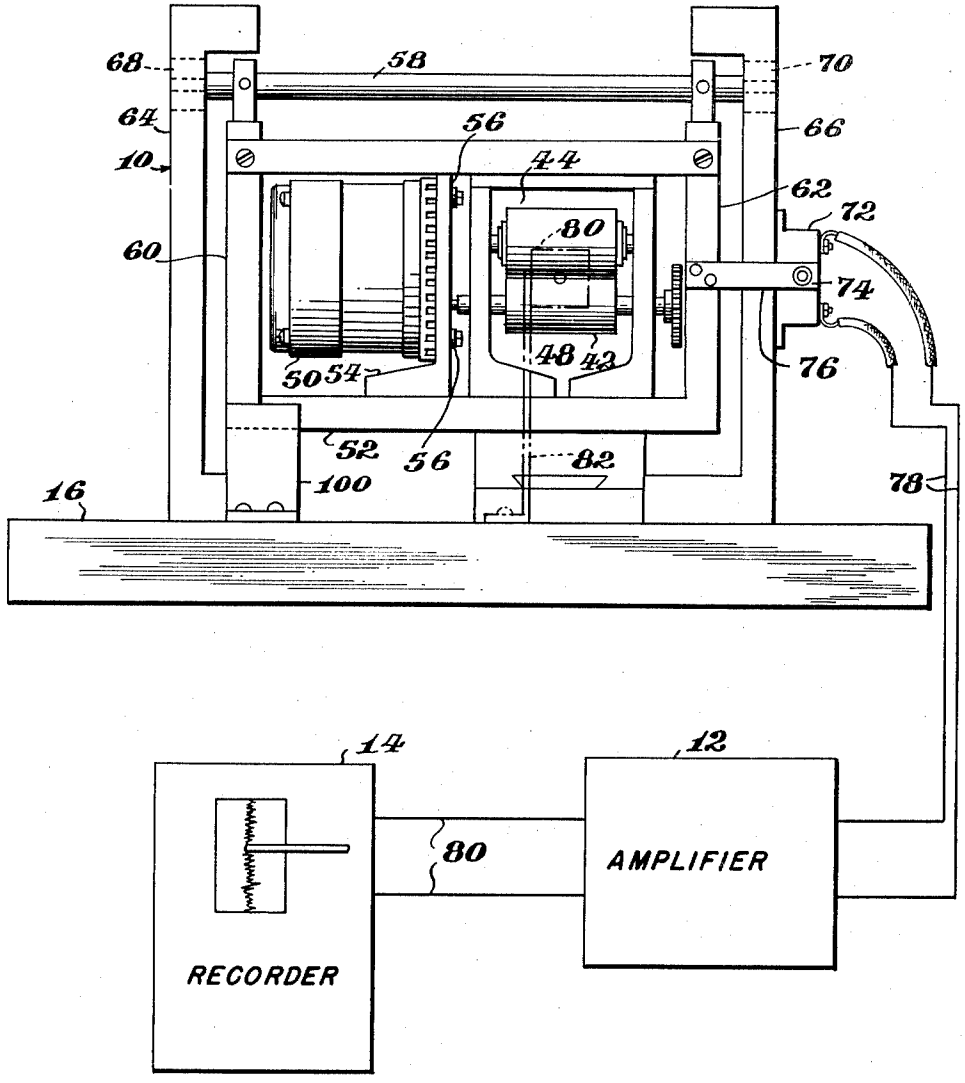
April 5, 1955 F. P. STROTHER ET AL 2,705,423

STRAND DRAFTING AND TENSION MEASURING APPARATUS

Filed June 11, 1952 3 Sheets-Sheet 1

FIG. 1.



