Sept. 2, 1947. E. J. WITCHGER 2,426,962

PROCESS FOR MAKING MEASURING TAPES

Original Filed Nov. 24, 1939

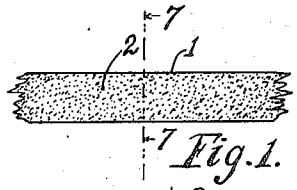


Fig. 1.

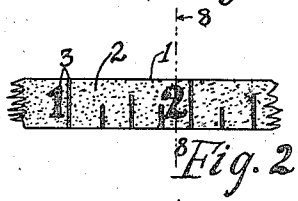


Fig. 2.

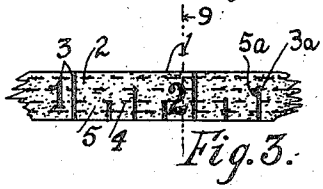


Fig. 3.

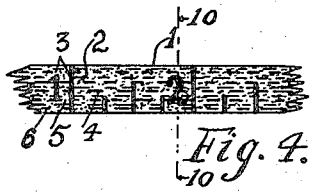


Fig. 4.

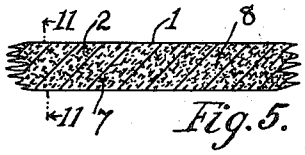


Fig. 5.

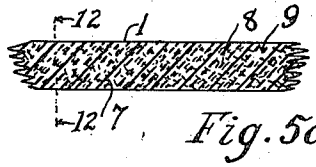


Fig. 5a.

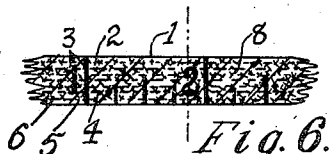


Fig. 6.

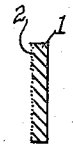


Fig. 7.

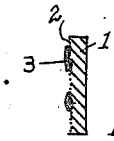


Fig. 8.

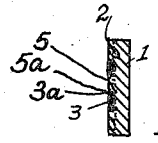


Fig. 9.

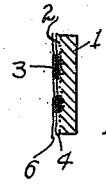


Fig. 10.

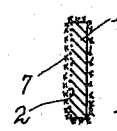


Fig. 11.

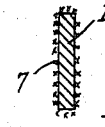


Fig. 12.

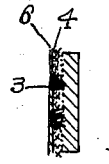


Fig. 13.

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Patented Sept. 2, 1947 2,426,962

UNITED STATES PATENT OFFICE

2,426,962

PROCESS FOR MAKING MEASURING TAPES

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Original application November 24, 1939, Serial No. 305,965. Divided and this application July 21, 1942, Serial No. 451,776

8 Claims. (Cl. 204—18)

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This invention relates to measuring tapes made of ribbon metal, with printed graduations and electroplated background areas.

Speaking generally, a novel principle is involved in my discovery of underlying causes of poor legibility, and short life in earlier tapes of such character and in remedying the same.

It is concerned with process steps that bring about certain new and useful improvements in respect to legibility and attractive appearance of such tapes, lasting sharpness of the edges of the markings; better color and other visual qualities of the unmarked or background areas, and greater durability of the finished article.

The foregoing and certain other objects which will be set forth in the specifications have been attained, not precisely by the improvement of any specific element or step, but by a novel reorganization and cooperative working of several known steps in unobvious sequence or order. The results thus produced have not heretofore been suggested or disclosed so far as I am aware.

A tape measure constructed according to my present process is described and claimed in my copending application for patent, Serial No. 305,965, filed November 24, 1939, issued March 30, 1943, as Patent No. 2,314,915, of which this is a divisional case. The inventive novelty involved in various aspects of my improvement will be more particularly pointed out in the following detailed description, illustrated in the drawing and defined in the claims.

