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MONITORING RIBBON THREAD THICKNESS AND STOP DEVICE

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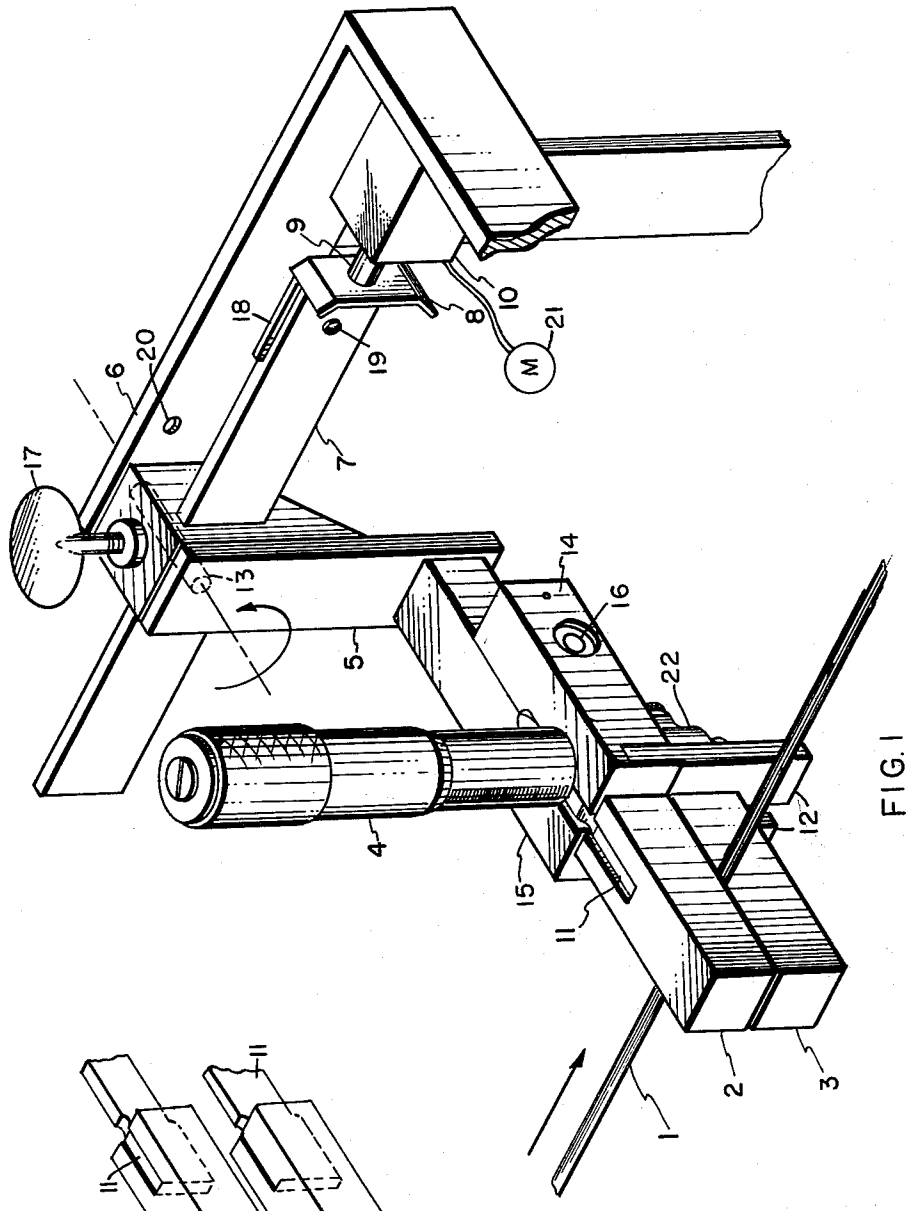

FIG. 1

FIG. 2

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MONITORING RIBBON THREAD THICKNESS AND STOP DEVICE

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This invention relates to improved mechanism for preventing the winding of defective ribbons, particularly ribbons of elastic threads loosely connected to each other for shipment.

Rubber threads have been made in the past by cutting a rubber sheet or frequently by cutting through a stack of rubber sheets to form a number of square threads which are then formed into ribbon for transportation. Serious problems have arisen with nonuniform or defective ribbons. This problem is particularly serious with rubber threads cut from a stack of rubber sheets, but can also arise with other threads in the form of a ribbon, for example extruded elastic thread of rubber, spandex and the like. As the problem is particularly acute with ribbons of rubber threads cut from a stack of rubber sheets the problems arising and their solution by means of the present invention will be described in connection with such a ribbon of rubber threads, it being understood that the invention is not broadly limited to ribbons of rubber thread, and is equally applicable to the detection and prevention of defective ribbons made up from other thread forms.

