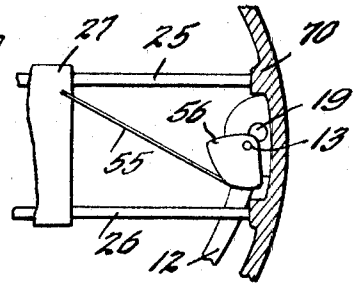


FIG. 10



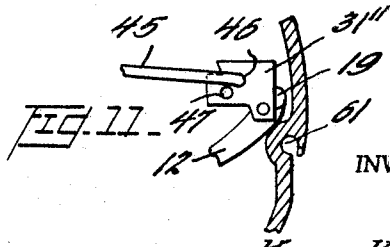


FIG. 11

INVENTOR

Hans Kühl,

BY

Watson, Cole, Grindle & Watson

ATTORNEYS

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Fig.3

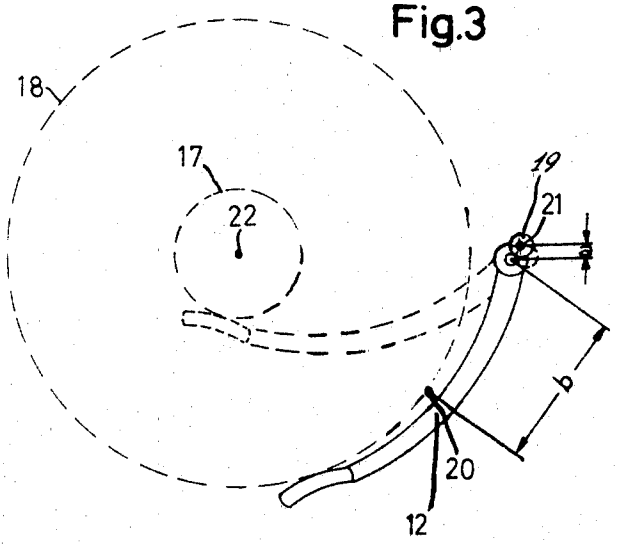
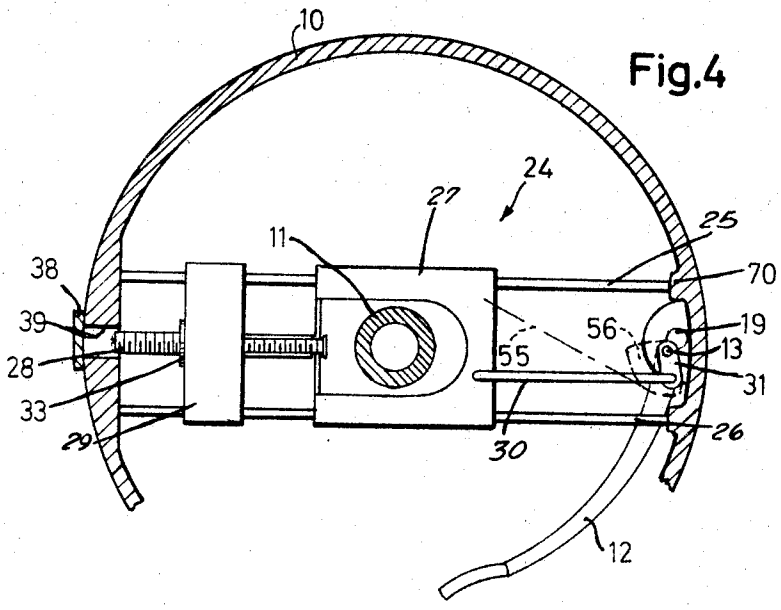


