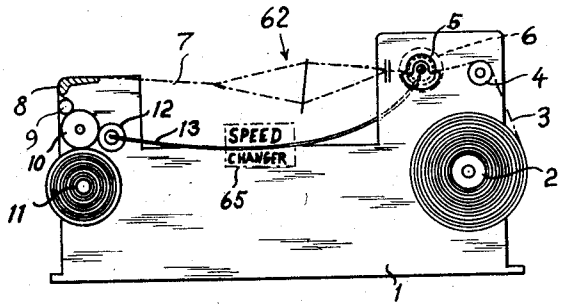
July 28, 1959 P. SZABÓ 2,896,329

SHRINKAGE COUNTER FOR LOOMS

Filed March 31, 1958 3 Sheets-Sheet 1

FIG.1



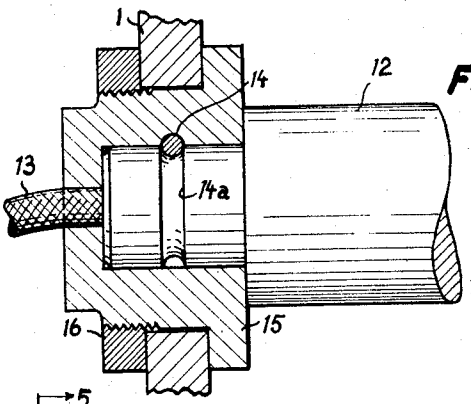
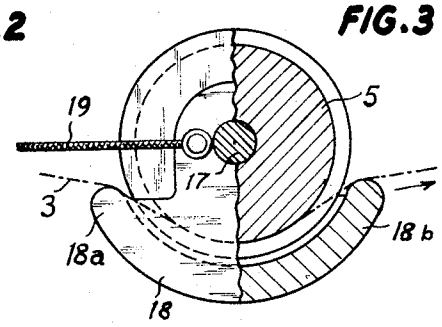


FIG.2

FIG.3



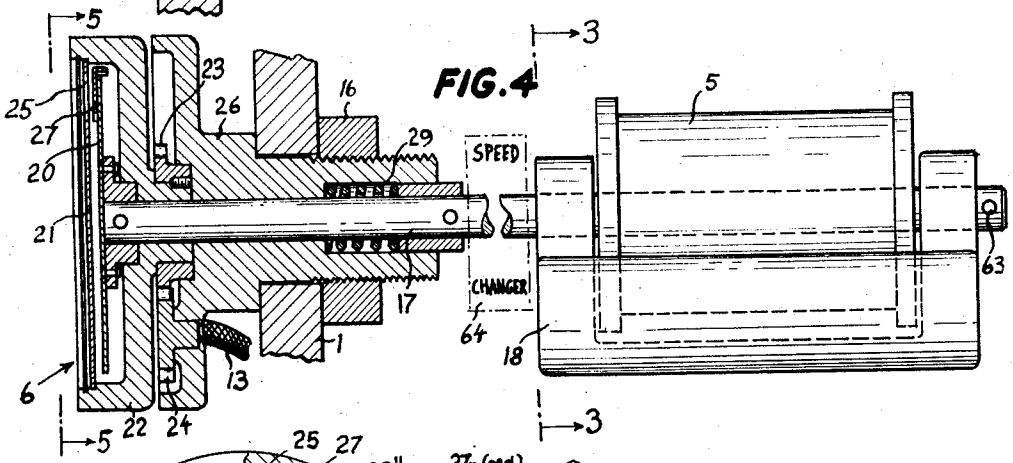


FIG.4

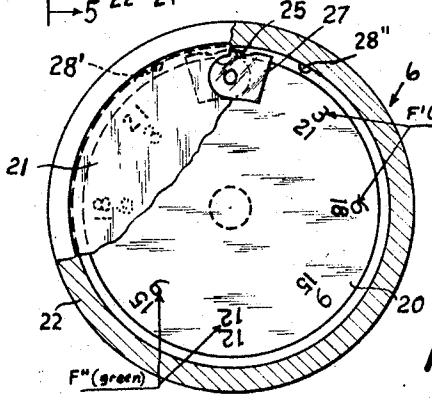


FIG.5

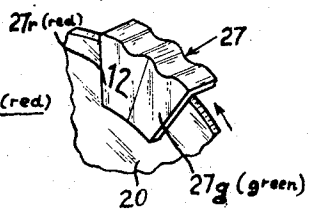


FIG.6

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July 28, 1959 P. SZABÓ 2,896,329

