Aug. 11, 1953 G. W. EWALD 2,648,118

TAPE

Filed April 15, 1949

Fig. I

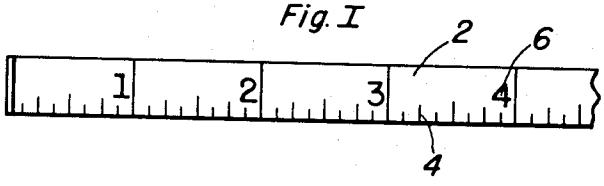


Fig. II

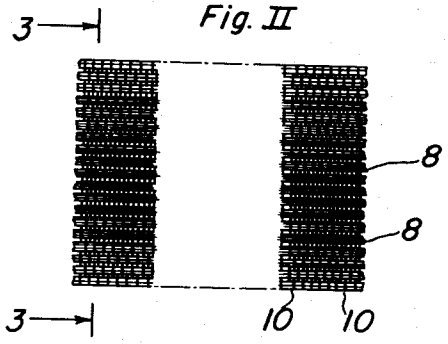
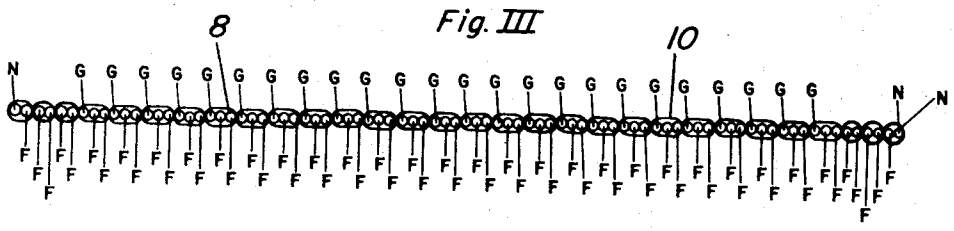


Fig. III



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Patented Aug. 11, 1953

2,648,118

UNITED STATES PATENT OFFICE

2,648,118

TAPE

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Application April 15, 1949, Serial No. 87,647

4 Claims. (Cl. 28—80)

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This invention relates to a woven tape having improved properties of dimensional stability, resistance to elongation, resistance to wear, resistance to water, enhanced tensile strength and superior surface characteristics. Although the invention is particularly applicable to measuring tapes where it produces a greater contrast between graduations and indicia and background areas, it is not limited to this form of application.

Many measuring tapes have been woven from textile fibers such as cotton and linen with or without metallic strands. These tapes were relatively inaccurate and did not meet all of the rigorous requirements for outdoor use such as are encountered in construction work, surveying and the like, particularly in respect to the properties of dimensional accuracy and resistance to wear with continued use.

Tapes made according to the invention described in Patent No. 2,321,920 to A. W. Keuffel et al. improved on these. These tapes were made from a woven strip having warp threads of both glass fibers and natural fibers such as cotton and linen. In these tapes the weft threads were also natural fibers. While measuring tapes woven in this manner are superior to conventional tapes woven exclusively from natural textile fibers because of the strength and dimensional stability of the glass fiber ends in the warp, it has been found that the presence of the natural fiber warp ends is objectionable. Natural fiber threads are built up from natural fibers whose length is limited by the plants from which they come. They have relatively low strength, high elongation and water absorbent qualities which detrimentally affect their properties i. e., they change in dimensions when wetted. They are also not absolutely white which is particularly true of linen threads. Tape woven from such threads does not have ideal surface characteristics, i. e., it is not smooth. A smooth tape is considered an advantage because of its appearance, its feel in the hand, because it does not pick up dirt as readily and because it does not catch on obstructions but tends to slide over them without damage to the tape.

The present invention eliminates the disadvantages inherent in the use of natural fibers in the warp threads of woven measuring tapes. The invention contemplates the provision of a woven strip having warp threads of synthetic filaments of oriented saponified cellulose acetate or similar filaments. Such filaments being

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made synthetically may have lengths as long as desired. Other properties of the threads are under control for the same reason. They have high strength and low elongation and when combined with warp threads of glass filaments produce a strip having the improved qualities which have been previously indicated. Due to the greater resistance to bending of the oriented saponified cellulose acetate threads in comparison with natural fiber threads a greater percentage of glass threads can be used to increase the dimensional stability in even greater proportion. The invention also contemplates synthetic fibers in the weft or filling as well. By properly combining in several different synthetic fibers those properties which are highly desirable for measuring tapes, namely, strength, wear resistance, dimensional stability, even when wetted, resistance to elongation under load, better surface characteristics and greater whiteness which contrasts better with graduations and indicia are obtained to an extent heretofore not considered possible.

