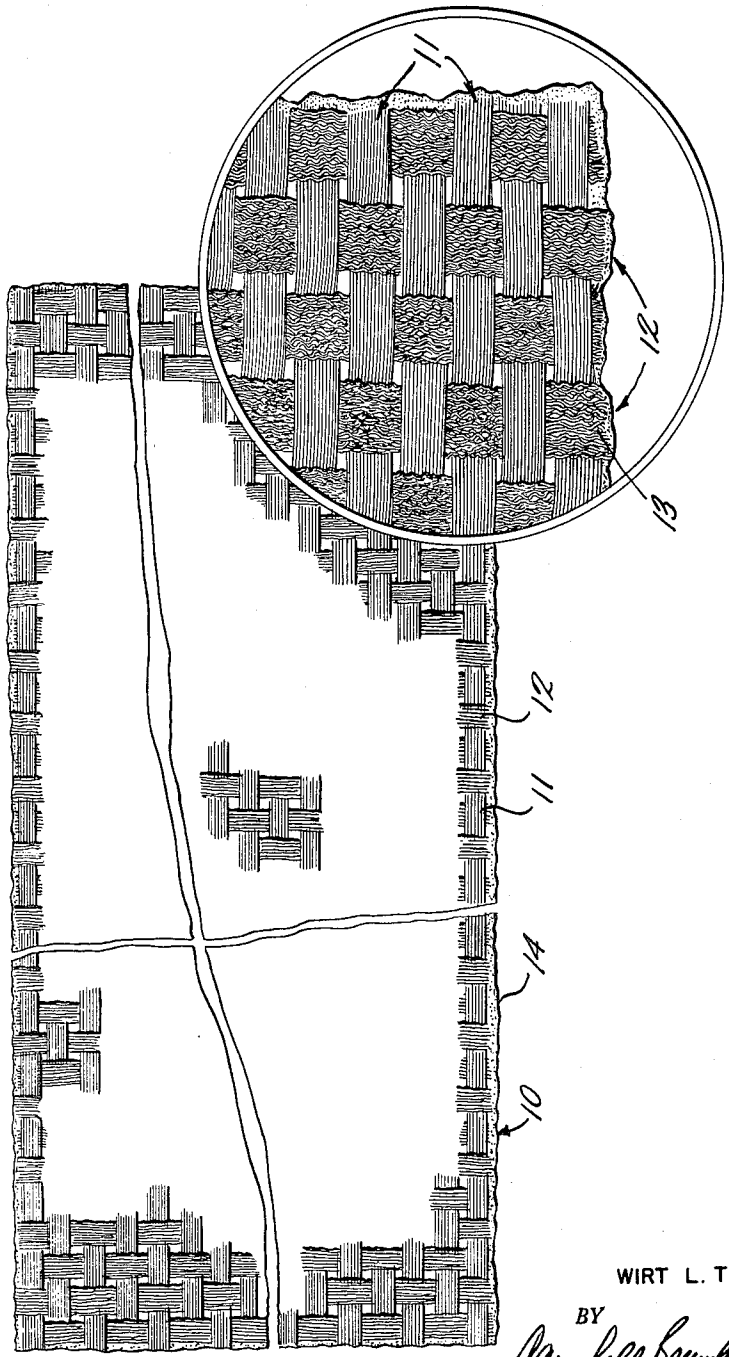
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INKED PRINTING RIBBON FOR USE IN TYPEWRITERS OR THE LIKE AND METHOD OF MAKING THE SAME

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INKED PRINTING RIBBON FOR USE IN TYPEWRITERS OR THE LIKE AND METHOD OF MAKING THE SAME

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This invention relates generally to ink bearing ribbons for use in printing devices, particularly typewriters, adding machines or the like, and to methods of making the ribbons.

Many attempts have been made to improve the wearing, ink carrying and printing qualities of inked ribbons for printing devices. In general, it has been possible to improve one and sometimes two of those qualities only with an offsetting decrease in another quality. For example, the development of nylon yarns, which have extraordinarily good resistance to abrasion, soon resulted in the appearance on the market of inked printing ribbons of nylon. Expectedly, the result was a ribbon of exceptional wearing quality which could withstand many impacts of type characters from both manually-actuated and power-actuated equipment. Also, the characters tended to be relatively sharp and clear. There was, however, a considerable loss in the ink capacity of the ribbons and in their ability to print a satisfactorily large number of lines of requisite contrast. It is recognized in the art that relatively greater ink capacity in printing ribbons is achieved by using spun yarns of staple fibers, such as cotton, rather than continuous filament nylon, for example. However, not only does the use of spun yarns of staple fibers tend to result in fuzziness in the printed characters, but the yarns deteriorate rather quickly under the impact of the type characters, sometimes before the ink supply is exhausted. There is, it follows, no known inked printing ribbon which is fully satisfactory as to each of the three basic qualities of durability, useful ink capacity, and legibility of print.