SHRINKAGE COUNTER FOR LOOMS

Filed March 31, 1958 3 Sheets-Sheet 2

FIG.8

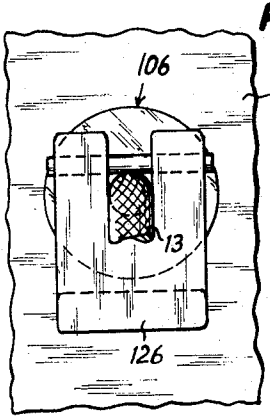


FIG.7

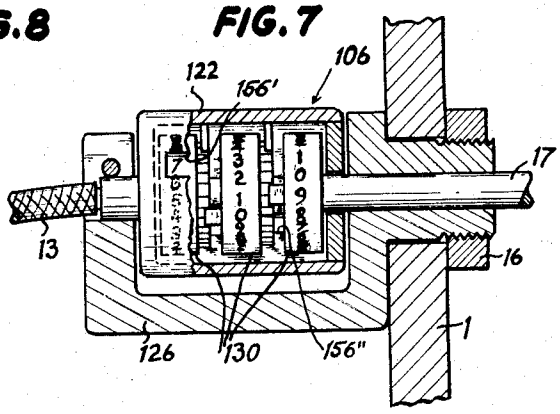


FIG.9

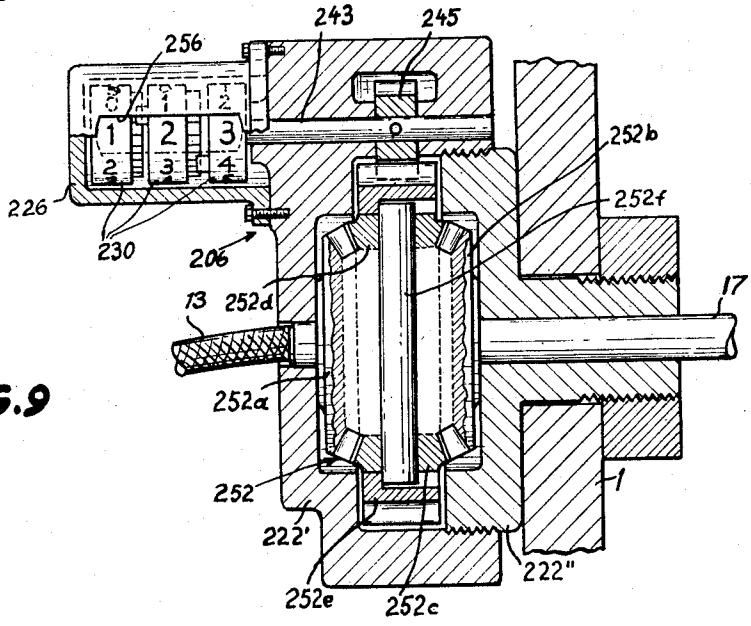


FIG.10

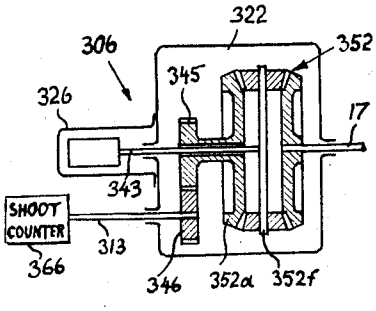
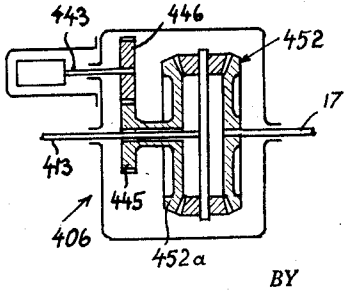