Additional objects and advantages of the invention will be readily apparent in the course of the following detailed description taken in connection with the accompanying diagrammatic drawing in which:

Fig. I is a view in plan showing a measuring tape.

Fig. II is a view in enlarged plan showing the woven fabric strip.

Fig. III is a view in vertical section taken along the line 3—3 of Fig. II and looking in the direction of the arrows.

Fig. I shows the completed measuring tape 2 provided with indicia including the graduations 4 and numerals 6.

Fig. II shows the straight filamental warp ends 8 woven with filling or weft threads 10.

Fig. III shows the straight filamental warp ends 8 in cross-section and the sinuous form of the filling of weft threads 10. The legends attached to this figure show the arrangement of the different filamental threads in one preferred embodiment of the invention. N represents nylon filament threads, F represents oriented saponified cellulose acetate or similar filament thread, and G represents glass filament thread. This embodiment is composed entirely of synthetic and glass filament threads.

The use of a woven strip wherein part of the warp threads are made from saponified, oriented cellulose acetate fibers results in an improved measuring tape because of the exceedingly high

tensile strength and relatively low elongation of these synthetic fibers when compared to natural fibers such as cotton, linen and the like. Further, when the remainder of the warp threads are of glass fiber, any tendency toward elongation of the oriented saponified cellulose acetate warp threads upon being subjected to stress will be minimized by the glass fiber warp threads. Because of the greater tensile strength of the synthetic filament threads, the tape can have greater strength for the same thickness or can be made thinner and still have the same strength as conventional woven measuring tapes.

The tape is woven on the loom with uniform tension on both the glass fiber warp threads and the oriented saponified cellulose acetate warp threads. In the previously proposed combination of warp threads of glass fibers and natural fibers such as cotton and linen, warp threads of different fibers must be woven with different tensions. This latter procedure produced a tape in which the warp threads of different materials were of different length which could be demonstrated by removing the filler thread in an intermediate portion of a length of tape. This is not true of the improved synthetic tape. A differential warp tension is not necessary when glass fibers and oriented saponified cellulose acetate yarn are used inasmuch as the tension properties of the two synthetic yarns are uniform. Wetting and attendant shrinkage or stretch are not material factors since the change in dimensions of the glass fibers when wetted is essentially zero and the change in dimension of the oriented saponified cellulose acetate fiber when wetted is approximately plus or minus $\frac{1}{10}$ of 1%. In the woven strip of the present invention the weaving is facilitated greatly because it is possible to apply equal tension to both the oriented saponified cellulose acetate warp threads and the glass fiber warp threads to produce a tape of high dimensional stability even when wetted.

The twist of the warp threads should be a minimum for dimensional stability. About 4 or 5 turns per inch is satisfactory.

The use of oriented saponified cellulose acetate warp threads in conjunction with glass fiber threads has further advantages in that a high percentage of the individual filaments of the glass yarn break when the tape is sharply creased and the contribution to the strength and dimensional stability of the tape by the glass warp ends is thus lessened. However, the oriented saponified cellulose acetate fibers do not break when the tape is creased. The fact that the saponified oriented cellulose acetate warp ends used in conjunction with the glass have high strength and dimensional stability makes it possible for the creased tape to have these properties to a greater extent than if the warp ends used in conjunction with the glass warp ends were of natural fibers.

A further advantage in the use of saponified oriented cellulose acetate warp ends as against natural fibers is that the synthetic yarn has higher strength and it is necessary to use less material thus permitting a tape of less thickness which is desirable to keep down the bulk of the tape of a given length and the size of its case.

Since the dimensional stability of the woven tape is essentially a function of the properties of the warp threads alone, which warp threads extend longitudinally of the tape, any suitable thread may be used for the weft or filling in weaving the improved tape of the invention. Thus the weft may be of cellulose acetate, cotton, linen, rayon or the like, but nylon weft threads have been found particularly advantageous. These nylon threads impart to the tape a greater wear resistance due to their high abrasion resistant qualities and thus protect those portions of the warp threads which they cover against abrasion. Nylon weft threads do not slide too freely over saponified cellulose acetate thread. Certain combinations of materials for the warp end weft threads are undesirable from this point of view in which case handling of the tape during manufacturing operations may cause slipping of the weft thread and uneven spacing of it on the warp.

