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REGENERATED CELLULOSE INKING
MACHINE RIBBONWilliam W. McElrath, Roanoke, Va., assignor to
Cello-Rite Ribbon CorporationNo Drawing. Application November 1, 1935,
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19 Claims. (Cl. 197—172)

This invention relates to improvements in regenerated cellulose writing machine ribbons, particularly ribbons adapted to be inked and used on machines such as typewriters, bookkeeping machines, multigraphing, recording, adding and computing machines, and for the general purpose of an ink transfer means for recording or copying by impressions thereon. This application is a continuation in part of my application filed complete February 14, 1935, for improvements in Regenerated cellulose ribbons and the like, Serial No. 6,607.

Conventional ribbons as used for the above purpose are usually narrow strips of cloth, this cloth being woven either of cotton, or true silk, the cotton fibers being of a vegetable cellulose in origin, and those of the silk of animal and nitro-geneous cellulose. These strips or ribbons are impregnated or padded with ink-compounds and admixtures of chemicals, including amorphous carbon, some dyes, oils and other ingredients, depending upon the color of record desired.

In conventional typewriter or machine ribbon cloth and the like, the cellulose forming the base structure of the fibers is composed of vegetable or animal fibers as above pointed out, and the cloth properly impregnated with soluble ink-compounds, or other recording transfer agents. Microscopical examinations of these ribbons show a great number of epidermal scales and protruding broken portions or the up-turned ends of the fibers themselves; these protrusions of course increase the "covering-power" per unit weight of yarn for the woven cloth, and is advantageous from a textile standpoint; but this disruption is not beneficial in woven cloth intended for ribbon usage as it tends to hold open the yarn between adjacent filling and warp threads, thus creating minute openings or interstices in and between the threads forming the cloth proper. Observation seems to indicate that by these minute openings, more oxidation takes place than should, and this may account in part for poor absorption and rapid drying out of the ink-compounds, besides impairing the wearing qualities of the ribbon.

My invention relates to the usage of a regenerated cellulose yarn (commonly known as artificial silk) as the base material for the woven cloth, specifically those yarns known as multi-filament because of the large number of filaments in each strand making up the yarn. These yarns may be woven into a cloth which is very suitable for cutting and edging into different widths of ribbons for the various machines above mentioned, and is well adapted by its physical prop-

erties to be impregnated or padded with suitable ink-compounds as required for various operating and functioning conditions.

One object of this invention is to provide a regenerated cellulose inking machine ribbon which will produce "sharp-writing".

Another object of this invention is to provide a regenerated cellulose inking machine ribbon constructed in such sizes of yarns, and counts of cloth, as to give it the properties of great affinity, absorption, and capillary attraction for suitably copying and recording ink-compounds.

Another object of this invention is to provide a regenerated cellulose inking machine ribbon which will produce well-defined and uniform impressions for recording and copying.

A further object of this invention is to construct, from a regenerated cellulose yarn, writing and copying machine ribbons, comprising balanced and proportioned yarn sizes and thread counts in the cloth therefor, which will insure longer wearing qualities, and less drying-out of the ink-compounds.

A still further object of this invention is to construct machine ribbons of proper yarn sizes made of a regenerated cellulose, woven of suitable proportioned cloth counts, so as to permit the ribbon being made as thin as practical, consistent with proper strength and durability, for the purpose of adding flexibility to the ribbon, thereby insuring additional multi-copying from the original impression received from the machine type-element.

A further important object involved in this invention is to construct a machine ribbon of a regenerated cellulose yarn that is practically free from epidermal scales or protruding fibers liable to break off or be cut therefrom and which commingle with the ink-compounds and fill the type or faces with deposits that harden and cause the blurring of writing copy that is a usual defect of conventional ribbons.

Other objects and advantages pertaining to this invention are apparent to those familiar with the art to which it appertains.

In order to accomplish the above objects as set forth, I wish it to be specifically understood that I employ in the construction of the inking machine ribbon cloth, yarns of multi-filament construction and composed of a regenerated cellulose, as hereinafter described.

From a technical standpoint, the expression "artificial silk" is misleading in that the different processes produce quite different yarns with varied physical properties. The viscose, nitro-

cellulose and cupra-ammonium are all processes involving the regeneration of the cellulose compounds or solutions, whereas the cellulose acetate process is not the regeneration of the cellulose, but involves esterification of cellulose. This last mentioned process gives entirely different physical properties for its yarns, in that the strength is lower than that of the regenerated cellulose yarns listed, and the hygroscopicity is materially lower, making it unsuitable for my purpose.

It is important that the cloth for machine ribbons must possess great strength, this usually is taken between 70 lbs. per square inch to 100. It is also important that the yarn have a large number of fine filaments, and today we have commercial yarns with a multiplicity of filaments running down to 1 denier per filament, or even finer. This high filament count per thread is most important, as it makes a much softer cloth gives added flexibility as well as added capillary attraction for dyes in finishing, and is much stronger per square inch. These higher filament yarns are now termed "multi-filaments" in the trade, as mentioned above, and I wish it to be understood that in referring to the same herein those yarn threads are meant which have as a minimum 20 filaments to as many as 100, the weight being from .8 to 1.8 or more deniers per filament.