When a ribbon is cut from a stack of sheets of rubber, for example a stack of 40 sheets, this is usually effected by a rotating cutting wheel or knife which may start in the center and cut a spiral out to the edges of the sheets. A ribbon results with the cut rubber threads loosely attached to each other by the natural tack of the substance. A stack of sheets of only moderate diameter, for example, a few feet, can be made to yield a ribbon the threads which may be many thousands of feet long, depending on the gauge of the threads desired. The cutting machines proceed at considerable speed and sometimes the cutting wheel may become slightly loose or may chatter so that it does not always cut perfectly straight, that is to say at right angles to the surface of the stacked sheets. When this occurs there will be a thick spot on the ribbon with a corresponding thin spot on the opposite side of the cut, separated of course by the length of ribbon between the two positions. While any substantial non-uniformity of ribbon thickness, from flat face to flat face, is undesirable, thin spots are particularly troublesome as they may constitute weaknesses in the final thread when the ribbon is used to produce elastic fabrics and the like, the threads being normally separated. The ribbon formed is merely a convenient and very economical way to transport long lengths of thread.

It is customary to wind the ribbon, which may pass between guiding rolls onto drums and back-wind onto spools or cartons for shipment. During the winding the ribbon passes between thumb and finger of an operator. She is supposed to sense the occurrence of a thick spot or thin spot as the ribbon passes between her fingers, and to stop the winding machine and cut out a defective section when this occurs. This has created a serious manufacturing problem. The accuracy of determining nonuniformity in the ribbon is often inadequate. A highly skilled operator starting in the morning when she is rested can do a reasonably acceptable job. However, as the day goes on, with increasing weariness the sensitiveness of her manual gauging may fall off. This may be

exaggerated by the varying physical condition of the operator, for example if she comes to work tired the period of reasonably satisfactory gauging skill will be shorter. As a result ribbons with defective sections sometimes pass the inspection. This is a very serious matter because a ribbon with a defective spot can cause interference with its use by the final customer, and cutting out and reconnecting a defective spot is much more serious and time consuming and costly in the final use than in the ribbon form.

In spite of the human frailty which resulted in a certain proportion of defective ribbons this has been the only method used. The cost of defective ribbons has been considered an unavoidable drawback.

The present invention solves the problem completely by substituting a precision machine for the human fingers. The machine does not get tired, does not lose its sensitiveness, and can avoid the shipment of ribbons with defective portions. When it was first attempted to design a machine, or perhaps more correctly an attachment to a winding machine, ordinary micrometer calipers were purchased, their jaws elongated by welding on extensions so that they could handle ribbons of the desired width, and by attaching the micrometer to a pivoting member which, when it pivoted sufficiently, actuated a microswitch which through relays stopped the machine. At first this simple machine operated beautifully and the problem appeared to be solved. After a few months, however, the machine failed. After running for a short time operation became erratic and unreliable. It was found after considerable experiment that failures resulted from the development of some play in the micrometer jaws. Obviously, of course, it is essential that the jaws remain parallel and that they be adjusted accurately so that there will be the right amount of friction, and/or wedging whenever a thick spot on the ribbon passes through. The jaws were set for a slight oversize, for example a thousandth of an inch or so, but when the jaws began to develop play this precise dimension could no longer be maintained. The machine operated erratically and was therefore no better than the human operators it replaced.

Having found out that failures resulted from development of play in the jaws it might seem that this could be cured by using greatly oversized jaws. This, however, is not practically possible because we are dealing with a delicate gauging and so a comparatively small amount of friction must cause the micrometer and its framework to tilt and actuate the switch. If the jaws are enormously oversized, for example five to eight times, the weight of the whole instrument becomes so great that precision is lost.

The present invention solves the problem by modifying the micrometer, providing the enlarged jaws with extended plates connecting to the micrometer screw, the plates being at right angles to the travel of the ribbon. Also these plates move in guides which are also plates with their wide dimensions at right angles to the plates connecting the jaws to the micrometer. In this way the wide plates of the jaws bear on an extended surface of the guides and both members showed an extremely high rigidity to bending in the direction of their large dimension. Since these two directions are at right angles to each other a stiffness results which is equal or greater than that obtainable with a micrometer of enormously greater cross-section which is far too heavy for practical use. The plates and guides at right angles to each other solved the problem completely and the gauges operated reliably and continuously for long periods of time. At the same time the dimensions and hence weights of the micrometer

caliper are not increased at all or not significantly, and so sensitivity remains at a maximum.

While the important thing is an accurate gauge which will operate for many months on end reliably it is also a further advantage that the plates and guides are simple mechanical structures which can be produced at very moderate cost. In fact the gauge with the improvements of the present invention which make it practical hardly costs any more than the gauges which operated only for a month or two and then failed. Often an improved result is obtained only at considerable additional cost for construction, and in this respect the present invention is rather unusual that the great improvement which makes the device practical is obtained without any significant offsetting additional cost.

Another advantage of the present invention is that it is not necessary to build micrometers of special design. Ordinary commercial micrometers are easily adapted by welding or brazing the plates and guides, and it is thus possible to utilize readily available and hence relatively cheap elements.