The preferred tape of Fig. III is woven with nylon yarn warp at the edges which protects the tape against tearing inasmuch as nylon is hard to break in a tearing motion and thus prevents the starting of a tear and the destruction of the entire tape. This tape has improved tear resistance over prior art tapes for this reason.

Although the ratio of saponified cellulose acetate filament threads to glass fiber threads in the warp as given in the example is approximately two and one half to one, this ratio need not be adhered to in the production of an improved measuring tape in accordance with the practice of the invention, it being essential only that some of the warp ends are glass fiber thread and some of the warp ends are saponified cellulose acetate filament thread. Also no particular distribution pattern of the saponified cellulose acetate filament threads among the glass fiber threads is necessary beyond the obvious expedient of arranging the glass fiber threads of relatively low elongation at fairly regular intervals among the saponified cellulose acetate filament threads so as to avoid the concentration of acetate threads at any section of the warp to the exclusion of glass fiber threads in that section. One good way of arriving at the proportion of glass filament threads to be combined with saponified cellulose acetate threads is to choose one which will permit both these types of threads to break simultaneously in a tension test. A tension vs. elongation graph for this tape will show only one point of rapidly increasing elongation with increasing tension, i. e., the breaking point. This condition is most efficient in the use of the warp threads. Tapes having different proportions of glass to synthetic filament threads may show two such points.

Although the example shown in the drawing has most of the warp threads bunched in groups of three, this weave need not necessarily be adhered to. In general the greater the number of threads so bunched together, the greater is the lengthwise stiffness of the tape. The warp crimp is a minimum and therefore dimensional stability a maximum under these conditions.

If tear resistance is not necessary, an excellent tape can be made without the use of nylon in the warp threads. The use of nylon in any large proportion of the warp will produce elasticity or springiness in the tape. This characteristic is desirable at the selvedge but not for the tape as a whole.

The completed woven fabric ribbon must be subjected to several additional process steps before it becomes a completed measuring tape. These steps may be varied considerably within

the scope of this invention which is directed to the woven fabric strip. The usual process includes base coating, printing and top coating. The steps given in Patent No. 2,321,920 may be applied to the fabric strip herein described. Preferably these subsequent steps should be chosen to retain the whiteness of the woven strip to as great a degree as possible in order to provide maximum contrast with the graduations and indicia which are preferably black and may also include another color such as red.

The practice of the invention utilizing a warp partly comprised of saponified and oriented cellulose acetate filament threads of great tensile strength and low elongation and partly comprised of glass fiber threads of great tensile strength and even lower elongation results in the production of a measuring tape of distinctly improved dimensional stability and accuracy, of simplified manufacture and improved contrast.

Since modifications may be made in the warp pattern distribution, it is intended that all matter contained in the foregoing description be interpreted merely as illustrative and not in a limiting sense.

What is claimed is:

1. A woven measuring tape having aligned straight warp threads of uniform length comprising glass fiber threads and saponified oriented cellulose acetate filament threads, said glass fiber threads and said cellulose acetate filament threads being present approximately in the ratio of 1 to 2.5, said glass fiber threads being distributed among said cellulose acetate filament threads throughout the warp pattern, a sinuous filling interconnecting said warp threads, a coating on the tape and graduations and numerals depicted on the tape.

2. A woven measuring tape having aligned warp threads of uniform length, the warp threads comprising glass fiber threads and saponified oriented cellulose acetate filament threads, a sinuous filling of nylon threads interconnecting said warp threads, a coating on the tape and graduations and numerals depicted on the tape.

3. A woven measuring tape having aligned warp threads of equal length, the warp threads comprising glass fiber threads, saponified oriented cellulose acetate filament threads and nylon threads, said nylon warp threads being provided at the edges of the tape, a sinuous filling interconnecting said warp threads, a coating on the tape and graduations and numerals depicted on the tape.

4. A woven tape having aligned warp threads of uniform length, the warp threads comprising glass fiber threads and saponified oriented cellulose acetate filament threads and a sinuous filling of nylon threads interconnecting said warp threads.

GEORGE W. EWALD.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
232,122	Hammesfahr	Sept. 14, 1880
260,163	Chesterman	June 17, 1882
2,210,290	Heinsohn	Aug. 6, 1940
2,321,920	Keuffel et al.	June 15, 1943
2,353,224	Dreyfus	July 11, 1944
2,372,983	Richardson	Apr. 3, 1945
2,539,301	Foster	Jan. 23, 1951