Fig.4



INVENTOR

Hans Kühl

BY

Watson, Cole, Grindle & Watson

ATTORNEYS

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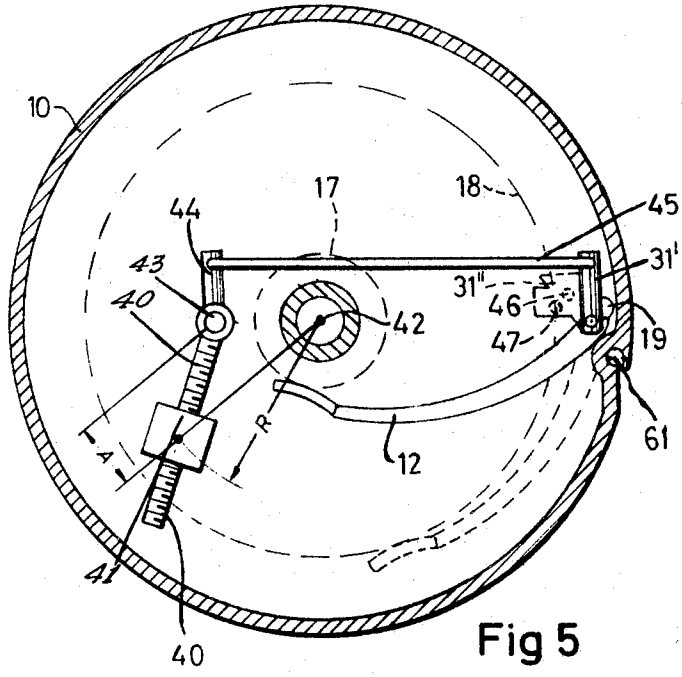


Fig 5

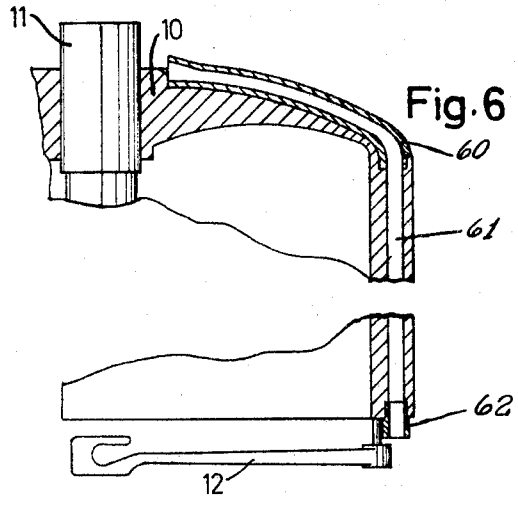


Fig.6

INVENTOR

Hans Kühl

BY

Watson, Cole, Grindle & Watson

ATTORNEYS

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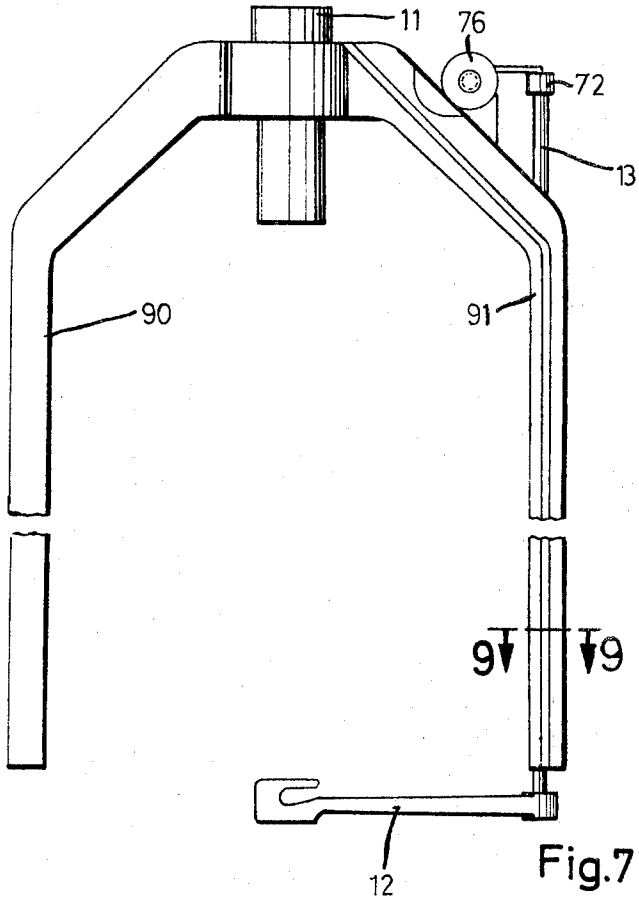