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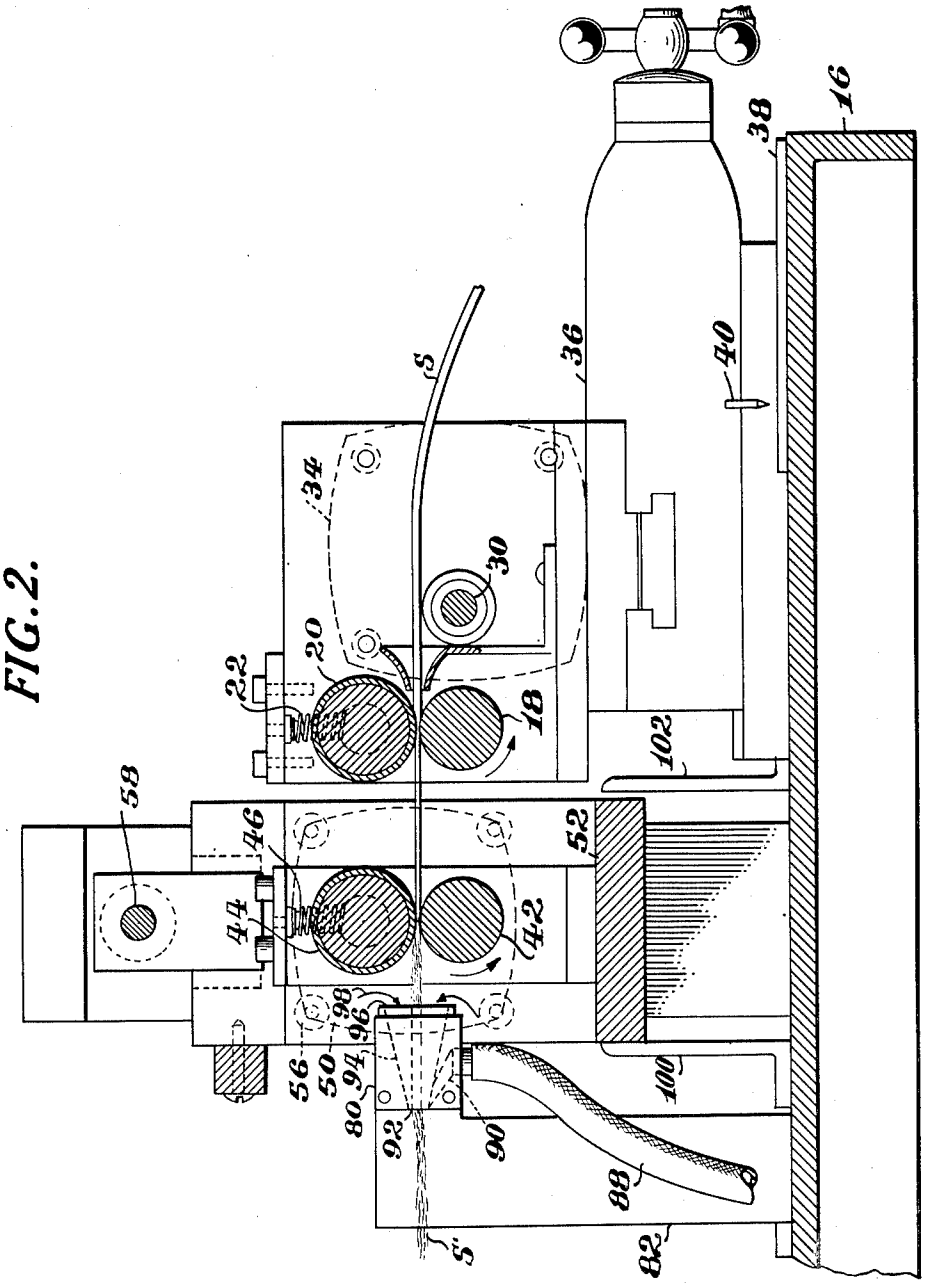
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FIG. 2.



