May 25, 1926.

1,585,660

H. S. FRAMPTON

THREAD MEASURING DEVICE

Filed Nov. 26, 1921

2 Sheets-Sheet 1

Fig. 1.

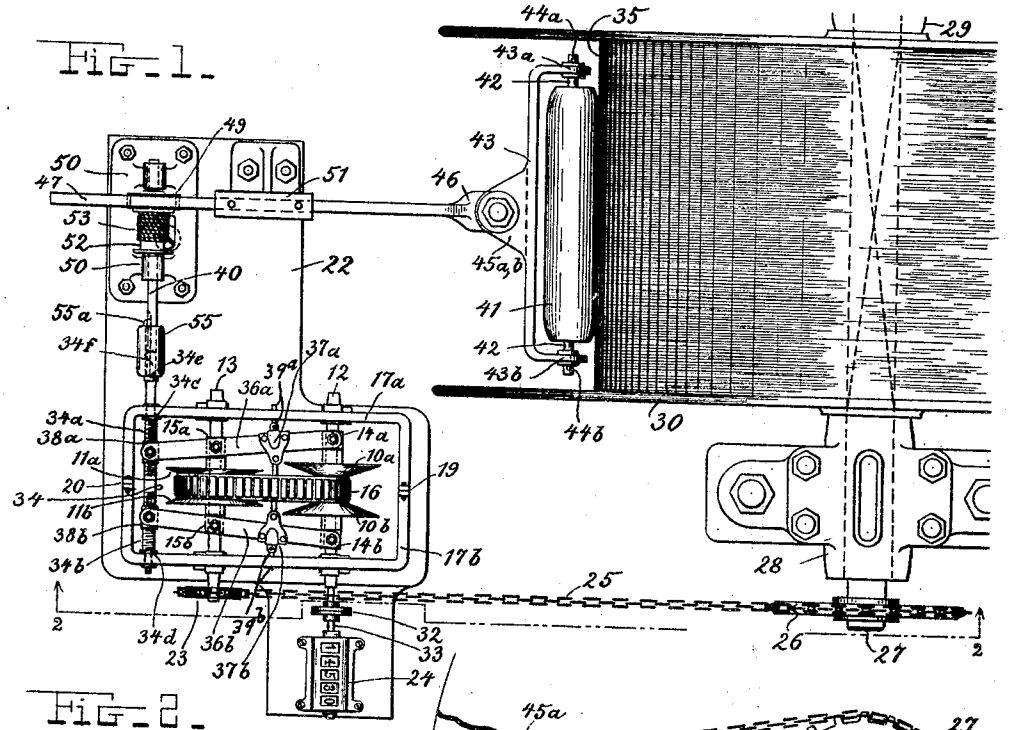


Fig. 2.

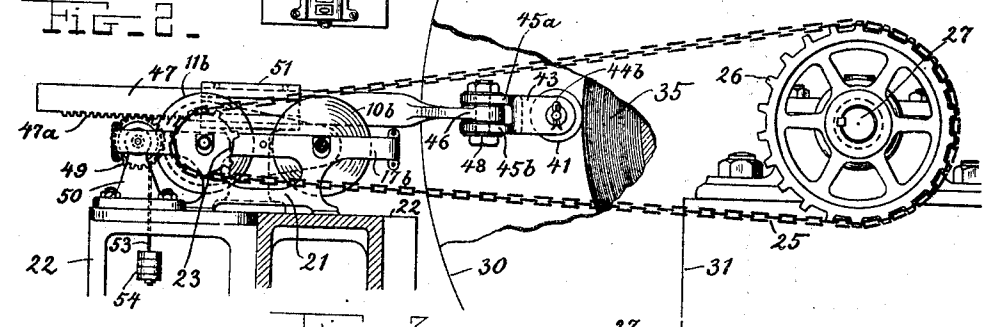
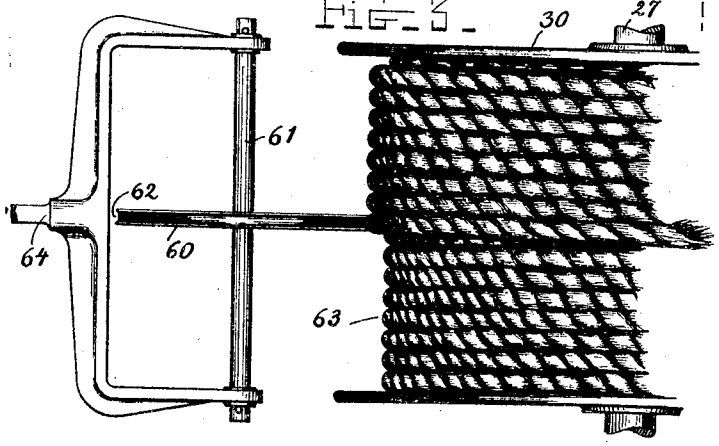