In the accompanying drawing:

Fig. 1 illustrates schematically a strip of polished ribbon metal after having been given a punctulate or pitted surface of mat-like texture whereby improved physical and optical characteristics are imparted to the final outer surface of the finished product;

Fig. 2 shows the strip, Fig. 1, after having been marked with numerals and graduation characters;

Fig. 3 shows the strip, Fig. 2, after its background areas have been plated with nickel or equivalent coating;

Fig. 4 shows the strip, Fig. 3, after having been provided with a coating of harder metal over the first plating;

Fig. 5 shows an alternative embodiment wherein a mat-surfaced strip, Fig. 1, has been rust-proofed and the rust-proofed coating has been treated preparatory to receiving a coating of metal;

Fig. 5*a* shows a further modification wherein the mat surface has been created by the rust-

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proofing operation itself, and then treated, as in Fig. 5, to prepare for electroplating;

Fig. 6 shows the rust-proofed strip, Figs. 5 or 5*a*, with printed markings and plated background areas, this being a preferred structure and method for quantity production of high grade measuring tapes;

Figs. 7 to 13, inclusive, are enlarged and distorted cross-sectional views of the pieces shown in the respective adjacent Figs. 1 to 6, the sections being taken at places indicated by broken lines.

I shall now explain my new process and the novel physical features of the product, incidentally pointing out their advantages over earlier practice because correct appreciation of the novelty and advantages in use of my new process requires a brief exposition of disadvantages inherent in earlier tapes.

The following numerals on the drawings indicate the following physical elements that illustrate the several steps in the process, by showing the article as it appears after performing each step in regular order, as set forth in the claims; and also showing the finished rule, in its preferred form in Figs. 6 and 13.

1—original commercial polished ribbon metal base,

2—pits of microscopic dimensions created on the base, as by etching,

3—conventional markings printed in non-conducting ink on the surface,

3*a*—edges of markings 3,

4—electrodeposited coating on the unprinted or background areas of the printed base,

5—electrodeposited coating 4 is of light colored metal,

5*a*—edges of coating 5,

6—hard metal electrodeposited upon the light metal 5,

7—indicates the pitted surface 2 after having been treated with crystal forming compound, referred to in the specifications as "rust-proofing" by immersing the ribbon in a heated solution that reacts on the metal surface, changing it to a phosphate coating insoluble in water and resistant to corrosion,

8—the surfaces 7 after the step of removing the less adherent crystals therefrom,

9—indicates the thinned phosphate coating after the step of removing the less adherent surface crystals from the surface 7.

Considered each by itself the various facts underlying the recited operations have long been known, yet, so far as I am aware, they have not

been brought together in such a way as to produce measuring tapes that possess the commercial and practical advantages attained by this invention.

When a metal ribbon with burnished or polished surfaces, known to the trade as "polished ribbon metal" has been printed with graduation markings in ink, is laid on a table and viewed from a short distance away, from different angles relatively to a light source, its unprinted areas act like mirrors that make the tape appear shiny, brilliant, or glary from some view points and from others dull and dark according to the nature of the image which the unprinted areas may happen to reflect. Dark images present inadequate contrast with the markings, giving the tape poor legibility. Bright images cause glare that makes the tape difficult to read. The reflected surroundings sometimes produce undesirable variant light-and-dark effects at different places along the tape surface.

Heretofore it has been thought highly desirable to have such highly reflective surfaces on metal tape measures because their brilliance makes a very attractive appearing article having marked customer appeal and also the highly polished tape was said to reduce undesirable friction effects in coiling the tape within its casing, and facilitated cleaning the tape. I have discovered, however, a fact which seems to have escaped the attention of those skilled in the art to which this invention appertains, namely, that instead of a highly reflective finished reading surface being a desirable feature, it is highly undesirable in measuring tapes.

Such erratic and undesirable optical effects are due, at least in part, to the fact that the polished or burnished surfaces of commercial "polished" ribbon metal has a multitude of minute parallel hair-like lines or scores, created in the final surfacing of the ribbon. The scores, being close together and extending lengthwise, cause the ribbon surface to reflect light differently viewed sidewise than when viewed lengthwise.