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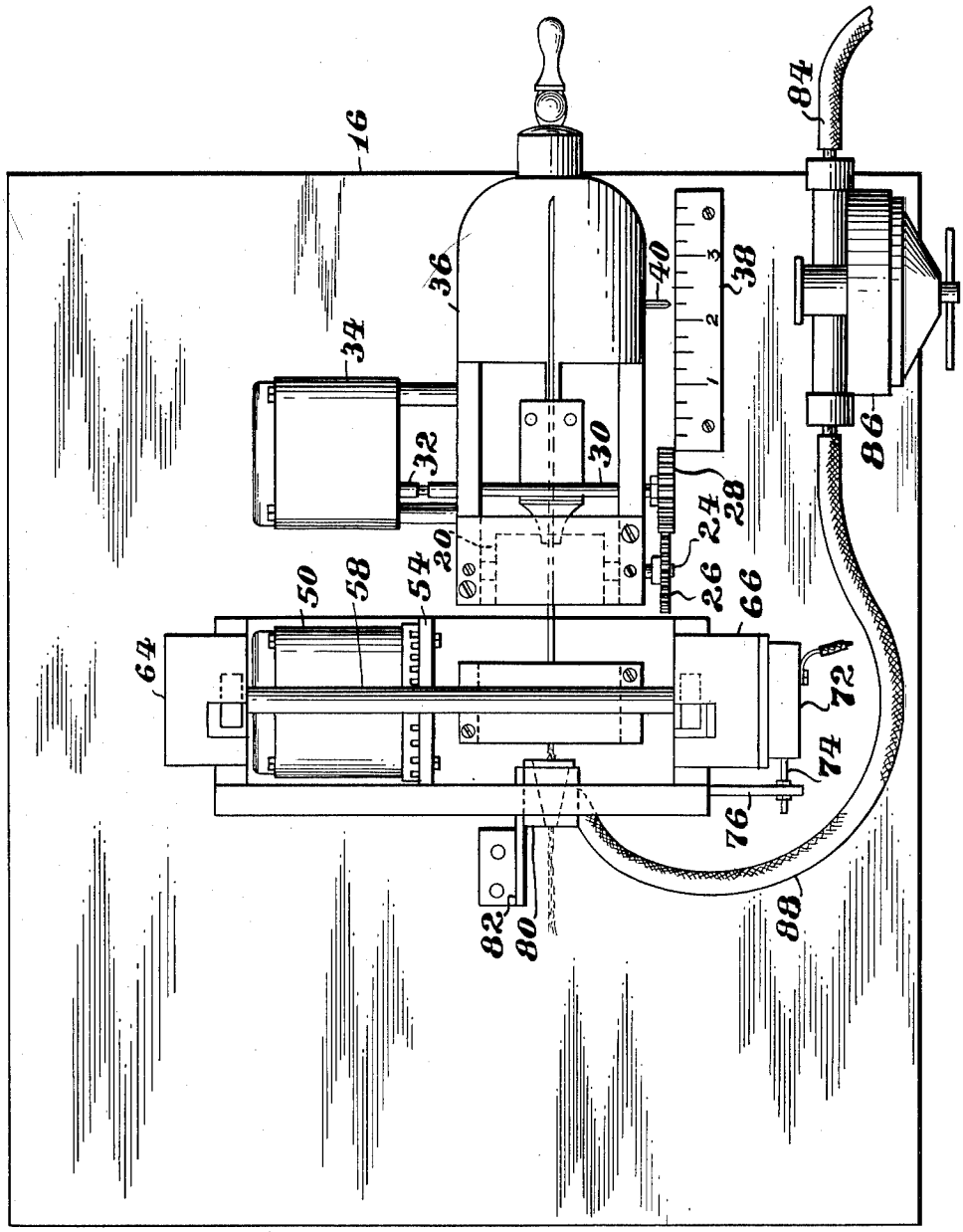


FIG. 3.

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2,705,423

STRAND DRAFTING AND TENSION MEASURING APPARATUS

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7 Claims. (Cl. 73—141)

This invention relates to textile testing apparatus and particularly to apparatus for measuring forces involved in the drafting of strands of textile fibers such as sliver and roving.

It is a well known practice in the textile art to draft sliver and roving, and it is of considerable interest and important to measure drafting forces. Such information is useful in determining proper roving twist, and evaluating fiber finishes, and evaluating many different fiber characteristics and their relationship to spinning and yarn qualities, for determining the effect of moisture content of the drafting and for carrying out other basic studies in the drafting of fibers.