With the foregoing explanation of the conditions and requirements that I have found to obtain in the adaptation of artificial silk to inking machine ribbons or ink-transfer means, I now wish to impart my discovery to those familiar with the art, so that its value and commercial practicability will be apparent, based upon actual experimentation and practical consideration from observations in putting the invention into practice.

As stated herein there are three prevailing commercial processes employed today of the regenerated cellulose base for the manufacture of artificial silk yarns, however, I might also mention that there are several modifications of these processes which alter the cellulose compounds or cellulose solutions in such a way as to permit different physical characteristics of the yarns, and for special purposes these changes seem to be warranted. For example, and referring more particularly to the herein called viscose process; suppose this yarn has a strength of approximately 1.40 grams per denier when made from a cellulose solution of 8 per cent or cellulose base with 6 percent caustic soda, and precipitated with an acid bath containing 10 per cent sulphuric acid. It has been discovered that by changing the caustic soda to 5 per cent (calculated as NaOH) and increasing the acid bath concentration, as to 45 to 55 per cent sulphuric acid monohydrate, the increase in the strength of the yarn is brought up to approximately 4 to 6 grams per denier, this being much stronger than true silk. This process is known as the Lilienfeld and is classified in the regenerated cellulose processes. Therefore I wish it to be understood that such a process or modification thereof is within the scope of my invention, as long as the cellulose compounds or solutions are regenerated to make the yarns ink-absorbent and of sufficient strength.

Conventional inking machine ribbons heretofore have been made usually from cloth having certain thread counts per square inch, that is to say it may contain 150 threads in the warp, and 125 threads in the filling, the cloth count there-

fore being 275 threads, and these threads are designated in numbers or sizes as 60, 80, 100, etc., as known in the trade. The cloth itself has a thickness varying from .003" to .008" or even heavier, depending upon the duty expected of the ribbon. It is found that the thinner the ribbon the "sharper" the writing, but at the sacrifice of wearing qualities. It is important therefore that the yarn should be as strong as possible for the thinner ribbons.

In the preferred embodiment of my invention, I use yarns, made by the regenerated cellulose process, which are composed of multi-filaments having a minimum of 20 filaments per thread, and as many as 100 as a maximum, and construct machine ribbon cloth from sizes and counts of yarns within the following limits, or the nearest suitable commercial yarns:

Warp thread count.....	220-100	Filling thread count.....	180-100
Warp size (denier).....	25-100	Filling size (denier).....	30-120
Thread filaments.....	20-90	Thread filaments.....	20-120

From the yarn sizes and cloth counts given above I am able to construct machine ribbon cloth from cloth counts of 200 to 400 threads to the square inch, and varying in thickness from .002" to .010" or some heavier if desired, and this specifically is new in the art and forms a part of my invention.

As a specific example of a cloth suitable for my inking machine ribbons the yarn sizes and cloth counts may be constructed as follows:

Warp thread count.....	100	Filling thread count.....	140
Warp size (denier).....	40	Filling size (denier).....	50
Thread filaments.....	30	Thread filaments.....	35

Thus the count of the cloth is 300 threads or 9840 filaments to the square inch, and the thickness of this cloth when finished and ready for the ink-compounds will be about .004". This cloth being closely woven from multi-filament yarns made by the regenerated cellulose process, the product is a very ink absorbent flexible cloth, particularly adapted for inking machine ribbons, and its actual "bursting" strength is approximately 130 lbs. per square inch (Mullen test). This ribbon has good capillary attraction and takes the ink-compound well, and gives very "sharp-writing" which therefore permits additional multi-copying over conventional non-flexible, heavy stiff ribbons.

For heavy duty machine ribbons, such as adding and bookkeeping machines, a coarser filament and thicker ribbon is preferable, the fine filaments not having sufficient strength to make a durable ribbon for this severe service. I have found the following construction satisfactory for such heavy duty ribbons where sharp impressions are not essential:

Warp thread count.....	100-150	Filling thread count.....	100-140
Warp size (denier).....	65-100	Filling size (denier).....	75-110
Thread filaments.....	20-30	Thread filaments.....	20-35

As a specific example the warp and filling were both made of 100 denier yarns having 20 filaments, there being 110 such yarns in the warp and 110 yarns in the filling, making 210 threads per square inch containing a total of 4400 filaments of 5 deniers each. Such a ribbon may have a thickness of from .007" to .010", and will take up sufficient ink to compare favorably with the best cotton ribbons for durability.

It is seen from the above yarn sizes and cloth counts listed, that a large number or kinds of constructions of machine ribbon cloth are possible, and I do not wish to limit myself to any particular construction, other than the limits of practicability or suitability within the sizes and counts mentioned herein.