FIG.11



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July 28, 1959 P. SZABÓ 2,896,329

SHRINKAGE COUNTER FOR LOOMS

Filed March 31, 1958 3 Sheets-Sheet 3

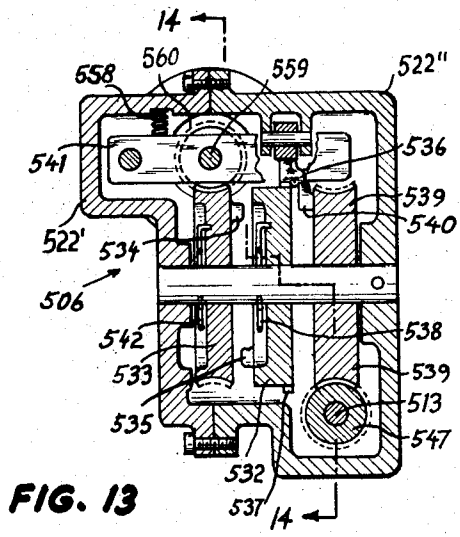


FIG. 13

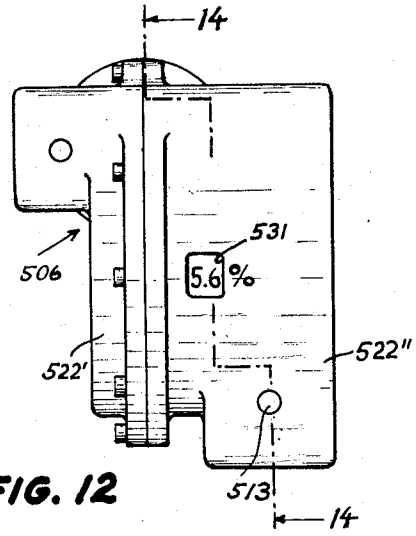


FIG. 12

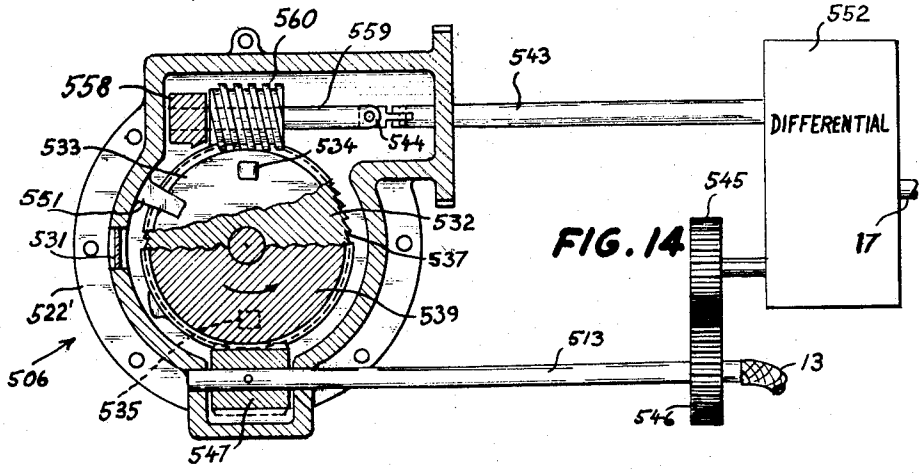


FIG. 14

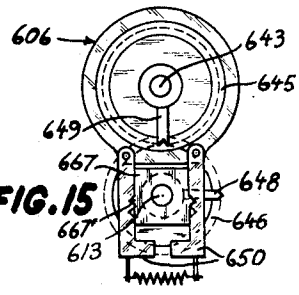


FIG. 15

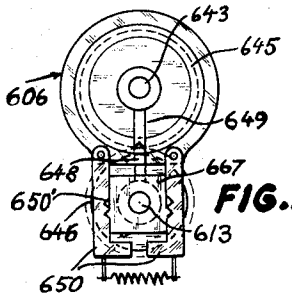


FIG. 16

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SHRINKAGE COUNTER FOR LOOMS

Paul Szabó, Montreal, Quebec, Canada

Application March 31, 1958, Serial No. 725,065

20 Claims. (Cl. 33—129)

My present invention relates to an apparatus for determining and recording the effective longitudinal warp shrinkage on looms.