Fig.7

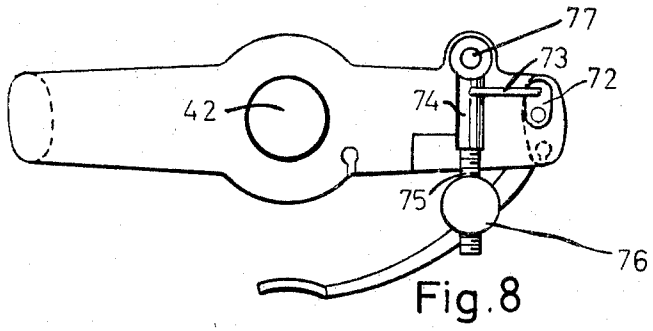
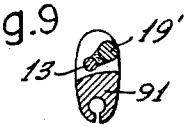


Fig.8

Fig.9



INVENTOR

Hans Kühl

BY

Watson, Cole, Grindle and Watson

ATTORNEYS

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3,389,547

FLIER FOR ROVING MACHINES

Hans Kühl, 16 Urbanstr., 731 Kornbergweg, Germany

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ABSTRACT OF THE DISCLOSURE

A roving machine flier having a swinging pressure finger to guide the roving to the spool and an automatic mechanism for regulating the pressure exerted by the finger, such mechanism comprising two devices, each operatively connected to the finger and adapted to generate torque in response to centrifugal force, the first of these devices functioning to at least partially compensate for the effect of momentum on the finger due to flier rotation and changing finger position, and the second device being effective to apply a generally predetermined bias to the finger and including a weight movable between fixed limits on a part of the flier and producing a force under rotation, and connection which may include a crank lever pivoting as a unit with the pressure finger, between the finger and the weight to transmit force therebetween over the full range of weight positions between such limits.

The invention relates to a flier for roving machines, specifically fly frames, of the type having a pressure finger mounted pivotally on the flier to guide the roving to the spool.

With fliers of this type the pressure finger is pressed against the spool by means of a predetermined biasing force. With one arrangement known in the art this is achieved by means of a compression spring bearing at one end against the flier arm to press the pressure finger against the spool. The spring is thus loaded and its tensile characteristics are designed to produce an approximately constant contact pressure of the pressure finger against the spool. One of the broblems of this type of construction, however, is that the pressure finger is also pressed against the spool when the machine is stationary and starting up and can cause unevenness in the roving. Also with this known form of construction, the contact pressure can be held constant at only a specific flier revolution speed, any variation from which causes a rise or fall to occur in the contact pressure of the pressure finger.

In another known type of flier, the pivot shaft for the pressure finger carries a counterweight of a size designed to press the pressure finger against the spool with the desired force at some pre-determined rotational speed. Obviously this form of construction is also subject to the disadvantage of the contact pressure of the pressure finger varying at higher or lower speeds of operation.

The basic object of the invention is to provide an improved flier free of the disadvantages of known fliers.

A further object of the invention is a flier in which the pressure finger presses against the spool with a contact pressure which does not vary in relation to the winding diameter.

Yet another object of the invention is to produce a flier having a pressure finger capable of exerting an adjustable contact pressure so that it is possible, in particular, to regulate the contact pressure to a constant value over a range of flier speeds. By this means the useful scope of the roving machine in question is enlarged.

According to the broad concept ot the invention, a flier for roving machines is provided with a pivotally mounted pressure finger for guiding the roving and a first and a second torque device is arranged on the flier each having

a functional connection with the pressure finger, the first torque device being adapted to compensate at least partially, preferably completely for the intrinsic angular torque caused by the flier rotation and generated by the changing position of the intrinsic mass of the pressure finger about its pivotal axis during winding, while the second torque device is adapted to control the force with which the pressure finger can be pressed against the spool associated with the flier.