Even after the background portions of the commercial ribbon have been electroplated, the aberrations from light to dark, with glare and poor legibility, persist in the plated face of the finished tape, even increasing the difficulty.

In manufacturing a tape according to my method, I give a commercially smooth metal ribbon a pitted or punctulate face, mat-like in character, for I have discovered that the underlying ribbon metal when pitted as herein described will impart to the finished measuring tape, through the overlying coats of plated metal, several valuable optical qualities hitherto unforeseen, adding to its value, usefulness and durability by giving the finished plated surface improved non-glare properties and also a superior silver-white color.

I have also discovered that by producing such minutely pitted punctulated surfaces, the erratic optical effects herein-before referred to can be entirely obviated and thereby a tape of much greater legibility can be procured but with entirely unexpected results from the standpoint of markedly increased durability or longevity, while also producing an article of even greater attractiveness in appearance than the polished tapes of the prior art.

For convenience in terminology and not intended to be construed in a limiting sense, I designate certain surfaces as being "punctulate," "pitted" or "mat-like," meaning that such a surface comprises a multitude of uniformly distributed unevennesses, punctures, points, dots, or pits of microscopic dimensions. The operation that produces the surface is called "pitting."

In the following disclosure I shall at first set forth an analysis of the process as adapted by me to the mass production of high grade measuring tapes, and later shall explain certain modified modes.

In the first step of my process according to what I consider its best mode, a polished commercial metal ribbon may be subjected to treatment that gives its final surface the desirable punctulate or pitted quality.

The pitting treatment may comprise, preferably, subjecting the ribbon to mild etching by immersing it in approximately a ten per cent solution of nitric acid for about fifty or sixty seconds.

Loose particles are then removed from the etched and pitted surface by washing and brushing.

At this point it may be explained that what I have just referred to as "mild etching" mode of pitting is quite different from the deep etching heretofore employed in the manufacture of tapes wherein markings were applied directly to the face of a ribbon and the residual areas or backgrounds were then etched to a depth that made the markings stand out in relief. Deeply etched tapes proved unsatisfactory in use, for they soon lost the contrasty effect essential for easy reading. The mild etching or pitting operations used by me give a velvet-like mat, without creating surfaces in relief. Deep etched ribbons are weaker.

I have found another satisfactory way to produce pitting, by combining rust-proofing with pitting, in a single operation, as will be described later.

Pitting can also be accomplished by sand-blasting the ribbon. This is an inexpensive method for pitting the ribbons of some types of tape measures.

When the market shall offer a commercial ribbon metal with surfaces already "pitted," as distinguished from the burnished and minutely parallel-scored surfaces now commonly available, then it will no longer be necessary to perform a pitting operation as an initial step in the manufacture of tapes according to my process.

The second step according to my preferred mode now under discussion has to do with rust-proofing the pitted or punctulate ribbon surface before performing subsequent steps such as marking and plating.

This rust-proofing step contributes important advantages without unduly increasing the cost of manufacturing high grade measuring tapes and I consider it a preferable, although not indispensable, feature of my process or method, considered in its broader aspects.

Rust-proofing as the second step, may be accomplished by known processes employing various known acid phosphate coating baths. It comprises immersing the ribbon in a heated solution that reacts on the metal surface, changing it to a phosphate coating insoluble in water and resistant to corrosion.

Although better results are derived if pitting and rust-proofing are done as separate first and second steps of my process, in the manner above set forth, I have found that the rust-proofing operation alone, omitting the first step, light etching, will pit the surface of a commercial rib-

bon metal sufficiently to attain the major portion of the advantages derived from pitting and then rust-proofing the pitted surface.

The third step is to apply conventional tape markings to the pitted and rust-proofed surface, using any ink or equivalent substance that will not be damaged by solutions commonly used in electroplating.