The present invention has for one of its objects, therefore, to provide a new and improved ink carrying ribbon for use in printing devices.

Another object of the invention is to provide an inked ribbon which is durable, has a large, usable ink capacity and affords a clear, sharp print.

In accordance with the present invention, inked printing ribbons for use, for example, in typewriters or other business machines, can be made of highly abrasion-resistant yarns, such as continuous filament nylon, to achieve at least the expected durability, while at the same time having the ability to reproduce an unexpectedly large number of printed lines of good quality. The ribbon includes in its weave construction multi-filament yarns, the filaments of which are distorted to form cavities or pores therein. Preferably the filaments are distorted before weaving, imparting resilience, which can be both axial and torsional, to the yarns. The filaments of these yarns are thereby made capable of rearranging themselves to form a myriad of cavities or pores which expose surface areas of buried filaments. This effect can be augmented by storing energy in controlled amounts in the yarns before or during weaving and which, when released in the woven fabric, causes a redisposition of the filaments within the yarns to create cavities among the distorted filaments. Both the newly exposed filament surface areas and the cavities are

thought to contribute to the ink capacity of the finished fabric. The stresses imposed on the body of the fabric by this stored energy are, however, so controlled that they do not perceptibly distort the fabric surface, thereby preserving thinness and flatness in the fabric which, together with other factors, contribute to the clarity and sharpness of the "write." The finished fabric can be cut into the desired final form, such as ribbon form, and inked in accordance with conventional techniques to achieve the final product.

Representative embodiments of the invention are fully described below having reference where appropriate to the accompanying drawing which is a surface view in enlarged scale and somewhat diagrammatic in nature of a portion of a printing ribbon useful, for example, in typewriters or other business machines.

Referring to the drawing, the invention is illustrated as embodied in a printing ribbon **10** comprising a plain weave fabric woven initially in conventional loom width and including continuous filament warp yarns **11** of 40 denier, 34 filament, 7 turns of twist nylon on the order of 148 to the inch and continuous filament filler yarns **12** of 40 denier, 34 filament, 5 turns of twist nylon, 100 to the inch. The filaments of the yarns **12** are formed with permanent distortions **13** which can take the form of heat-set crimps imparted thereto, for example, by the methods described in U.S. Patents Nos. 2,575,838 and Re. 23,824, applying their teaching, however, to the multiple filament, continuous filament yarns of the present invention by treating the finished yarns rather than a slubbing of fibers. In one representative embodiment of the invention approximately 64 distortions or crimps per inch were imparted to the filaments.

These yarns, particularly when subjected to finishing treatment as described below, exhibit an axial and torsional resilience exceeding the resilience which the yarns would exhibit in the absence of the permanent distortion and cavities or pores can be made to appear therein. The yarns are preferably maintained in stressed condition against at least a portion of this imparted resilience during the weaving operation. Yarns treated in accordance with the disclosure of the above cited patents tend to maintain temporarily a relatively distortion-free configuration until the stored forces of distortion, which can be thought of as "memory," are released by further treatment.

The fabric is relaxed to release stored forces or stresses i.e. activate the "memory," as by immersion in a neutral soap solution at about 90° F. Preferably the fabric is dried without framing to allow the forces to adjust themselves in the fabric to best advantage. As a result, the filaments, particularly the pre-distorted filaments, will be so disposed in each yarn that a myriad of internal cavities or pores exist among the filaments and so that many previously buried and closely bound filaments will be exposed. The amount of energy stored in the filaments is so selected that when released, it will not distort the fabric surface, which should remain flat and smooth, but will rearrange the filaments in the yarns. For the most part, the energy storage factor must be arrived at empirically, being a function of such factors as the weight and type of yarn and of the weave construction. It will be understood that the tension forces imparted to the yarns during weaving can be used as a supplement to the forces locked in the yarns by the distortion treatment and that, depending on the nature of the particular distorting treatment used, the yarns can be made to exhibit useful cavity or pore effects without a relaxing or force-releasing treatment after weaving. Also, it will be understood that supplemental soluble coatings can be used on the distorted yarns to maintain the yarns in relatively dis-

tortion-free condition to facilitate weaving, the soluble coating being removed after weaving to help release the stored forces.