Fig. 3.



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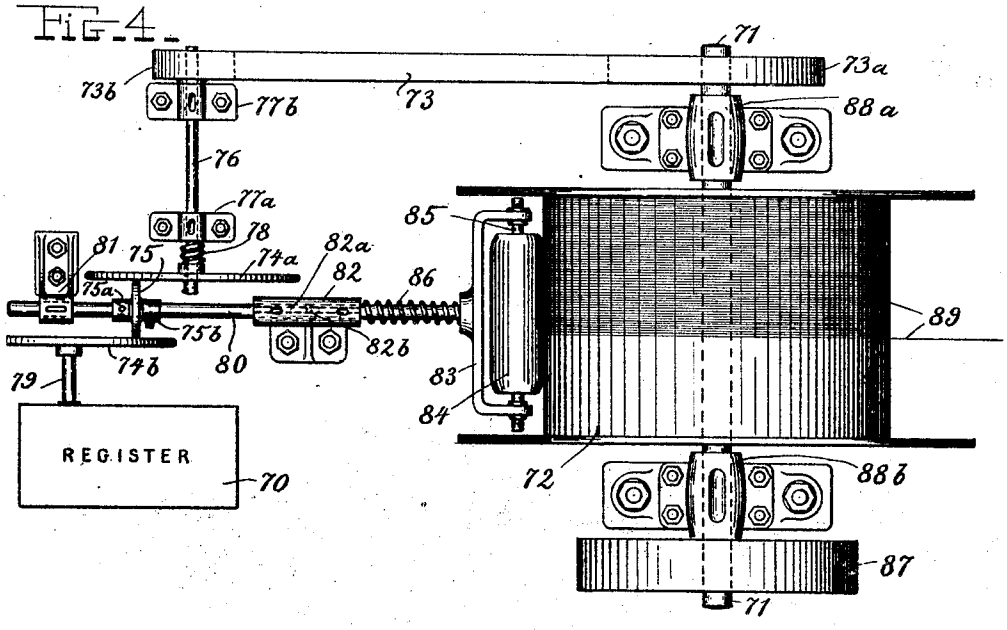
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FIG. 4.



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UNITED STATES PATENT OFFICE.

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THREAD-MEASURING DEVICE.

Application filed November 26, 1921. Serial No. 517,894.

This invention relates to improvements in measuring devices for all mechanical purposes where a thread, cord, wire, cable, logline, a breadth of paper, linen, cloth or any other continuous and pliable fabric of unlimited length is wound up on a drum or reel, and where it may be required to measure the length of the wound up article as accurately as possible.

In particular this invention is adapted to warp mills and knitting or weaving machines, to measure the length of a single thread or of a multiplicity of parallel threads, a "warp", which is wound from a spool frame or "jack", onto a drum, preliminary to entering the loom or knitting machine.

In such case it is desirable and tends to facilitate the operation, that each drum to be filled should always contain a certain and definite yardage of the thread or warp.

There have various attempts been made to accomplish this object.

The simplest way to supply the required number of yards would obviously be to choose reels of a known capacity, and either watch the reel or drum and stop the winding, when the reel appears to be filled or else install some automatic arrangement whereby the drum acquiring its maximal allowable load actuates a throwing out mechanism.

These two methods however give at best only very rough approximations, varying within wide limits not only with the same fabric and capacity of drums but in addition giving entirely different results with threads of different thickness, different tension, and so forth. Moreover, if, as has been done, an idler wheel were employed, pressed by a spring or weight against the winding turns of the drum, and this idler wheel, steadily increasing its distance from the drum center with the growing load, actuates some lever system with which it is connected, and which ultimately effects a stop of the winding operation, there is always the tendency of the threads to buckle up on the drum to be reckoned with.