The shrinkage value of fabrics or webs is an important factor of cost and cloth quality. The ratio between warp-thread and cloth lengths has to be checked during production or at least periodically. Up to now this has been accomplished by time-consuming and sometimes unreliable measurements.

It is an object of my present invention to provide, as a tool for systematic production control, means for automatically determining and indicating the effective warp shrinkage, in terms of warp length measured against the length of the finished web or against the number of weft threads as established from the number of shuttle traverses, thereby enabling ascertainment of any deviation from a predetermined shrinkage value.

It is another object of this invention to provide means for giving cumulative shrinkage readings after a prolonged period, for instance when the warp thread available on the loom has been used up, or at the end of any convenient working period such as a day or a week.

A further object of the invention is to provide means for immediately ascertaining not only the magnitude but also the sign of the instantaneous deviation of the accumulated shrinkage from a rated value.

Still another object of the invention is to provide means for integrating the deviations of shrinkage from a rated value over a predetermined interval, e.g. a period of 1,000 revolutions of a controlling shaft.

An important feature of the present invention is the provision of a differential counter so arranged on a conventional loom as not to interfere with its normal operation. This shrinkage counter has two inputs respectively actuated by a first rotating element measuring or controlling the movement of the warp threads and by a second rotating element measuring or controlling the advance of the web.

The invention will be described in greater detail with reference to the accompanying drawing in which:

Fig. 1 shows the arrangement of a shrinkage counter on a conventional loom;

Fig. 2 is a cross-sectional view of a web-follower element driving one input of the counter of Fig. 1;

Fig. 3 is an end view (partly in section) of a warp-follower element driving the other input of the counter, taken on the line 3—3 of Fig. 4;

Fig. 4 is a cross-sectional view of an embodiment of a shrinkage counter with dial mechanism, showing shrinkage deviations from a predetermined value;

Fig. 5 is a face view (parts broken away) of the counter illustrated in Fig. 4, taken on the line 5—5 of Fig. 4;

Fig. 6 is an enlarged perspective view of a detail forming part of the counter shown in Figs. 4 and 5;

Fig. 7 shows in axial cross-section a modified shrinkage counter adapted to register accumulated length differences;

Fig. 8 is a lateral elevation of the shrinkage counter shown in Fig. 7;

Fig. 9 shows a third embodiment of a counter according to the invention, also giving cumulative readings;

Figs. 10 and 11 are schematic views of two modifications of the counter shown in Fig. 9;

Fig. 12 is a side view of a shrinkage counter adapted to indicate momentary values of deviation;

Fig. 13 is a sectional view of the counter shown in Fig. 12;

Fig. 14 is a cross-sectional view taken on the line 14—14 of Figs 12 and 13; and

Figs. 15 and 16 show, in different operating positions, a further modification of a counter according to the invention.

In the overall arrangement shown in Fig. 1, a conventional loom **1** (part of whose frame has been omitted) has a warp beam **2** from which the warp or chain **3** runs, over a warp-feed roller **4** and a warp follower **5**, in the usual way over lease rods, heddles, reed and beater, all of which are only schematically indicated and denoted in Fig. 1 by reference numeral **62**. After the weaving process, the web or fabric **7** is led over the breast beam **8**, a guide roller **9** and a friction roller **10** to the cloth beam **11** where it is rolled up. The warp follower **5** is directly coupled, by means of shaft **17** (see Fig. 4), to the shrinkage counter **6**. The rotation of roller **10** is transmitted by a web follower **12**, shown as a roller, over a flexible shaft **13** (such as a Bowden cable) to counter **6**. Owing to this arrangement, warp follower **5** measures the length of the supplied warp thread while web follower **12** measures the length of the completed web. Both rotational torques are transmitted simultaneously to shrinkage counter **6**.