The invention will be described in connection with the drawings in which:

FIG. 1 is an isometric view of the gauge, and

FIG. 2 is a detail, partly broken away, of the gauge jaws.

The gauge is fastened to the framework of an ordinary ribbon-winding machine, and since the rest of the machine is not in any way changed it is not shown. The ribbon of cut rubber thread is shown at **1** and moves generally from left to right in the direction of the arrow. It passes through two extended jaws **2** and **3** which are set slightly oversize so that the ribbon of the proper size in passing through the jaws creates negligible friction. The two jaws have welded into them flat plates **11** which connect them to an ordinary micrometer caliper **4**. The plates **11** are welded into the two jaws of the micrometer and are shown in more detail in FIG. 2. This caliper in turn is rigidly attached to a member **5** which is pivoted in a framework **6** attached to or part of, the winding machine, by means of the pivot **13**. A bar **7** is clamped to the member **5** and is terminated by a shoe **8**. This shoe bears on a spring-pressed switch plunger **9** of a micro-switch **10**. The flat plates **11** are moved by the micrometer screw in a guide slot between two plates **12** which in turn are fastened to a portion of the member **5** clamped around the micrometer caliper. The lower jaw **22** of the caliper to which the plate **11** from the extension jaw **3** is welded moves in the ordinary manner by turning the caliper micrometer. The plate **11** slides in the guide slot between the two plates **12**.

In operation when the jaws have been accurately set to the desired spacing the ribbon passing through does not create enough friction and the jaws and member **5** remain in a vertical position. The spring-pressed plunger **9** is compressed and the switch **10** is therefore, of course, closed. If a thick spot in the ribbon comes along the friction rises rapidly, the jaws move to the right, and this causes the member **5** to turn on its pivot **13** in the direction shown by the curved arrow. This raises the shoe **8** until finally it moves off the plunger **9** which then is urged by its spring outwardly, the switch **10** is opened turning off the motor **21** and the machine stops.

The operator then examines the ribbon and cuts out the thick, and in the case of spirally cut ribbon the thin spot, which may be a foot or more distant. The ribbon ends are then fused or otherwise fastened together, the caliper and jaws **2** and **3** moved to the vertical position of the member **5** which closes the switch **10**, and the machine starts up. It will be noted that the operator does not have to be constantly gauging the ribbon with her fingers, but only has to examine it minutely when the caliper has moved and has stopped the machine. Complete reliability is obtained and it is possible for one operator to supervise more than one winding machine

with a resulting saving in labor costs. It will be seen that the member **5** has extensions **14** and **15** which clamp onto the micrometer caliper proper, using a conventional clamping screw **16**. It is thus possible to use commercial micrometers without having to build them, and if after long service the caliper develops play, a new one can be substituted easily.

Sometimes it is necessary to vary the friction at which the member **5** will turn. This is easily effected by providing a series of pivot points **20**, one of which is shown, in the framework **6**, and moving out the bar **7** which passes through the member **5** and is clamped by a clamping screw **17**. In this way the leverage represented by the bar and the shoe **8** is varied and the machine can be set for different degrees of friction. An even simpler way is to use a single pivoting point and a number of bars **7** with different weights on the end. Such a weight is shown at **18** clamped on to the bar **7** through a rivet or screw **19**. This possibility of varying the friction at which the gauge turns off the winding machine, which not an essential part of the broad invention, is an advantageous refinement which is included in a preferred modification of the invention.

The invention is primarily useful for gauging ribbons, but of course it can be adapted for gauging other shapes by a suitable contouring of the micrometer jaws.

We claim:

1. In a machine for winding a continuous length of material of predetermined thickness the improvement which comprises

(*a*) a gauging element attached to the winding machine and provided with jaws positioned so that the moving material passes between them,

(*b*) the jaws having micrometric adjusting means to adjust the spacing of the jaws a predetermined opening,

(*c*) relatively wide plates connecting each jaw to the micrometric adjusting means,

(*d*) a guide slot composed of two relatively wide and thin plates having their wide dimensions at right angles to the plates connecting the jaws to the micrometric means, the latter plates sliding in the guide slot formed between the second plates,

(*e*) pivot means permitting the jaws to move the gauging element in a circle when the friction of the material passes through the jaws exceeds a predetermined value, and

(*f*) switching means actuated by pivoting of the gauging member to stop the winding machine.

2. A machine according to claim 1 in which the switching means is a microswitch with a spring-pressed plunger and the actuation means is a bar swung by the pivoting of the gauging member and provided with a face contacting the switch plunger and having an extent such that it is moved out of contact with the switch plunger at a predetermined degree of pivoting.

3. A machine according to claim 2 in which the surface contacting the plunger is provided with edges bevelled away from the plunger so that when the gauging member is restored to its original position the switch plunger is urged inwardly.

4. A machine according to claim 3 in which the bar and surface engaging the switch plunger extend horizontally and their weight determines the friction at which the machine is stopped.

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