This produces a more or less concave or convex curvature of the winding surface underneath the idler and results in a premature stopping of the operation.

The other alternative to accomplish the desired result would be to measure the length of the thread directly by transmitting its running speed unto a contact wheel which in turn actuates a registering or counting apparatus.

This in fact is the present standing of the art, and this method though in general giving more accuracy than its forerunners, is far from satisfactory.

The source of failure and deficiency is the unavoidable slippage between the thread or threads and the contact roller, be it that the thread or warp, before being run onto the winding drum, runs over a part of the periphery of the contact roller, exerting friction thereon, or that a contact roller is pressed against the drum, transmitting its revolutions, caused by friction with the drum, to the counting apparatus.

This slippage, giving wrong results, which accumulate with the length of the thread or warp, though not always at a uniform ratio, becomes a precarious handicap with the finer textures of thread, as for instance with silk, the smoothness of the warp acting similar to a lubricant.

The first object of this invention is to provide means whereby the exact length of a fabric, wound onto a drum, is measured, regardless of the shape or capacity of this drum and regardless of the gauge and quality of the wound up article.

A second object is to eliminate from the direct measuring method the source of failure, known as the slipping action of the thread or other wound up article.

Other subservient objects will become apparent from the description following hereafter.

These various objects are attained by the introduction and application of a new principle which concerns the actuation of a counting machine or registering apparatus, used for indicating the number of measuring units reached by the wound up article.

According to this principle the registering apparatus receives its impulse not from the wound up article, but from the drum shaft or any other revolving part of the winding apparatus, dependent for its number of revolutions upon the speed of the drum shaft and capable of transmitting the speed of the drum synchronously or in definite ratio to any other device driven by it.

This transmission however is not a direct and uniform transmission, but is effected by a variable speed drive interposed between the impelling part and registering apparatus.

The variable speed drive in turn is controlled and influenced by the wound up article in a manner similar to certain measuring methods above alluded to, which employ no measuring register, but eliminating in this novel use and combination the errors inherent to and resulting from these methods.

The application of this new principle is described in detail hereafter and shown in the accompanying drawings, in which:—

Figure 1 is an assembled plan view showing in part a winding warp drum, furthermore a so called "Reeves drive", receiving its motion through a chain drive from the shaft of the warp drum, and transmitting it to a registering apparatus. It furthermore illustrates a way by which this Reeves drive can be controlled by the wound up article.

Figure 2 is a sectional view, taken on the line 2—2 of Figure 1, part of the drum flange being also broken away to expose the contact wheel forming a part of the controlling device.

Figure 3 shows a modification of the contact wheel for a certain class of wound up articles.

Figure 4 illustrates the adaptation of the invention to another make of variable speed drives. It also shows a belt transmission instead of the chain drive employed in the former arrangement.

Referring now in particular to the first two figures it is evident that for the application of the new principle, as explained, there are several variable speed drives of standard make or well known construction that lend themselves to this arrangement of transmission, and as an appropriate example a "Reeves drive" is chosen.

This drive consists of two pairs of conical wheels, 10^a, 10^b and 11^a, 11^b, of equal size the pairs being mounted slidably on the parallel shafts 12 and 13, the apices of the wheels of each pair facing each other. One at least of each pair of wheels is slidable along a straight key-way,—not shown in the drawing—, so as to exert a driving force on the shaft. Over the two pairs of conical wheels runs a silent chain drive, 16, properly tensioned.

The shafts 12 and 13 are journalled in a frame, consisting of two U-shaped halves 17^a and 17^b, bolted together at 19 and 20, and extending downward into pedestals 21, resting on a base 22, which may be shaped appropriately to serve also as a support for the other accessories to be described hereafter.

Both shafts are extended beyond one of their journals. One, which is destined to serve as a driving shaft, in this instance 13, is provided on its extension with a keyed-on sprocket pinion, 23, driven by a chain drive 25, running over a sprocket wheel 26, the latter being keyed on the drum shaft 27, which is journalled in pillow blocks, one of which is shown at 28,—the other being only suggested in the drawing at 29.