By virtue of this concept, the contact force of the pressure finger can be made adjustable in a controllable manner, for example by means of an adjustable element of the second torque device arranged to regulate the magnitude of torque produced thereby and/or the funtcional relationship of such torque to the setting of the pressure finger. In a preferred embodiment, provision can be made for continuous adjustment between given limits, thus permitting the contact pressure exerted by the pressure finger to be selected precisely in accordance with any desired flier speed.

Any known type of mechanism for generating force can be employed as a force element for the purposes ot this invention. According to a preferred form of construction, the force element is a flyweight, the useful force by which results through the action of centrifugal force. Other suitable force elements can, if desired, be employed in lieu of a force element of this type, for example hydraulic, pneumatic or electromagnetic force elements, e.g. a rotary magnet or the like. In some cases it is also possible to use one or more springs to advantage as force elements.

Preferably, however, a flyweight is employed as the force element since, the force exerted by this flyweight can be adjusted or regulated in a particularly simple manner by varying its distance from the rotary axis of the flier. This arrangement can be designed so that the magnitude of torque exerted through the second torque device remains constant for each angular position of the pressure finger.

Furthermore, it is preferred to arrange the second torque device in the upper section of the flier. In this way, the mass of the lower section of the flier can be reduced and undesirable expansion of the lower section of the flier is prevented.

It is contemplated by the invention that in place of conventional flier arms a bell-shaped cover should be provided, this preferably being molded of a transparent plastic material. A bell-shaped cover of this nature has the advantage of permitting a considerably better equalization of its mass, giving considerably smoother operation. Moreover, the enclosed form of the bell-shaped cover is the most stable form one can achieve. Creation of lint and undesirable air movement is also reduced.

The objects and features of the invention as just described will be more fully understood from the following detailed description of several illustrative embodiments when read in conjunction with the annexed drawings in which:

FIG. 1 is a front elevation of a bell-shaped flier constructed in accordance with the invention, certain parts being shown in cross-section;

FIG. 2 is a horizontal sectional view through the flier of FIG. 1 taken along the line 2—2 of FIG. 1;

FIG. 3 is a diagrammatic plan view, partially in phantom, showing the mode of operation of the first torque device employed in the flier of FIG. 1;

FIG. 4 is a horizontal sectional view through the flier of FIG. 1 taken along the line 4—4 of FIG. 1, part of the bell-shaped cover being broken away for sake of clarity;

FIG. 5 is a view similar to FIG. 4 of a modification of

the flier of FIGS. 1–4, in which the second torque device differs from that illustrated in FIG. 4;

FIG. 6 is a fragmentary longitudinal sectional view through a preferred bell-shaped cap or cover in accordance with the invention, illustrating a detail thereof;

FIG. 7 is a front elevation of an additional embodiment of the flier according to the invention;

FIG. 8 is a top plan view of the flier illustrated in FIG. 7;

FIG. 9 is a horizontal section taken along line 9—9 of FIG. 7 but omitting the pressure finger;

FIG. 10 is a fragmentary sectional view similar to FIG. 4 and showing a modification of the embodiment of FIG. 4; and

FIG. 11 is a view similar to FIG. 5 showing a modification of the embodiment of FIG. 5.

In the embodiment of the invention illustrated in FIGS. 1 to 4, the flier includes a bell-shaped cap **10** provided at its top with a coupling member **11**, which is of the conventional type and therefore not shown in detail. The member **11** serves to connect the flier to the spindle which is also of the conventional type and therefore not illustrated. At the lower end of the flier is a pressure finger **12** mounted on the lower end of a shaft **13** supported for pivotal movement about a vertical axis **13** in bearings **15** and **16** in such a manner that the pressure finger can always press against the periphery of the spool of roving indicated in dotted lines in FIG. 3, with the smallest winding diameter designated **17** and the largest winding diameter **18**. Shaft **13** extends the length of the cap **11** in closely spaced parallel relation to the inner surface thereof.