What I claim and desire to secure by Letters Patent is as follows:

1. An inking machine ribbon fabric composed of ink absorbent filaments spun from a regenerated cellulose, said filaments being of small size grouped in a plurality of multi-filament yarns having not less than 20 filaments each, adapted to be impregnated or padded with a soluble ink-compound for the purpose of recording and copying.
2. An inking machine ribbon composed of filaments spun from a regenerated cellulose, said ribbon comprising a plurality of multi-filament yarns having not less than 20 filaments each and impregnated or padded with ink-compounds for the purpose of recording and copying.
3. In an ink-transfer means, a textile fabric composed of an ink absorbent spun cellulose base, said fabric comprising a plurality of multi-filament yarns having not less than 20 filaments each, treated with ink-compounds for the purpose of recording and copying by impressions thereon.
4. In an ink-transfer means, a textile fabric composed of regenerated cellulose yarns having not less than 20 filaments each, said yarns having a breaking strength of 1.40 to 6 grams per denier, and treated with ink-compounds, whereby a large number of impressions may be made thereon to produce recording and copying.
5. In an ink-transfer means, a textile fabric composed of a regenerated cellulose yarn having not less than 30 filaments, said filaments having an individual filament size between .8 and 1.8 deniers, and treated with ink-compounds, whereby impressions thereon produce recording and copying.
6. An inking machine ribbon for recording and copying, composed of a regenerated cellulose, and comprising a multiplicity of multi-filament yarns, said yarns having not less than 30 filaments per thread, said ribbon being treated with ink-compounds and adapted to receive impressions thereon.
7. An inking machine ribbon cloth for recording and copying, composed of a regenerated cellulose, and comprising a multiplicity of multi-filament yarns, said cloth having not less than 250 thread counts per square inch, and said yarns not less than 30 filaments per yarn thread, said cloth being treated with ink-compounds and adapted to receive impressions thereon.
8. An inking machine ribbon cloth for recording and copying purposes, composed of a regenerated cellulose, and comprising a multiplicity of multi-filament yarns having not less than thirty filaments, said filaments having an individual yarn size between .8 and 1.8 deniers.
9. An inking machine ribbon cloth for recording and copying purposes, composed of a regenerated cellulose, and comprising a multiplicity of multi-filament yarns having not less than thirty filaments each, said yarns having a breaking strength between 1.40 to 6 grams per denier.
10. An inking machine ribbon cloth for recording and copying purposes, comprising a multiplicity of multi-filament yarns, having not less than thirty filaments each, and composed of regenerated cellulose, said cloth having not less than 250 thread counts per square inch as a minimum.
11. An inking machine ribbon composed of a woven fabric having the yarns in its warp and filling comprising not less than thirty filaments each and formed of ink absorbent synthetic material, such as regenerated cellulose, impregnated with ink compound suitable for record or copying purposes.
12. An inking machine ribbon composed of a woven fabric having the yarns in its warp and filling comprising not less than thirty filaments each and formed of ink absorbent synthetic material, such as regenerated cellulose, woven with a total count of not less than 300 yarns to the square inch, and impregnated with ink compound suitable for record or copying purposes.
13. An inking machine ribbon composed of a woven fabric having the yarns in its warp and filling formed of ink absorbent synthetic material and comprising at least 9000 filaments to the square inch, each not over 1.8 deniers in weight, impregnated with ink compound suitable for record or copying purposes.
14. An inking machine ribbon fabric composed of closely woven regenerated cellulose yarns each having not less than twenty filaments of suitable sizes woven with a total count of not less than 4200 filaments to the inch, whereby the fabric is rendered ink absorbent and flexible.
15. An inking machine ribbon composed of a woven fabric having the yarns in its warp and filling comprising not less than twenty filaments each and formed of ink absorbent synthetic material, such as regenerated cellulose, woven with a total count of not less than 210 yarns to the square inch, and impregnated with ink compound suitable for record or copying purposes.
16. An inking machine ribbon fabric composed of yarns made of synthetic material, such as regenerated cellulose, having a multiplicity of filaments, for example over 4200 filaments per square inch, said filaments being of small size and substantial strength, for example, over 1.4 grams per denier breaking strength, whereby the fabric is rendered ink absorptive and durable.
17. An inking machine ribbon fabric composed of closely woven multi-filament regenerated cellulose yarns providing a uniform and strong ribbon having not less than 9000 filaments per square inch of not more than 1.8 denier per filament in weight and over 1.4 grams per denier breaking strength, whereby the fabric is rendered ink absorptive and flexible.
18. An inking machine ribbon composed of a woven fabric having the yarn in its warp and filling formed of ink absorbent synthetic material and comprising a count not less than 220 yarns per square inch, said yarns having a breaking strength not less than 1.4 grams per denier.
19. An inking machine ribbon composed of a woven fabric having the yarns of its warp and filling formed of ink absorbent synthetic material, such as regenerated cellulose, composed of at least 9000 filaments to the square inch, and woven with a total count of as much as 300 yarns to the square inch.

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