The pillow blocks are of course appropriately supported, as indicated by 31, and on the shaft is fixedly mounted the drum 30 onto which the article to be wound, in this instance the warp 35, is run.

The other shaft 12, which is destined to serve as the driven shaft, is coupled on its extension by the face coupling 32 to the driving shaft 33 of the registering apparatus 24, which can be of any appropriate make and construction.

Returning to the description of the Reeves drive there is mounted in the same plane as the shafts 12 and 13, the shaft 34. The shaft is journalled in the frame at 34^c and 34^d and is provided with shoulders at these places so that it cannot slip in an axial direction. Between these shoulders it is provided with right- and left-hand threads 34^a and 34^b.

Double-armed levers 36^a and 36^b extend above the shafts 12 and 13 outside of the conical wheels. About half-way between these shafts each lever passes through a saddle, 37^a or 37^b. These saddles are supported by the upturned inner ends of through-bolts 39^a and 39^b, fastened in the frame 17^a, 17^b. Around these ends as fulcrums they can oscillate and with them the double-armed levers 36^a and 36^b.

To the levers are attached by swivel bolts sleeves 14^a, 14^b and 15^a, 15^b, which slide on the shafts 12 and 13 respectively, and being placed in close juxtaposition to the conical wheels, form guide collars for the same.

To the end of each longer arm of the levers is attached by a swivel bolt a sleeve-nut, 38^a or 38^b, threaded unto the shaft 34. Each sleeve-nut is provided with right- or left-handed inside threads, according to which threaded part of the shaft 34 it surrounds.

The outwardly extending end of the shaft 34 is either provided with a ledge 34^e or an offset, and beyond this it is key-wayed, so that it can be coupled to another keyed shaft or spindle, in this case spindle 40, by means of the coupling 55 and the key 55^a.

It is evident that when the shaft 34 is turned one way or the other, the threaded nuts 38^a and 38^b will either approach toward or away from each other, bringing the lever arms to which they are attached, nearer together or spreading them, while the arms beyond the fulcrum will move in the opposite direction.

Consequently, as one or the other pair of conical wheels is pressed together, the silent chain will be forced to run upon a larger

diameter, as shown on shaft 13, and the other wheels will be forced outwardly by the pressure of the chain to follow the receding sleeves of the spreading lever arms.

In this way the ratio of transmission is varied, that is, while the driving shaft 13 is running at a uniform speed, the shaft 12 is slowed up or hastened, according to the manipulation of the double-armed levers.

The controlling apparatus comprises a contact wheel 41, of a cylindrical shape, running upon the threads of the wound up warp and pressed gently against the warp drum in any convenient manner, for instance as described hereafter.

The wheel 41 is mounted on a shaft 42, and this shaft is confined in the journals 43^a, 43^b of the fork-like frame 43 by split pins 44^a and 44^b.

The middle part of the frame from which the fork-arms start, is extended toward the rear and split lengthwise into two lobes 45^a and 45^b, opposing each other and perforated in such way that this middle part forms another fork into which a head 46, formed on the end of rack 47 is linked and held in place by the nutted bolt 48. This swivel connection, though it allows an easier adaption of the contact cylinder 41 to the outline of the warp periphery, is however only an optional improvement on the customary form of such contact wheels and not an indispensible feature of this invention, if conditions do not recommend it, as shown later in Figure 3.

The rack 47 which is provided with teeth 47^a for a certain distance on its underside, is guided by an open slide-stand 51 and actuates a pinion 49, fixedly located on the spindle 40. This spindle, which, as has been shown before, is coupled to the Reeves drive shaft 34, is journalled and supported by the cradle 50 which, like the slide-stand 51, the registering apparatus 24 and the Reeves drive, as described, can rest on a common base 22.

The spindle 40 carries in addition a little drum 52, keyed to or otherwise fixed on the shaft, around which is wound a rope 53 with weight 54, attached in such a manner that the unwinding of the rope by the weight which thereby rotates the drum tends to push the rack, with the contact wheel ahead of it, towards the drum surface, exerting thereby a constant gentle but yielding pressure gainst the rotating warp.