Associated with pressure finger **12** is a first torque device which, in this embodiment, takes the form of a counterweight **19** fixed securely along the length of shaft **13**. This counterweight is so designed and arranged that the torque which it generates in shaft **13** under the influence of the centrifugal force as the flier rotates is of identical magnitude and in opposition to the torque applied to the shaft through the action of centrifugal force on the pressure finger.

For a better understanding of these forces, reference should be made to the diagrammatic view of FIG. 3. Thus the torque attributable to counterweight **19** is determined by the centrifugal force acting on its mass center **21** multiplied by the lever arm *a*, i.e. the perpendicular distance between the center **21** and the pivotal axis of the pressure finger. The torque produced by the pressure finger is determined by the centrifugal force acting on the mass center **20** of the pressure finger multiplied by the perpendicular distance *b* between this center and from the pivotal axis of the pressure finger. The desired compensation of the torque produced by the action of centrifugal force on the pressure finger may be achieved virtually independently of the change in angular position of the pressure finger as the diameter of the spool winding varies during winding, by intelligent selection of the relative positions of the mass-centers of the counterweight and pressure finger radially of the axis of shaft **13**. For all practical purposes, substantial equalization of forces will result if the increase in the effective lever arm (*b*) of the centrifugal force on the pressure finger about the shaft axis is in proportion to the increase in the effective radius of the mass-center **20** from the winding center **22**. If this result is impractical, the effective lever arm (*a*) of the centrifugal force acting on the counterweight can also be made to increase to act to the equalizing effect. The change in the effective radius of the counterweight from the winding center **22** is virtually negligible in this embodiment but under other appropriate circumstances, this factor could also be brought into play.

The requisite contact pressure of pressure finger **12** on the periphery of the spool, which is not illustrated in detail, is obtained by means of a second torque device generally designated **24** (FIG. 4). This second torque device contemplates the provision on two parallel guide bars **25** and **26** of a sliding member **27**, from one end face of which extends a rotatable threaded spindle **28** in threadwise engagement with a flyweight **29** resting on guide bars **25** and **26**. Thus, rotation of spindle **28** produces an adjustment in the radial position with respect to the flier center of a flyweight **29** which therefore serves as a force supplying element, being guided by parallel bars **25** and **26**. During operation, the pull of flyweight **29** resulting from the action of centrifugal force is transmitted via threaded spindle **28** to the sliding member **27** and from thence by way of a tierod **30** to one end of connecting link **31**. Link **31** is connected firmly at its other end with pivotal shaft **13** supporting the pressure finger so that the centrifugal force exerted upon flyweight **29** applies to shaft **13** torque which urges the pressure finger against the spool. The magnitude of this torque can be adjusted by changing the radial position of flyweight **29** by means of threaded spindle **28**. To achieve uniform setting of all fliers on a machine an indicator **33** may be fastened on flyweight **29**; and the setting of the said indicator can be read from a graduated scale **34** (FIG. 1). The scale is visible in a manner not illustrated through a glass recessed into the top **35** of bell-shaped cap **10**.

To protect the second torque device from lint or dust it is situated in the top-most area of the cap **10**, being separated from the remaining internal space in the bell-shaped cap **10** by a partition floor **36** to define a dust-proof chamber **37** for the device. The chamber **37** formed in this manner is provided with an access aperture **39** (see FIG. 4) through which the threaded spindle **28** can be manipulated to adjust the flyweight. This aperture can also be sealed off by means of a cover indicated at **38**.

In this embodiment, the operating link **31** is arranged at such an angle relative to pressure finger **12** that the torque exerted on pressure finger **12** by the second torque device is virtually independent of the pivotal position of this finger. Here this is achieved by adjusting the effective length of the link **31** relative to the pivotal position of finger **12** in such a manner that the change in the centrifugal force of sliding member **27** and flyweight **29** as a result of their displacement radially of the flyer axis is more or less proportionate to the change in effective lever arm of the link about shaft axis **13** as the pressure finger pivots during operation. Since the relationship necessary for this result will be readily appreciated by the expert, it need not be explained in greater detail. It is, however, pointed out, for example, that the constant level of torque produced by the second torque device can also be obtained by other measures, for example through creating the torque by means of a spring (not shown) having a tensile strength which remains virtually unchanged relative to the pivotal position of the pressure finger.