The mounting of the web-follower roller **12** is shown in Fig. 2. A bearing **15** is secured to the frame of loom **1** by a lock nut **16**. Roller **12**, journaled in this bearing, is preferably coated with a resilient material, for instance rubber, so as to be frictionally entrained by the rough-surfaced roller **10**. A pin **14**, entering a groove **14*a***, holds the roller **12** in axially fixed position. The flexible shaft **13**, leading to counter **6**, is attached to the outer roller end.

Figs. 3 and 4 illustrate the mounting of the warp-follower roller **5**. This roller is rotatively entrained by the forward movement (as indicated by the arrow) of the warp threads **3** on which it is floatingly supported with its cast-iron cradle **18**; the latter has stabilizing projections **18*a***, **18*b*** which deflect the warp threads. The support **18** is attached to a steel cable **19** having its other end anchored to the loom frame, the roller **5** being thus prevented from following the warp motion. Roller shaft **17** extends through the loom frame **1** toward shrinkage counter **6**. The other end of this shaft has a hole **63** adapted to receive a cotter pin (not shown) upon whose removal the warp-follower assembly **5**, **18** may be easily withdrawn from shaft **17** for replacement of roller **5** by another having a smaller or larger diameter. This may be necessary to compensate for varying shrinkage values as encountered in different weaving processes. A single roller will be satisfactory, however, if a stepless speed changer (indicated diagrammatically at **64**) is inserted between warp follower **5**, **18** and shrinkage counter **6**. A similar transmission may also be inserted between web follower **12** and counter **6**, as indicated diagrammatically at **65** in Fig. 1.

The counter **6** shown in Figs. 4 and 5 is adapted to indicate, as a difference of two rotational movements acting thereon, the shrinkage deviations from a predetermined value. To this end, a dial **20** and a mask **21** are provided; dial **20** is firmly attached to shaft **17** and

is consequently rotated in unison with roller **5**, or in a predetermined ratio thereto if transmission **64** is used. A bearing **26** is fixed by a lock nut **16** to loom **1**. This bearing supports a pinion **24** which is driven by flexible shaft **13**. Mask **21** is fixed to the casing **22** which is freely rotatable about shaft **17** and coupled with shaft **13** through a gear **23** meshing with pinion **24**. Dial **20** and mask **21** rotate always in the same sense, i.e. counterclockwise as viewed in Fig. 5; the markings on dial **20** are visible through a window **25** cut into mask **21**.

As shown in Fig. 5, dial **20** carries two sets of figures F', F'', the figures F' of the outer circle being in one color (e.g. red) and increasing in clockwise direction, the figures F'' of the inner circle being in a complementary color (e.g. green) and increasing in counterclockwise direction; the common numeral 0 may be in a neutral color, e.g. black. A transparent rider **27** is displaceable between two limiting pegs **28'**, **28''** within casing **22**. The rider **27** is in frictional engagement with the periphery of dial **20**, as best seen in Fig. 6, so that rotation of the dial entrains this rider to the left or to the right until it is stopped by peg **28'** or **28''** while dial **20** continues to rotate. The two halves **27***r*, **27***g* of rider **27** are transparencies having the same two complementary colors, i.e. red (left) and green (right), respectively, whereby, depending on the direction of the relative motion of dial **20** and casing **22**, only the outer or the inner set of figures will appear through window **25** while those of the other set will be invisible. Thus, if the shrinkage deviation is positive (shaft **17** rotating faster than cable **13**), rider **27** will be carried into engagement with left-hand peg **28'** and its green half **27***g* will be visible through window **25** so that only the contrasting outer figures F' will show, indicating increasing values of deviation as the dial **20** leads the casing **22** in its counterclockwise rotation. With negative deviation, the background visible through window **25** will be the red rider half **27***r* (rider **27** in contact with right-hand peg **28''**) and the contrasting figures F'' will indicate the magnitude of this deviation as the dial **20** lags behind the housing **22**. Thus, proper adjustments may be made on the loom to eliminate the shrinkage deviation. After such adjustment, or at suitable intervals, the shrinkage counter **6** may be reset to zero; to this end, casing **22** can be pulled forward in relation to shaft **17**, against the force of a helical spring **29**, whereby the meshing of gears **23**, **24** will be interrupted. After the 0 marking on dial **20** has been realigned with window **25**, casing **22** is released and returns to its original position owing to the retractive action of its restoring spring **29**.