As a preliminary condition it is assumed, that the ratios of transmission, that is, the proportion of the sprocket wheel 26 to its pinion 23 and to the gearing of the registering machine have been so calculated and chosen, that when the two shafts 12 and 13 are running at the same speed or—expressed by other conditions—when the two double-armed levers 36^a and 36^b are parallel and the silent chain 16 runs at both ends over the same radius, the units of measurement recorded by the counting dials correspond exactly to the circumferential speed of the thread on a medium winding radius, that is, half way between the much slower initial circumferential speed, when the thread starts to wind around the empty drum, and the much higher final circumferential speed of the thread, when the drum is almost filled, provided that the drum shaft always would rotate at the same speed. Then it is evident that, before in actual running this stage is arrived at, the shaft of the registering apparatus must run slower, and after the stage is passed, quicker than the driving shaft 13. Therefore the diameter of the rack pinion 49, the pitch of the threads 34^a and 34^b and the proportions of the levers 36^a and 36^b must be so calculated and chosen that throughout the whole steady increase of the circumferential speed of the thread the speed variation of the registering shaft keeps pace with it,—which can easily be accomplished, as all increments of motion in the different parts are in simple arithmetical progression and are dependent upon each other.

The manipulation and mechanical operation of the invention is as follows:

When the winding starts, the contact cylinder 41 is in its most protruding position, touching the bare drum mantle, the weight 54, is at its lowest point, the double-armed levers 36^a and 36^b are farthest apart on the shaft 34 and press the cones 10^a and 10^b together, while the cones 11^a and 11^b are spread apart. The initial speed of the register, starting at zero on its dial, is therefore the slowest. As the drum begins to fill, the contact cylinder with the rack is gradually pushed backwards, the rope with the weight winds up, and the nuts 38^a and 38^b on the swivel-screwed shaft 34, together with the cones 11^a and 11^b approach each other. The cones 10^a and 10^b on the other hand are spread apart, and the registering apparatus runs gradually faster, until the desired length of warp is registered, when the machine can be stopped by hand or, as shown later, may be arranged to stop automatically.

The arrangement, as described hitherto, is considered as one showing the principal features of the invention to their best advantage. Certain circumstances however may call for the omission or modification of details, without deviating from the leading principle.

It therefore seems appropriate to point out some of the possible modifications, which either the nature of the fabric or technical consideration may necessitate, and two extreme cases are illustrated by Figures 3 and 4.

Figure 3 indicates the adaptation of the

invention as described, for the winding up or unwinding of a cable. It is understood in the first place, that not only a filling drum can be measured and recorded by the described system, but also a drum undergoing the reverse process, that of being emptied, without requiring any changes in the general arrangement.

A contact roller, as shown and described in Figure 1, would in the case of a thick cable prove awkward, and especially, when an upwinding cable, reversing its course at the end of a layer, suddenly overlaps itself, it could easily become entangled with the shaft end of the contact roller. Therefore a modification as shown is recommended.

Instead of a long narrow cylinder, rounded off at the edges, as shown in Figure 1, the contact wheel consists of a narrow grooved disc 60, slidably mounted on a shaft 61, which is long enough to allow a travel of the disc for the whole width of the drum face. The groove 62 on the face of the wheel corresponds in its width and depth to the size of the cable 63 and may otherwise be cut smooth or roughened to keep a better grip on the cable.

As mentioned before, it is not advisable in this case that the fork-like frame should be jointed to the rack by a swivel, therefore it should be made integral with it, as indicated at 64, the disc 60 automatically following the cable in its course.

That in this and other cases it could be maintained, that the speed of the article to be wound—or unwound—is transferred directly to the contact wheel, as is also done by the old direct measuring methods, employing a counting apparatus, is true, but this incidental circumstance is not utilized any further. The contact wheel does not actuate the registering apparatus, nor does it influence the movements of the speed controlling apparatus through its own speed, but only through its varying distance from the center of the winding drum, and therein lies the difference.

It is further possible, that no "Reeves drive", which is a standard article of common use, may be available, and that it would be necessary to employ a variable speed drive of widely different construction.

Figure 4 shows that this can be accomplished without changing the essential principle of the invention in any way.