The term "markings" designates graduation marks, figures, letters, or other characters on the tape. The terms "printing," "inking," "marking" are intended to embrace any suitable or usual way of applying figures and graduations to the tape, and more particularly figures and graduations printed in ink or the like that remain unplated when the remainder of the surface is plated. The unmarked areas are referred to as "background."

As the fourth step, the ink is hardened rapidly at appropriate temperature, say, about 270 degrees Fahrenheit, or, if preferred, more slowly at room temperature.

The fifth step is the removal of loose particles of phosphated metal from the unprinted, rust-proofed, background areas without removing the more firmly secured portion. The objects of this step will be apparent from the following explanation.

After having been rust-proofed and printed, the unprinted portions of the surface present rather insecurely attached crystals or particles of phosphate that interfere with subsequent electroplating, causing the coat of plating to craze, crack, or flake when the tape is bent. Experts heretofore have deemed it commercially impracticable to attempt electroplating upon flexible ribbon measuring tapes that had been rust-proofed in the usual way.

I have discovered a simple way of treating the pitted rust-proofed tape surfaces so they shall take electroplating perfectly and hold it permanently under the conditions of use.

A portion only of the adherent phosphate is removed from those unprinted "background" areas which are to be subsequently electroplated. Removal of the looser crystals may be accomplished by scrubbing with water or, alternatively by subjecting the printed tape to the action of dilute muriatic acid, (say, a 2 per cent to 5 per cent solution in water) for about twenty seconds.

Thus treated, the resultant modified rust-proofed "background" surfaces are free from loose particles and display a mat-like texture very like the pitted base surfaces that were produced by etching in step number one.

The sixth step is to electroplate the background crystal-free portions of the pitted and rust-proofed surface which is not covered by the markings. A light colored metal such as nickel or silver is used. Electroplating does not "take" at all on the printed markings which act as masks, but the exposed pitted or mat-like rust-proof surfaces, cleaned of surplus crystals, take the plated metal so deeply and bond it so securely that the coating of plate on the "background areas" will not crack or craze when the tape is flexed, twisted, or buckled in use.

The seventh step is to again electroplate upon the nickeled background areas with chromium or equivalent hard metal, imparting additional strength, durability, and hardness to the tape face, the purpose being to prevent injury to the face by scratching, rubbing, or impacts in use. Although this step, chrome plating for a second

metal coat, is preferable, it is an optional step and is omitted by me in making some classes of tape measures where extreme surface hardness is not a matter of great importance.

The eighth and final step, which is desirable but optional, is to coat the pitted rust-proofed printed and plated tape with a transparent lacquer.

The advantages in use of the above enumerated process steps, or the designated modifications, taken in the order indicated will now be further explained.

The foregoing disclosure of my process shows that a "pitted" ribbon metal surface, as the term is here used, is provided in the beginning, or by a first step. It may be produced, as stated, in several ways, as by etching or sand blasting. The pitted surface is the base upon which the subsequent operations of ink marking and electroplating are performed. The step of rust-proofing may follow such pitting, or the pitted surface may be produced by the operation of rust-proofing followed by removal of loose crystals. But for some classes of tapes I omit the rust-proofing step. Therefore I shall first discuss pitting in general as applied to flexible ribbon metal for measuring tapes.

Preparing the ribbon surface by "pitting" as a first operation gives unusually tenacious holding power or "tooth" for the ink substance. The material becomes deeply and evenly incorporated as a permanent part of the ribbon. These markings will not scale off or flake and they will not wear away under conditions of use to such an extent as to destroy or even materially reduce the legibility of the tape. Even persistent scraping with a sharp tool will not obliterate such markings, but leaves the tape measure in readable condition much longer than has heretofore been deemed possible.

Some earlier tapes have been objectionable in that the marking substance, being printed directly upon a polished or burnished metal surface, eventually blistered or flaked off, giving the tape a short life.