Figs. 7 and 8 show a modified shrinkage counter **106** adapted to be used in lieu of counter **6**. Instead of a dial and a mask, the counter **106** has three digit wheels **130** driven by warp-follower roller **5** through shaft **17**. The counter is supported on loom **1** by a bracket **126** secured to the loom frame by means of lock nut **16**. The rotation imparted by web-follower roller **12** to flexible shaft **13** rotates the casing **122** of the counter which is provided with two slot-like windows **156'** and **156''** cut out of the housing at diametrically opposite locations. Each digit wheel **130** carries around its circumference two consecutive series of the numerals 0 to 9. Thus, the same readings will appear in both windows in any relative position of wheels **130** and casing **122**.

This embodiment gives a wider range of cumulative readings than the previous one, since the number of digit wheels can be increased at will. The counter **106** may be equipped with conventional means for resetting the digit wheels to zero.

Fig. 9 shows another form of shrinkage counter **206** in which the difference of the rotative speeds of input shafts **13** and **17** is transmitted to the digit wheels **230** by means of a differential gear **252**. The casing **226** is fixedly mounted on a two-part gear box **222'**, **222''** secured to the wall of loom **1** by lock nut **16**. The two planet wheels **252***a*, **252***b* of the differential gear **252** are respectively driven by shafts **13** and **17**; the differential housing **252***e*, carrying the sun wheels **252***c*, **252***d* on an axle **252***f*, is provided on its outer periphery with gear teeth meshing with a pinion **245** fixed to the driving shaft **243** of the counter. Each digit wheel **230** carries a single peripheral series of numerals 0–9 which can be viewed through a window **256**.

A slightly altered counter **306** is shown schematically in Fig. 10. Casing **326** is mounted on gear box **322** which holds differential gear **352**. By way of modification, one of the inputs to the shrinkage counter is here constituted by a shaft **313** connecting the conventional shoot counter **366**, forming part of the loom **1**, with a pinion **346** meshing with another pinion **345** which is rigid with planet wheel **352***a*. The rotation of the differential housing is transmitted to the digit wheels within casing **326** by a connection between drive shaft **343** and sun-wheel axle **352***f*. The readings are the same as with the embodiment of Fig. 9.

Fig. 11 schematically shows a further modification in which the counter **406** has its left-hand input shaft **413** (which may lead to either the web-follower roller **12** or the shoot counter **366**) coupled directly with the sun wheel axle, the output of differential gear **452** being fed to digit-wheel shaft **443** via planet wheel **452***a* and gears **445**, **446**.

Figs 12–14 show a shrinkage counter **506** adapted to indicate instantaneous values of deviation. These values can be read through a small window **531** in composite gear box **522'**, **522''**. The first rotary input is provided by an extension **513** of flexible shaft **13**, the other input being constituted by a shaft **543** extending from the differential gear **552** which may be of the type shown in any of Figs. 9–11. The differential **552** is driven from shaft **17** and, via meshing gears **545**, **546** having a transmission ratio of unity, from shaft **513**.

The numbers appearing in the window are applied to the periphery of a counter disk **532** controlled by a worm disk **533** which is driven by a worm **560**; the shaft **559** of this worm is linked to shaft **543** via a universal joint **544**. Disks **532** and **533** carry dogs **535** and **534** respectively. The edge of disk **532** has teeth **537** engaged by a detent **536**. Disk **532** is provided with a helical restoring spring **538**, disk **533** having a similar spring **542**. The restoring action of these springs is, however, limited by the interengagement of dogs **534**, **535**.