Those skilled in the art will understand that drafting is usually accomplished in apparatus having a plurality of sets of rolls between which the material to be drafted passes. Each set of rolls runs at an increased rate of speed to stretch the strand, so to speak. In a strand of cotton fibers, for example, the individual fibers are relatively short and the stretching action essentially pulls the fibers over one another to readjust their respective positions to elongate the strand.

In the past a number of attempts have been made to measure forces involved in drafting strands of textile fibers. Various methods using conventional tensile testing machines have been designed to measure the force necessary to start a strand of fibers to draft or be broken apart. However, since the starting force is much greater than the force required to continuously draft the fibers, the results obtained are of doubtful value. Nevertheless, these tests are not only static tests, but are time consuming and difficult to use. Since the forces in a drafting zone are of dynamic nature, they should be measured continuously while the fibers are being drafted if the results are to be useful and to be translated to mill practice.

Accordingly, it is a primary object of this invention to provide apparatus for the dynamic measurement of drafting forces.

Basically, the apparatus provides moving the strand past a first point and then past a second point, the second point imparting a relative motion to the strand in a drafting direction, with the provision that some motion is permitted between the first and second points, so that increased resistance to drafting will cause one point to move toward the other under the drafting forces. A movement detecting means is attached to the movable part and this is employed to give an indication of the relative distance between the parts or, in other words, the drafting forces. Thus, it is a further object of this invention to provide apparatus designed along the just-mentioned lines.

A further object of the invention is to provide apparatus having a first stationary set of drafting rolls, a second set of drafting rolls to be driven at a higher speed and movable with respect to the first, and with strain gauge means attached to the second set of rolls for determining the drafting forces applied thereto.

It is a further object of this invention to provide an air jet device for removing draft or roving from the rolls.

Further objects and the entire scope of the invention will become apparent from the following detailed description of one embodiment of the invention and from the appended claims.

An exemplary embodiment of the invention may be best understood by reference to the accompanying drawings, in which:

Figure 1 shows a front elevational view of apparatus according to the present invention and also an associated amplifier and pen recorder.

Figure 2 shows a side elevational view in section of the apparatus of Figure 1, and

Figure 3 shows a top plan view of the apparatus shown in Figure 1.

Referring now to the drawings, which show an exemplary embodiment of the invention, in Figure 1 the testing apparatus is designated generally as **10**, having connected thereto an amplifier **12** and pen recorder **14**. The apparatus **10** comprises a preferably heavy base **16** on which the remainder of the structure is mounted. The first set of drafting rolls consists of a driven roll **18** and an idler roll **20** urged by spring **22** downwardly into engagement with roll **18**. Roll **18** is provided with a shaft **24** extending from an end thereof on which is mounted gear **26**, this gear meshing with gear **28** on a transverse shaft **30**, which extends to the output shaft **32** of a gear reduction motor unit **34**. The complete assembly of rolls **18** and **20**, gears **26** and **28**, shafts **30** and **32** and motor unit **34** may all conveniently be mounted on the base **16** by the agency of a conventional compound rest **36** of the type commonly found in metal working lathes. As will become fully apparent hereinbelow, the lathe compound rest is useful in the practice of this invention since it provides a close setting of the distance between the drafting rolls.

A scale **38** may be attached to the base **16** and a pointer **40** attached to the compound rest, to accurately record the position of the rolls **18** and **20** relative to the frame **16**.

The second set of drafting rolls consists of driven roll **42** and idler roll **44**, the latter being urged by spring **46** downwardly into engagement with roll **42**.

Rolls **18** and **42** may be of metal and may be either splined or smooth. The rolls **20** and **44** are preferably covered with a suitable resilient material such as rubber. Roll **18** and the body of roll **20** may be of steel. However, it is preferable to construct roll **42** and the body of roll **44** of aluminum or other light material to reduce the mass of these parts.

Roll **42** is mounted on shaft **48** which is coupled with the output of a gear reduction motor unit **50**. Both the motor **50** and the rolls **42** and **44** are mounted from a transverse plate member **52**. The motor **50** is preferably mounted from plate **52** on upstanding bracket **54**, with the actual mounting of the motor on the plate **54** being by means of resilient washers **56**. With this type of mounting, and with a flexible connection between the motor unit and the shaft **48**, vibrations from the motor will not be transmitted to the rolls **42** and **44**.