The "pitted" surface on the ribbon imparts to the finish coating of the tape certain other desirable characteristics not heretofore obtainable to such extent, if at all. For example, a first coating of metal electroplated on the pitted surface will display a non-glary finish. Likewise, a second coating of harder metal, plated over the first coat will be free from harmful glare. For a further example, I sometimes apply to the pitted ribbon a single relatively thick plating of hard metal, and the surface of that heavy coat also is found to be non-glary and mat-like, due to the mat-like surface on the underlying base ribbon. This insures that the outer hard plated coating which is much more wear resistant than the ink on the graduation markings serves to protect the graduations from being rubbed off when the tape is in use.

Having pointed out the great holding power of a pitted ribbon surface for the ink or marking substance, and its deep powerful bond for the plated metal on the background areas, I shall now describe an important additional and collateral advantage of providing a pitted ribbon surface beneath those places where marginal edges of the markings meet the marginal edges of the plating.

In earlier tapes with polished surfaces where margins of printed markings met edge-to-edge with the margins of a metal coating, flexing of

the tape would eventually cause the meeting edges to separate far enough to let moisture get to the ribbon itself. Corrosion of the underlying metal started and soon one or both of the meeting edges would become undermined and eventually gave way, the result being that the graduations lost their sharp outlines and became fuzzy, blurred, and less easy to read.

The pitted surface is helpful in preventing such defects because it bonds so thoroughly with the ink markings at their very edges and likewise with the edges of the electroplated coating that separation of the meeting edges of ink and plating is less liable to occur than in the earlier tapes alluded to.

Attention is now directed to rust-proofing when practiced as the second step in a preferred mode of making tape measures according to my disclosed process.

The phosphatic coating which results from the rust proofing instead of having the hard, naturally repellant and impervious surface properties of the metal provides a surface which exhibits marked properties of porosity and absorbency to which protective coatings such as paints, lacquers, or the like are remarkably adherent.

While these adherent properties and advantages of rust-proofed surfaces indicated the use of rust-proofing for electroplated articles, the art after much experimentation found that thin flexible ribbon metal which could otherwise be plated successfully for use in tape measures could not be uniformly or satisfactorily electroplated for such use after being rust-proofed. Hence it has generally been believed that in spite of its desirability, rust-proofing could not be used where it was necessary or desirable to electroplate the surface of the metal.

It was thought that the difficulty experienced in attempting to electroplate rust-proofed metals was due to the insulating or at least poor electro conductivity of the phosphatic coating on the metal, resulting from the rust-proofing treatment.

Also, earlier attempts fell short of success, either because loose phosphatic crystals developed by the rust-proofing process were not removed before plating or else the removal of surplus crystals was done by buffing or polishing to a degree that brought the surface down to a smooth condition wherein nearly all of the rust-proofing was removed. Such methods defeated their own purpose. The causes of such failures and the way in which my method, alluded to in the foregoing description, has overcome the difficulty will become apparent from the following explanation.

I have found that in addition to the expected advantages from employing a rust-proofed base metal with its desirable anti-rusting properties, new, unexpected, and exceptional results have been attained in the art of constructing metal tape measures as follows:

(*a*) Due to the much greater porosity of the rust-proofed metal over the untreated metallic ribbon stock, the printed ink markings are bonded so securely to the metal that they can not be removed or impaired except by grinding or scraping below the surface of the metal to which they are affixed;

(*b*) The electroplated coatings are much more intimately and firmly united to the background or unmarked areas of the tape and will resist crazing, cracking or peeling to a much greater extent than electroplated, non-rust-proofed tapes.

(*c*) Separation of the margins or meeting edges of the printed and electroplated areas as a result of flexing of the tape has been entirely eliminated, and

(*d*) As the surface resulting from the rust-proofing is a minutely punctulate one of mat-like texture the objectionable surface reflections of the polished ribbon tapes has been completely overcome.