To facilitate re-threading of the roving in the event of breakage during operation, apertures **50** and **51** are provided at different levels in the cylindrical walls of the bell-shaped cap (see FIG. 1) to allow better access to broken roving. Furthermore, for easier operation of the pressure finger **12** a recess **52** is provided on the bottom rim **59** of bell-shaped cap **10**. For balancing the flier conventional balancing weights can be used and these have consequently not been shown in detail. Preferably the balancing weights, the bar-supporting bosses **70** and the bearing apertures **15** and **16** can be constructed integrally with the bell-shaped cap **10**.

In a modification (shown in FIG. 10) of the embodiment illustrated in FIGS. 1 to 4, the tie-rod **30** is replaced by a flexible traction cord or band **55** which stretches between the sliding member **27** and a segmental camplate mounted firmly on shaft **13** and indicated at **56**, similar in priciple to the actuating motion for the lifter arms of the ring rail for a ring spinning or twisting machnie. The curvature on ths camplate **56** can be designed to produce any desired pre-selected pattern in the torque force exerted on the pressure finger **12** over the limits of its angu-

lar position. In particular, the curvature can be shaped to ensure that this torque is constant irrespective of the angular position of the pressure finger. The other components of the embodiment of FIG. 10 are the same as the embodiment of FIG. 4 and have the same numerical designations.

A further modification in the second torque device is illustrated in FIG. 5. This modified device, also located in the upper section of bell-shaped cap **10**, includes a cylindrical flyweight **41** in threadwise engagement with a threaded pin **40** which is pivotable about a pivotal axis **43** parallel to the flier axis **42**. A tie-rod **45** is hinged at one end to crank lever **44** rigidly connected with threaded pin **40** and is articulated at the other end with an operating lever **31** fixed on the pivot shaft of the pressure finger. Here, also, the arrangement of the lever system of the second torque device relative to pressure finger **12** is so designed to ensure the exertion on the pressure finger of an adjustable torque of a pre-selected magnitude independent of the angular position of the pressure finger. The torque exerted by the flyweight about its pivotal axis **43** is proportional to distance R from the axis of rotation **42** of the flier and proportional to the length of its effective lever arm A about axis **43**.

In many cases it is more desirable that the torque applied to the pressure finger by the second torque device should not be constant but should relate to the angular position of the pressure finger. This result can be achieved, for example, by fastening the rod **45** in a different manner from that shown in the position lines in FIG. 5. Thus, the lever can take the form indicated in FIGURE 11 at **31**, rod **45** being inserted optionally in either one of the two apertures **46** and **47**. In each of these two basic settings for rod **45** a different functional relationship between the applied torque and the angular position of pressure finger **12** is achieved. In other respects the modified embodiment of FIGURE 11 is the same as in FIG. 5 and the same numerical designations appear therein.

FIG. 6 shows a form of roving guide for bell-shaped cap **10**. This roving guide embodies partial channel sections **60**, **61** and **62**, of which channel sections **60** and **62** are best manufactured of a highly wear-resistant material such as a ceramic. A similar roving channel can also be formed by a one piece split tube which can ideally be cast or moulded integrally with bell-shaped cap **10**. The bell-shaped cap is preferably manufactured of known plastic, particularly of transparent plastics.

Another embodiment is shown in FIGS. 7 to 9 in which the flier is of the more ordinary type of the art; embodying two arms **90** and **91** arranged symmetrically to the rotational axis **42** and does not require further description. On the pivot shaft **13** of pressure finger **12**, a crank lever **72** is mounted firmly and is joined pivotally by means of pushrod **73** to the shaft **74** of a threaded pin **75**. A spherical flyweight **76** is arranged on the threaded pin for adjustment therealong in an axial direction. The threaded pin is pivoted at **77**, its pivotal axis running parallel to the axis of the flier. The pivot axis **77** is located on the same flier arm **91** as shaft **13** of the pressure finger. A counterweight **19** fastened on shaft **13** is adapted to the profile of flier arm **91** in such a manner that no additional wind resistance can arise (see FIG. 9).