The plate **52** is hung from an overhead shaft **58** by means of depending side hanger members **60** and **62**. The shaft **58** is maintained in position by two relatively massive supports **64** and **66** extending upwardly from the base **16**. Frictionless bearings, such as ball bearings, are provided at **68** and **70** for permitting shaft **58** to be freely rotatable in the supports **64** and **66**.

Attached to support **66** is a strain gauge **72** of any conventional variety. Preferably, this will be a so-called unbonded strain gauge, and may be one such as described in Patent No. 2,036,458. It will be understood, however, that other types of strain gauges may be employed. The operating arm **74** of the strain gauge is attached to an arm **76**, otherwise fixedly attached to the hanger support member **62**. The strain gauge **72** may be connected by leads **78** to the amplifier **12** and the output of the amplifier **12** may be over leads **80** to the pen recorder **14**.

From the apparatus as thus far described, referring particularly to Figure 2, it will be understood that a sliver S may be introduced to the first set of drafting rolls **18**, **20**, which will be driven at a fairly uniform predetermined speed by the motor unit **34**. The action of spring **22** will cause the sliver to be gripped between the rolls **18** and **20**. The sliver S will then be passed between the second set of drawing rolls **42** and **44** and these rolls will be driven at an increased rate of speed by motor unit **50**. Accordingly, drafting of the sliver will occur along the length of the sliver between the first and second sets of drafting rolls.

In view of the fact that the second set of drafting rolls **42** and **44** and all the associated equipment including the driving motor **50** are mounted on the pendulum structure depending from shaft **58**, it will be apparent that this structure will tend to rotate counter-clockwise as viewed in Figure 2 about the shaft **58** as increased resistance is met to the drafting of the sliver. That is, since the rolls **42** and **44** are moved at a greater rate than rolls **18** and **20**, the unit comprising rolls **42** and **44** will move toward the rolls **18** and **20**, or the sliver therebetween will be extended in drafting fashion.

Since the operating arm **74** of strain gauge **72** moves with the pendulum supporting structure, the strain gauge will register any relative motion between the two sets of rolls. The usual unbonded strain gauge will provide resilient restraint against motion and it, therefore, automatically set up its reading in terms of units of force and such reading may be applied to the amplifier **12** and eventually to the recorder **14**.

In operation for the testing of any particular type of textile strand, the relative speeds of motor units **34** and **50**, or the combination of gears **26** and **28**, will be arranged to provide for simulated drafting as would occur in a conventional drafting machine. The strand S is then introduced through the two sets of rolls and the motor units energized. By suitable calibration the pen recorder **14** may be adjusted to read directly in desired units of force. With the usual type of strain gauge the movement of the operating arm **74** and hence the complete pendulum support for the rolls **42** and **44** will move only through a very short range. The length of the arc at the arm **76** may be, for example, only about 0.001 inches. Thus, for all practical purposes, the position of the rolls **42** and **44** relative to the first drawing point at rolls **18**, **20** will be fixed and the situation will correspond to that found in a conventional drafting machine. Nevertheless, there will necessarily be some movement between the sets of runs to actuate the strain gauge and hence, in another sense, the sets of rolls are movable one to the other.

The amplifier **12** may be adjusted as will be well understood by those skilled in the art to provide an output for the pen recorder which will follow every change in registered strain. However, on the other hand, integration effects may be introduced into amplifier **12** to "smooth out" the resulting pen recording on the recorder **14**.