The fabric is scoured and otherwise prepared for inking as by cutting into widths suitable for the ribbons desired, with the distorted yarns 12 preferably running transversely of the ribbon. The selvages 14 of the ribbons can be formed by heat-sealing during the cutting operation, utilizing a heated cutter. The ribbon is then inked, preferably in accordance with conventional technique for inking nylon ribbon, allowing a period of curing during which the ink can find its way into the cavities among the distorted filaments to coat the filaments. As a result of the various treatments prior to inking, the finished product will have a fabric count of about 167 warp ends to the inch and about 100 filling ends to the inch, or a total count of about 267. Tests have shown that a filler count of the heat-set distorted filaments of from 95 to 110 per inch gives a satisfactory product. It will be appreciated, however, that there is some latitude possible in the count of the fabric prepared for inking, in the amount of yarns used and the type, all dependent upon the characteristics of the ultimate ribbon which is desired. For example, if a particularly heavy-duty ribbon is desired, the denier may be increased to 70. In the finished ribbon, the permanent distortions imparted to the weaving yarns appear as distortions in addition to the more or less sinusoidal distortions which are normally imparted by the weave, i.e., the wavey configuration of the yarns passing over and beneath successive traversing yarns.

It is also possible in accordance with the invention to distort the filaments of at least a portion of the multifilament yarns used in the weaving of the basic fabric by imparting a higher than normal twist to the finished yarn, heat-setting the twist, and then twisting in the opposite direction, all in accordance with the disclosure, for example, of U.S. Patent No. 2,564,245. Considerably less than the maximum possible twist is useful in the practice of the present invention. As in the embodiment of the invention described above, the distortion or twist is imparted in amounts so that when the yarns are stressed against the distortion for release after the weaving, the forces will be sufficient to rearrange the filaments of the yarns in the finished weave, but insufficient to distort the fabric surface. It will be understood that the high twist heat-set into the yarn causes it to contract into a relatively small space when free of all restraining forces. However, stresses in the form of tension and torsion can be maintained in the yarn during weaving, as by the application if necessary of a soluble coating which at least partially prevents contraction, or by tension on the yarns during weaving, or both. In this fashion, controlled amounts of energy are stored in the yarns in a manner similar to that described above. After weaving, the stored energy is released as by a relaxing treatment in which the fabric is immersed in a liquid such as warm soapy water, which, if a coating is used on the yarns, should also be a solvent for the coating, pursuant to which the distorted filaments in the yarns rearrange themselves to create the further cavities or pores and to expose buried filaments.

One of the advantages which has been found to be directly related to the use of the distorted filaments, through crimping or twisting, for example, has been the ink carrying capacity of the ribbon. This characteristic is a factor, therefore, to be considered in determining the amount of the distorted filament yarns to be utilized in the weave. As described above, the yarns are used in the filling. Under some circumstances, however, they can be used also in the warp. There are several factors involved and related to the increased ink carrying capacity of the ribbons formed in accordance with the present invention, one being that, in addition to carrying more ink, the ribbon in use appears to have the property of metering the ink to the paper as a result of the impact of the type characters in such a fashion that it has been found to produce about twice as many printed lines as the conventional nylon ribbons and of sharper quality. Also, the ribbons formed in accordance with the present invention appear to absorb the impact of the type in such a manner that cut-through is resisted for a longer interval. Moreover, the ribbon has less tendency to bag and, after severe use, fold over upon itself.

While nylon is found to provide the most desirable form of distorted yarn for the practice of my invention, other continuous filament yarns can be used in a distorted form such, for example, as Dacron. Also, for certain purposes, spun yarns of non-continuous filaments can be used in part, although in general, it is preferred to maintain the finished ribbon as thin as possible by using continuous filament yarns, which not only tend to be free of fuzziness detrimental to the forming of sharp characters but which have less tendency to clog the type characters. Also, it has been found that the use of continuous multifilament yarns in both directions in the weave, that is both warp and filling, but with the yarns which extend crosswise of the finished ribbon being of the predistorted type and the yarns which extend lengthwise of the ribbon being free of the distortions, affords a highly satisfactory printing ribbon for general use. The use of pre-distorted yarns predominantly crosswise of the ribbon imparts high ink capacity to the ribbon while the use of distortion-free yarns longitudinally imparts strength and durability to the ribbon without imparting abnormally high stretch factors which could result in undesirable effects, particularly in inked ribbons which are operated under various tensions. Of course it will be understood that a portion of the longitudinally disposed yarns could be of the distorted type without seriously impairing the ability of the ribbon to withstand tension.

It is to be understood, therefore, that the invention can take various forms and arrangements within the scope of the present invention, which should not be regarded as limited except as defined by the following claims.

I claim:

1. An inked ribbon for use in printing devices comprising interwoven warp and filling yarns, at least a portion of the yarn extending in at least one direction in the weave comprising multiple and continuous filament yarns having pre-set distortions therein in addition to the distortions normally imparted by the weave, and the filaments having pre-set distortions being in a condition of at least partial relaxation after having been woven with the filaments stressed in an amount sufficient to overcome at least partially the pre-set distortions whereby the filaments of the filling yarns become randomly laterally spearated to define cavities in the yarns and an ink medium in said cavities in said yarns and ribbon.