The intrinsic angular momentum resulting from the rotation of the natural mass of the pressure finger about the flier axis by the action of centrifugal force on the mass center of the pressure finger is compensated at least in part by the first torque device. Obviously, it may be possible for the torque exerted by the first torque device to exceed the intrinsic angular moment of the pressure finger; in this event the second torque device need generate only a portion of the torsional force by which the pressure finger is pressed on to the spool. A more preferred arrangement, however, is for the torque exerted by the first torque device to be approximately of equal magnitude to the intrinsic angular moment of the pressure finger, this balanced condition being maintained irrespective of the angular position taken by the pressure finger during operation. In this case, the force acting to press the pressure finger against the spool is supplied substantially completely by the torque produced by the second torque device, an arrangement found particularly advantageous.

Having thus described my invention that which is claimed is:

1. In a flier for roving machine of the type having a pivotally mounted pressure finger to guide the roving to the corresponding spool, an improved mechanism for automatically regulating the pressure exerted against the spool by said finger comprising first and second torque devices mounted on said flier, each having an operative connection with said pressure finger, said first torque device being adapted to at least partially neutralize the angular momentum forces acting on said finger due to bodily rotation and changing angular position during operation, said second device being adapted to bias the finger against the spool with a generally predetermined pressure, said second torque device including a weight means mounted on the flier for limited independent movement and adapted to produce a force under the influence of centrifugal force during flier rotation, a crank lever mounted for unitary pivotal movement with said pressure finger and a force-transmitting connection between said weight means and said lever.

2. The flier of claim 1 wherein the effective length of the crank lever is adjustable.

3. The flier of claim 1 including guide means for supporting said weight means for sliding movement along a straight line path.

4. The flier of claim 3 wherein said straight line path passes through the axis of rotation of the flier.

5. The flier of claim 1 wherein said weight means is mounted on a lever arranged for pivotal movement about an axis parallel to the rotational axis of the flier, and said connection extends between said last-mentioned lever and the crank lever for the pressure finger.

6. The flier of claim 5 wherein said weight means is adjustable lengthwise of said lever.

7. The apparatus of claim 1 including means for adjusting the biasing force of said second torque device.

8. In a flier for roving machine of the type having a pivotally mounted pressure finger to guide the roving to the corresponding spool, an improved mechanism for automatically requlating the pressure exerted against the spool by said finger comprising first and second torque devices mounted on said flier, each having an operative connection with said pressure finger, said first torque device being adapted to at least partially neutralize the angular momentum forces acting on said finger due to bodily rotation and changing angular position during operation, said second device being adapted to bias the finger against the spool with a generally predetermined pressure, said second torque device including a weight, a support for said weight mounted on said flier, said support permitting movement of said weight thereon between predetermined limits generally radially of the flier axis, and said operative connection is comprised by means connecting said support and said pressure finger for transmitting forces developed by said weight to said pressure finger over the full range of positions of said weight on said support between said limits.

9. The flier of claim 8 wherein said first torque means includes a weight mounted for unitary pivotal movement with said pressure finger, said weight and pressure finger being so disposed relative to the axis of said pivotal movement that the moment arm of said weight varies in substantially inverse relation to the variation in the moment arm of said pressure finger as the latter pivots to accommodate changes in spool diameter, whereby the respective torque generated by said weight and said pres-

sure finger during flier rotation substantially offset one another, said second torque device thereby substantially determining the working pressure applied by said finger to the spool periphery.

10. The flier of claim **8** whereby said connecting means is such that the amount of torque developed by said second torque means is substantially independent of changes in the position of said pressure finger.

11. The flier of claim **1** wherein said weight means is mounted for limited independent movement along a predetermined path in response to said centrifugal force and including means for adjusting the initial position of said weight means with respect to the axis of flier rotation, said adjustable means being adapted for continuous adjustment between predetermined limits.

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JOHN PETRAKES, *Primary Examiner.*