A worm **547**, driven by shaft **513**, keeps a worm wheel **539** in constant rotation. Wheel **539** is provided near its periphery with a cam **540** which will successively engage the detent **536** and a lever **541**, urged downwardly by a spring **558**, once during every revolution of wheel **539** so that the worm **560**, rotatably carried on this lever, will be disengaged from disk **533** for a short period. At this moment the disk **533** will be turned backwards by the torsional force of its spring **542** until dog **534** reaches an abutment **551** provided on the inner wall of casing portion **522'**. With worm wheel **539** rotating counterclockwise as viewed in Fig. 14, cam **540** momentarily inactivates detent **536** just before lifting lever **541** to disengage worm **560** from disk **533**.

The operation of this system is the following: Disk **533** starts turning from its rest position and entrains with its dog **534** the dog **535** of disk **532**. With every revolution of worm wheel **539**, cam **540** lifts shaft **559** and discontinues the meshing of worm **560** with disk **533**, whereupon the latter returns to its rest position determined by abutment **551**. Counter disk **532** is held in position by detent **536** against the action of spring **538**. As wheel **539** continues its rotation, lever **541** drops into its original position so that the connection of disk **533** and form **560** is re-established.

One revolution of worm wheel **539** corresponds to a predetermined period for which the shrinkage in length is to be indcated. This period can be adjusted so that it

corresponds to 1,000 revolutions of counter shaft **543**, or to any desired number of turns.

Upon any subsequent revolution of wheel **539** two possibilities arise. If shrinkage is larger in the following time period than it was in the previous one, dog **535** is entrained by dog **534** as soon as the previous shrinkage value is reached, detent **536** permitting the unidirectional advance of disk **532** resulting from this entrainment. At the instant when cam **540** inactivates the detent **536**, dogs **534**, **535** are still in contact with each other so that disk **532** is prevented from snapping back. When, during the further motion of wheel **539**, cam **540** disengages wheel **560** and disk **533**, dog **534** returns toward abutment **551** while disk **532** remains arrested by detent **536**, resulting in a new shrinkage-value indication through the window **531**.

If, however, shrinkage decreases in the subsequent period, disk **532** is allowed to snap back, through the action of spring **538**, as soon as detent **536** is lifted by cam **540**; disk **532** will then move backwards until dog **535** meets dog **534**. Thereupon detent **536** again becomes operative just before the meshing of worm **560** with disk **533** is interrupted. Consequently, the shrinkage counter records upon each revolution of wheel **539** only the last shrinkage value which will be corrected after each revolution in the above-described manner.

Figs. 15 and 16 illustrate a mechanism for automatically inactivating a counter according to the embodiments shown in Figs. 10 and 14. This mechanism comprises two gears **646**, **645** whose shafts **613**, **643** are provided with fingers **648** and **649**, respectively. These fingers have complementary extremities, one being wedged and the other notched. The number of teeth of the wheels have to be chosen so that they represent relative prime members, e.g. 21 and 29, in which case the two fingers will engage only after 609 revolutions (21×29) of the driving shaft **613**. When the two fingers meet, the gears **645**, **646** will be disengaged and the counter **606**, driven by shaft **643**, will stop. To enable such disengagement, shaft **613** is held in a bearing **667** clutched between spring-loaded arms **650**; when the two fingers interact, flexible shaft **613** will drop in its bearing **667** by a distance sufficient to unmesh the two gears. This movement is facilitated by the provision of two triangular notches **650'** in each arm **650**, either the upper or the lower notches receiving corresponding triangular projections **667'** of bearing **667** in the position of Fig. 15 and Fig. 16, respectively. Although input shaft **17** (Fig. 10 or 14) may continue to rotate when the bearing **667** has dropped into the lower notches, output shaft **643** will remain stationary in view of the negligible resistance encountered by gear **645** after the fingers **648**, **649** have become disengaged.

The invention is, of course, not limited to the specific embodiments described and illustrated. Thus, some of the features shown in certain of the disclosed embodiments may be used, if desired, in combination with other features from other embodiments, e.g. the shoot counter **366** of Fig. 10 may be connected to shaft **13** in Figs. 7 and 8, or the indicator disk **532** in Figs. 12–14 may carry a rider similar to member **27** (Figs. 5, 6) adapted to show whether the percentage value visible through window **531** represents an increase or a decrease from a value previously registered. These and other modifications, variations an adaptations are deemed to come within the scope of my herein disclosed invention as defined in the appended claims.