For here again, as in the former case, the registering apparatus 70 is driven from the axis of the drum 72 by a belt transmission 73, which might be just as well a chain transmission. Into this series is inserted the variable speed drive to be described hereafter, and this in turn is controlled and influenced by the contact-wheel device, modified in certain minor details.

The variable speed drive is supposed to consist in this case of two stationary so-called "brush-wheels" 74^a and 74^b and a travelling idler 75 between them, transmitting the motion of one to the other by friction. This friction is usually increased by covering the brush wheels with india-rubber or making the rim of the idler of this material. The brush-wheel 74^a is fastened on the end of a spindle 76, journalled in the pillow blocks 77^a and 77^b. At the outside of pillow block 77^b is fastened on the shaft the pulley 73^b which is driven by belt 73 from the pulley 73^a on the drum shaft 71.

Between pillow block 77^a and the hub of brush-wheel 74^a is inserted a compressive spring 78 to press the brush wheel against the idler 75 and secure a better contact thereby.

The brush-wheel 74^b can be mounted directly on the driving shaft 79 of the register 70. The idler 75 is loosely mounted between two set collars 75^a and 75^b on the shaft 80 which can slide to and fro through the bearing brackets 81 and 82, and on the end extending beyond the bracket 82 it forms a stationary connection with the fork 83, carrying the contact cylinder 84 by means of shaft 85. To prevent the turning of the shaft 80 in its bearings, one of these, for instance 82, is provided with a key-way 82^a, going the whole length, in which is guided the feather 82^b, made stationary on the shaft 80.

Between the bearing 82 and the fork 83 is inserted a compressive coil spring 86 which is substituted for and forms an equivalent of the weight 54 in the case formerly described.

The wheel 87 is the driving wheel of the drum. 88^a and 88^b designate the pillow blocks of the drum shaft, and 89 the thread to be wound up.

It is evident that the contact wheel 84 and the shaft 80, pushed outwardly by the increasing bulk of the drum load will carry the idler 75 along, which consequently increases its distance from the center of one brush-wheel 74^a and decreases its distance from the center of the other brush-wheel. In this way it changes and controls the relative speed of the two brush-wheels and with the increasing winding radius of the thread 89 hastens the speed of the registers shaft 79.

If it is desired to use this measuring device to stop the winding operation automatically as soon as a certain number of measuring units is reached, this can be accomplished through a combination of the described invention with various means available at the present stage of the art.

It is also evident that different makes of a registering apparatus, provided with automatic stops, could be employed, and it was pointed out before that there is a number of variable speed drives that could take the place of the two described.

It therefore is understood that the invention proper is not to be confined to the details described and the showing presented but rather to the principles as expressed by the claims attached hereto.

I claim:

1. In a thread-measuring device a thread winding drum, means to actuate said drum, a measuring register to measure the length of thread, winding up onto the drum, a variable speed drive, adapted to drive said register from the drum-actuating means, and speed varying means, comprising a contact roller, running on the periphery of the bobbin being wound and adapted to control said variable speed drive in conformity with the varying distance of said contact roller from the axis of the drum.

2. In a thread-measuring device, the combination with a thread winding drum, a measuring register and a variable speed drive to transmit motion from the drum to the measuring register; of a contact roller running on the winding surface of said drum, a fork, between whose prongs the contact roller is journalled, a push bar, means for linking the head of said push bar adjustably to the fork, means for guiding said push bar longitudinally, means to press the contact roller resiliently against the drum surface, and means to control the variable speed drive by the motion of said push bar.

3. A thread-measuring device, comprising a thread-winding drum, an apparatus to drive said drum, a contact roller, running on this drum, a forked push bar, the pronged end of which supports the contact roller, while the other end is formed as a rack, a pinion which the racked push bar actuates, a shaft to support the pinion, means to support the push bar, means to move the rack and pinion resiliently, so that the push bar and the contact roller is pressed against the drum, a Reeves drive, means to control the Reeves drive by the rotation of the shaft, carrying the pinion, and means to actuate the Reeves drive by the apparatus driving the drum, substantially as described.

In testimony whereof, I have signed my name to this specification, this 4th day of October, 1921.

HENRY S. FRAMPTON.