2. An inked ribbon for use in printing devices comprising interwoven warp and filling yarns, a majority of yarns running in at least one direction in the weave comprising a multiplicity of continuous filaments having permanent distortions in the form of heat-set crimps along the length thereof, said yarns being in that condition in the ribbon product which results from (*a*) weaving with axial stresses in the crimped yarns in an amount to diminish at least partially said crimps and (*b*) subsequently at least partially releasing said axial stresses whereby said crimped filaments of said crimped yarns are in randomly laterally spaced relationship providing a myriad of cavities throughout said yarns without producing pucker in the ribbon surface, and an ink medium within said cavities of said yarns and ribbon.

3. In a method of preparing an inked printing ribbon, the steps of weaving a fabric using at least in part multifilament yarns having permanent distortions therein while maintaining the yarns in a sufficiently stressed condition

to overcome said distortions at least in part, releasing said stresses in the fabric to cause the filaments of the multi-filament yarns to distribute themselves to form cavities thereamong, said stresses being insufficient to pucker the fabric surface, and applying ink to the fabric.

4. In a method of preparing an inked printing ribbon, the steps of permanently distorting the filaments of multi-filament continuous filament yarns to impart resilience thereto exceeding the normal resilience of the yarns, weaving a fabric comprised at least in part of said distorted filament yarns while maintaining the yarns in a stressed condition sufficient to overcome at least in part the resilience imparted thereto by the distortion and insufficient to pucker the surface of the finished fabric, relaxing the woven fabric to release the stresses to cause the distorted filaments to redistribute themselves in randomly spaced apart relationship forming cavities among the filaments and exposing the filament surfaces, and applying ink to the fabric to enter the cavities to coat the filaments.

5. An inked ribbon for use in printing devices comprising a fabric of interwoven warp and filling yarns made up of filaments, at least one of said yarns being formed of filaments with permanent pre-set distortions which have been temporarily partially diminished during weaving of the ribbon fabric, said filaments reacquiring at least partially said distortions after weaving to form randomly-spaced cavities within said yarns, and an ink medium within said randomly-spaced cavities and on the yarns in said ribbon.

6. An inked ribbon for use in printing devices comprising a fabric of interwoven warp and filling yarns made up of filaments, at least one of said yarns being formed of filaments with permanently crimped distortions which have been temporarily at least partially diminished during weaving of the ribbon fabric, said crimps at least partially returning upon release of the weaving stresses to form randomly-spaced cavities within said yarns, and an ink medium within said randomly-spaced cavities and on the yarns in said ribbon.

7. An inked ribbon for use in printing devices comprising interwoven warp and filling yarns, said yarns comprising a multiplicity of continuous filaments, the yarns extending crosswise of the ribbon including, predominately, filaments having a multiplicity of permanent pre-set distortions which have been temporarily partially overcome by the weaving stresses, said distortions at least partially returning to the filaments in said yarns after weaving forming randomly-spaced cavities within said yarns, at least a portion of the yarns extending longitudinally of the ribbon being free of said distortions, and an ink medium within said randomly-spaced cavities and on the yarns in said ribbon.

8. An inked printing ribbon as set forth in claim 7 wherein said yarns are formed of a proportion of nylon.

9. An inked ribbon for use in printing devices comprising interwoven warp and filling yarns, at least a portion of which are multi-filament yarns formed of continuous filaments, the filaments having permanent pre-set distortions temporarily partially diminished during the weaving of the ribbon fabric, said distortions at least partially returning to said filaments upon completion of the weaving to form randomly-spaced cavities within said yarn for producing a myriad of cavities in the yarn exposing the surfaces of the filaments in the yarn, and an ink medium within said ribbon.

10. An inked ribbon for use in printing devices comprising interwoven warp and filling yarns at least a portion of which are multi-filament yarns formed of continuous filaments, at least one of said yarns being formed of filaments with heat-set distortions which have been temporarily at least partially diminished by the weaving stresses, said heat-set distortions returning at least in part upon completion of the weaving to form randomly-spaced cavities within said yarns, and an ink medium within said randomly-spaced cavities and on the yarns in said ribbon.

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Disclaimer and Dedication

2,918,160.—*Wirt L. Thompson, Jr.*, Fairfield, Conn. INKED PRINTING RIBBON FOR USE IN TYPEWRITERS OR THE LIKE AND METHOD OF MAKING THE SAME. Patent dated Dec. 22, 1959. Disclaimer and dedication filed June 2, 1972, by the inventor.

Hereby disclaim and dedicate to the Public, all that portion of the term of said patent subsequent to Jan. 7, 1972.

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