I claim:

1. In a loom having means for weaving incoming warp threads into an outgoing fabric, in combination, a first element rotatable in step with the advance of said warp threads, a second element rotatable in step with the advance of said fabric, and a differential counter having two input members and indicating means responsive to relative motion of said input members, said input members being respectively connected to said first and second elements.

2. The combination according to claim 1 wherein said first element comprises a roller in contact with said warp threads.

3. The combination according to claim 2, further comprising mounting means for said roller floatingly supporting same on said warp threads, said mounting means including a shaft coupled with one of said input members.

4. The combination according to claim 3 wherein said mounting means further includes a bracket swingably positioned on said shaft, said warp threads passing between said roller and said bracket.

5. The combination according to claim 1 wherein said second element comprises a roller in contact with said fabric.

6. The combination according to claim 1 wherein said loom is provided with a shoot counter responsive to the number of weft threads woven into said fabric, said second element comprising a shaft coupled with said shoot counter.

7. The combination according to claim 1, further comprising a flexible shaft coupling said second element with one of said input members.

8. The combination according to claim 1, further comprising adjustable speed-changing means inserted between one of said elements and one of said input members.

9. The combination according to claim 1 wherein said counter comprises differential gear means, said input members forming part of said differential gear means, said differential gear means having an output member coupled with said indicator means.

10. The combination according to claim 9 wherein said indicator means comprises a movable carrier bearing a plurality of markings, coupling means for operatively connecting said output member with said carrier, restoring means tending to return said carrier to a starting position, and release means for inactivating said coupling means.

11. The combination according to claim 10 wherein said release means is coupled to one of said elements for periodic inactivation of said coupling means.

12. The combination according to claim 11 wherein said coupling means includes a first disk, said carrier being a second disk coaxial with said first disk, said disks being provided with co-operating formations mutually engageable for entrainment of said second disk by said first disk against the force of said restoring means, said restoring means tending to return said first disk to a starting position, said coupling means further including detent means for said disks periodically operable by said release means for momentary disengagement of said second disk followed by momentary disengagement of said first disk.

13. The combination according to claim 9 wherein one of said elements comprises a first shaft and one of said input members comprises a second shaft, said differential gear means being provided with transmission means interconnecting said shafts for rotation in unison, said transmission means being provided with co-acting formations mounted for interengabement in a predetermined relative position of said shafts, said formations when thus interengaged being adapted to inactivate said transmission means.

14. The combination according to claim 13 wherein said transmission means comprises two gears respectively mounted on said shafts, said gears having respective sets of teeth whose numbers are relatively prime.

15. The combination according to claim 1 wherein said counter comprises a plurality of digit wheels, one of said input members comprising a rotatable housing for said digit wheels, the other of said input members comprising a drive shaft for said digit wheels coaxial with said housing.

16. The combination according to claim 15 wherein each of said digit wheels is provided on its periphery with a plurality of digital series angularly spaced from one another, said housing being provided with a like plurality of angularly spaced windows enabling identical digits to be viewed therethrough.

17. The combination according to claim 1 wherein said counter comprises a dial coupled with one of said input members and a mask coupled with the other of said input members, said dial and said mask being coaxially mounted for relative rotation, said mask having a window exposing part of said dial, said dial bearing markings viewable through said window.

18. The combination according to claim 17 wherein said dial is a disk provided on its periphery with a rider frictionally entrainable thereon, further comprising stop means entrained by said mask for limiting the displacement of said rider on either side of said window whereby

said rider remains aligned with said window, said rider having two transparent portions of distinctive appearance overlying said markings and registering with said window in respective limiting positions of said rider.

19. The combination according to claim 18 wherein said portions are in complementary colors, said markings being divided into two groups of similar complementary colors whereby the markings of only one group are readily visible through said rider in either of its said limiting positions.

20. The combination according to claim 1 wherein said counter is provided with release means momentarily operable to decouple at least one of said elements from the associated input member, thereby enabling a resetting of said indicator means to a normal position.

No references cited.