Preventing undesirable glare and surface reflectiveness is an important matter in metal tape measure production, yet there is another consideration of great importance which improves the quality and influences sales, namely, color or shade of the pitted surfaces. I have found that a minutely pitted surface on the original ribbon gives to the final chrome coating an unusual and very attractive bluish white or silver-white color in effective contrast with dark colored ink markings and makes the tape measure more easily readable in dim lighting.

It is now evident that rust proofing and then removing a portion only of the less securely attached rust-proofing material, produces good optical results in the electroplated portions of the finished tape measure, namely, giving to the final chromium coat a non-glary mat-like character, and producing the attractive bluish-white or silvery-white color which has been alluded to. It is resistant to corrosion and wear, and insures permanent sharpness of the respective meeting edges of the inked graduation markings and of the electroplated metal coating for the background.

In the foregoing description reference has been made to performing various process steps on the "surface" of a strip. It will be understood that the terms "surface" and "face" as applied to the base ribbon metal strip are intended to designate areas on either or both sides of the strip.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. The process for making a legible, graduated measuring tape comprising preparing a metal strip with a matte surface, applying to said matte surface an electrodeposit resist ink to distinguish indicia areas from background areas, and electrodepositing at least one layer of corrosion resistant metal on the areas unprotected by the resist.

2. The method of making a graduated strip comprising etching a ribbon of steel to produce a surface thereon having diffused reflecting characteristics, applying electroplate resist to predetermined areas of the strip and electroplating a coating of metal on the areas of the strip not covered by the resist.

3. The process for making a legible graduated measuring tape comprising creating distinguishing areas of background and indicia on a surface of said strip, one of said areas being defined by applying to said surface an electroplate resist, preparing at least the other of said areas with a matte surface and electroplating a coating of metal on the areas of the strip not protected by the resist.

4. The process for making a legible, graduated measuring tape comprising preparing a metal strip with a matte surface, applying an electrodeposit resist ink to predetermined indicia areas of said surface, and electrodepositing at least one layer of corrosion-resistant metal having legible color contrast with said indicia areas on the areas unprotected by the resist, said metal coating assuming the matte characteristics of said underlying matte surface.

5. The method of making a graduated strip comprising etching a ribbon of steel to produce a surface thereon having substantially glare free diffused light reflecting characteristics, applying electroplate resist to predetermined indicia areas of the strip, and electroplating a coating of metal on the areas of the strip not covered by the resist, said coating of metal having legible color contrast with said indicia areas and assuming the substantially glare free diffused light reflecting characteristics of the underlying surface of said ribbon.

6. The process for making a legible, graduated measuring tape comprising creating distinguishing areas of background and of indicia on a surface of said strip, the indicia areas being defined by applying to selected portions of said surface an electroplate resist, preparing at least the background areas with a matte surface, and electroplating a coating of metal having legible color contrast with said indicia areas on the areas of the strip not protected by the resist, said coating of metal assuming the matte characteristics of the underlying matte surface.

7. The process for making a legible, graduated measuring tape comprising preparing a metal strip with a substantially glare free matte surface by treating the same with an acid phosphate rust-proofing agent reactive with the metal of said strip, applying electrodeposit resist to predetermined indicia areas of the strip for defining marks including measuring indicia on said strip, and electrodepositing at least one layer of corrosion-resistant metal having legible color contrast with said indicia areas on the areas unprotected by the resist, said corrosion-resistant metal assuming the substantially glare free matte characteristics of the underlying surface of said strip.

8. The method of making a graduated measuring strip comprising etching the surface of a ribbon of steel and then treating said surface with an acid phosphate rust-proofing agent reactive with the metal of said ribbon to produce a surface on said ribbon having corrosion-resistance and substantially glare free diffused light reflecting characteristics, applying electroplate resist to predetermined indicia areas of the strip for defining markings including measuring indicia, and electroplating metal coating having legible color contrast with said indicia areas on the areas of the strip not covered by the resist, said metal coating assuming the substantially glare free diffused light reflecting characteristics of the underlying surface of said strip.

EUGENE J. WITCHGER.

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