The strand or sliver S on leaving the second set of rolls **42** and **44** will normally be quite loose and considerable amounts of lint will be produced. This lint should be removed from the vicinity of rolls **42** and **44** so as to prevent a build-up of lint thereon. Such a build-up is undesirable since it adversely effects the gripping qualities of the rolls on the strand and will eventually alter the diameters and hence the peripheral speeds of the rolls. To effectively remove the strand and all lint therefrom, from the vicinity of the rolls **42** and **44**, and yet prevent the introduction of spurious forces on the movable structure, there is further provided as an important aspect of this invention a suction device **80**. The device **80** may be mounted from base **16** by means of support **82**. Air pressure may be supplied through line **84**, through pressure reduction regulator **86** and then through line **88** to a jet aperture **90** in the device **80**. Aperture **90** is directed toward an opening **92** in the device **80** and also opens into a conical chamber **94** having an opening at **96** in proximity to the output side of rolls **42** and **44**. As air under pressure moves rapidly through aperture **90** and out through opening **92**, a considerable movement of air will occur through the conical chamber **94** as indicated by arrows **98**. This will tend to draw the strand S and all lint in the vicinity through the device **80** to re-

appear in a stream S' at the side remote from rolls **42** and **44**. A suitable container may be placed to receive the material at S'.

As above stated, the movement of the supporting structure for the second drawing rolls need be very slight to actuate the usual types of strain gauges. To prevent unnecessary movement, and to also prevent damage to the strain gauge, stops **100** and **102** may be provided to engage the plate **52** at the extreme limits of the desired travel of the latter.

From the foregoing it will be understood that there is provided by this invention a very sensitive apparatus for measuring drafting forces. Experimental embodiments of the apparatus have been successfully operated and the tests thereon indicate that the device is quite sensitive and operates satisfactorily over a wide range of drafting forces.

It will be understood that the particular embodiment of the invention described in detail hereinabove, for purposes only of illustration. Since many other embodiments of the invention will occur to others upon reading this specification, it is intended that the true scope of the invention be determined from the appended claims.

What is claimed is:

1. Apparatus of the class described comprising a base, a first set of drafting rolls, first motor means for rotating said first rolls, the rolls and motor being supported on the base by means of an adjustment member, a second set of drafting rolls and motor moving means therefor, the second rolls and motor means being mounted on a pendulum frame pivotally supported on uprights extending from the base, a strain gauge mounted in fixed relation to the base and having an operating arm, said arm being attached to the pendulum support for movement therewith.

2. Apparatus of the class described comprising a first set of fixedly mounted drafting rolls, means for turning the first set of rolls at a first substantially constant speed, a second set of drafting rolls mounted on a movable support, means movable with the support for rotating the second set of drafting rolls at a substantially constant speed greater than the speed of the first rolls, the supporting means and second set of drafting rolls and the moving means therefor being mounted in pendulum manner on overhead anti-friction bearings, the arrangement being such that a strand of textile fibers or the like may be drafted therebetween, a strain gauge connected to operate between the movable support of the second rolls and a fixed point, and means connected with the gauge to indicate the strain to which the gauge is subjected.

3. Apparatus of the class described comprising first means for imparting motion at a substantially constant rate to a fiber strand to be drafted, second means for imparting motion to the strand at a substantially constant rate in excess of the rate imparted by the first means, one of said means being mounted in pendulum manner in overhead pivot means whereby said first and second means are movable relative to each other, means for restraining relative motion of the first and second means toward each other, and means for indicating the changes in relative position between the first and second means, the arrangement being such that increased resistance to travelling moves the first and second means toward one another under restraint of the restraining means.

4. Apparatus as defined in claim 3 wherein said indicating means includes a pen recorder.

5. Apparatus for measuring dynamic forces established in the drafting of strands of flexible textile fibers comprising a base, a first set of drafting rolls, means for supporting said first set of drafting rolls in fixed relation on said base, a second set of drafting rolls, means for supporting said second set of drafting rolls on said base for movement toward and away from said first set of drafting rolls, means for rotating said sets of drafting rolls at different but substantially constant rates whereby the individual textile fibers of a strand passing through said sets of drafting rolls will be caused to move relative to one another between said sets of drafting rolls, a strain gauge mounted in fixed relation with respect to said base and having an operating arm, said arm being connected with said second set of drafting rolls for movement therewith.

6. Apparatus as defined in claim 5 wherein said supporting means for said first set of drafting rolls includes

an adjustment member for adjusting the fixed position of said first set of drafting rolls with respect to said second set of drafting rolls.

7. Apparatus as defined in claim 5 wherein said supporting means for said second set of drafting rolls includes anti-friction means.

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