This invention relates to the preparation of artificial yarns and particularly yarns made of or containing organic derivatives of cellulose such as cellulose acetate from solutions containing the same.

An object of our invention is to prepare yarns containing organic derivatives of cellulose, particularly cellulose acetate, which yarns are easily wetted by water, whereby fabrics made of the same may be readily scouried, dyed and/or given any other desired finishing treatment.

A further object of our invention is to prepare artificial yarns containing organic derivatives of cellulose such as cellulose acetate, which yarns may be subjected to further textile operations such as knitting or weaving without the addition of lubricants or with the addition of less lubricants than have heretofore been used.

A further object of our invention is to prepare artificial yarns containing organic derivatives of cellulose and particularly cellulose acetate, which yarns produce less snarling in textile operations and which do not break as readily in looms as prior artificial yarns of this type. Other objects of our invention will appear from the following detailed description.

In the preparation of artificial yarns from organic derivatives of cellulose such as cellulose acetate, the most generally used method involves the spinning of solutions of the same in a volatile solvent into an evaporative atmosphere, as in the dry spinning process, or into a precipitating bath as in the wet spinning process.

We have found the surprising fact that if a relatively non-volatile substance is added to the spinning solution containing the organic derivatives of cellulose, which substance is soluble in water or any other scouring agent, yarns produced from such solutions may be more readily wetted and are self lubricating so that the further use of lubricants in the subsequent textile operations is not generally required.

In accordance with our invention, we prepare a solution containing the organic derivatives of cellulose in a volatile solvent, to which solution is also added a relatively non-volatile substance which is miscible with the solution, and which may be readily removed from the yarn or the fabric formed from the yarn by scouring in water or any other suitable scouring agency.

The organic derivative of cellulose used for making the yarn may be any suitable esters or ethers of cellulose. Examples of organic esters of cellulose are cellulose acetate, cellulose formate, cellulose propionate and cellulose butyrate while examples of cellulose ethers are methyl cellulose, ethyl cellulose and benzy cellulose.

However, because of the superior results obtainable by its use, we prefer cellulose acetate which may or may not be soluble in acetone. Specifically we prefer to use an acetone soluble cellulose acetate having an acetyl value of 52.5% to 56% and preferably 54.5%, but this invention is not limited to the use of such cellulose acetate.

While we do not limit ourselves to a specific volatile solvent to be used in our process, we have found that the use of acetone as a solvent gives excellent results. The relatively non-volatile substance added to the spinning solution may be any suitable substance that is miscible with the volatile solvent used in preparing the spinning solution, and which is also compatible, that is capable of forming solutions, with the organic derivatives of cellulose to be used in preparing the yarn.

We have found that relatively non-volatile alcohols are eminently suited for this purpose. We have found particularly that glycols such as ethylene glycol or diethylene glycol give eminently satisfactory results. Likewise we have found that glycerol and diacetone alcohol are very useful in this process. Also substances containing the alcohol groups such as esters like monacetin produce useful results. Furthermore ethers of the relatively non-volatile alcohols such as the ethers of glycol or diethylene glycol, of which the monoethyl ether of ethylene glycol may be mentioned are suitable for use in this invention. The term "relatively non-volatile substances" as used in the specification and in the claims is intended to include substances whose boiling points are above 100° or 150° C., so that when a solution of the organic derivatives in a volatile solvent containing these substances is evaporated at a temperature which is sufficient to volatilize the volatile solvent, these substances remain largely unvolatilized, and are present in the yarn to impart the desirable properties hereinafter described.

The amount of relatively non-volatile substance that is soluble in water that is to be added to the spinning solution, may be varied within wide limits depending upon the nature of the substances used and the results required. Generally we have found that if the organic derivatives of cellulose are dissolved in solvent mixtures containing from 1 to 30% of the relatively non-volatile substance, excellent results are obtained. The temperature of the spinning may also be varied in accordance with the nature of the volatile solvent used, the
nature of the relatively non-volatile substances used, and the relative proportion of non-volatile substances to volatile solvent.

Yarns produced by the dry spinning of solutions of organic derivatives as above described, retain a large percentage of the relatively non-volatile substances added, and since these substances are soluble in water, the yarn or the fabric from which the yarn is formed may be readily wetted by water. This is of great advantage in the dyeing, scouring and other finishing treatments of the fabric, since it expedites these processes.

Moreover, since many of these relatively non-volatile substances are oleaginous and have relatively high viscosity and possess the other properties required of lubricants, the yarn made in accordance with our process is self lubricated and therefore further lubrication for textile operations such as winding, twisting, knitting and weaving is not absolutely required with these yarns. Moreover, these yarns produce less snarling when twisted and less breaking in the loom than prior yarns, which is obviously a great advantage.

Although the yarns are in accordance with our invention are weaker than prior yarns while they still contain the relatively non-volatile substances that have been added to the spinning solution, they are of sufficient strength to withstand the strains to which they are subjected in ordinary textile operations. Though the yarns are thoroughly scoured, which scouring may be done on the yarns prior to making them into fabric, but which is preferably done after they are formed into fabrics, the yarns have strength at least equal to that of yarns formed from solutions not containing these relatively non-volatile substances, and in many cases they are actually stronger.

In order further to illustrate our invention but without in any way limiting ourselves thereby, the following specific examples are given.

**Example I**

We take a cellulose acetate having an acetyl value of 54.5% and a viscosity of 20 (as determined on an Oswald Viscometer with a solution of 6 grams of cellulose acetate and 100 grams of acetone, the viscosity of glycerol being called 100). This cellulose acetate normally has a moisture content of 5% and may be used directly in our process. However, if desired, the cellulose acetate may be placed in a vacuum drier where it is dried at an elevated temperature under a vacuum of 25" of mercury (i.e., 5" of mercury absolute pressure) until its moisture content is reduced below 1%. The cellulose acetate is then dissolved in a mixture containing from 1 to 5% of diethylene glycol and from 99 to 95% of acetone, in amounts sufficient to form a solution containing essentially 25% of cellulose acetate. The solution is then filtered, and spun in a dry spinning machine wherein the solvent is evaporated off at a temperature of 55° to 65° C, the thread thus formed being gathered up and wound or reeled.

The yarn produced in this manner displays a remarkable increase in ability to be wetted by water. This is indicated by the fact that if a fabric made of this yarn is placed on the surface of water, it sinks in 15 seconds, whereas fabric made from yarn which has been formed from solutions not containing the diethylene glycol does not sink in water until after 60 seconds. This yarn is self lubricated and may be subjected to textile operations without further lubrication.

After the yarn is scoured in water to remove the diethylene glycol, which is present therein and then dried, the yarn shows an ability to regain moisture of about 8% of its weight as against about 5% of its weight for a yarn formed in accordance with the prior practices. When this yarn is highly twisted and made up into repre fabrics such as crepe marocain, the dyeing thereof is of level and otherwise satisfactory, a result which was not obtainable by the use of yarn made by prior processes.

**Example II**

The cellulose acetate thus described in Example I is dissolved in a solvent mixture containing 1 to 10% of diacetone alcohol and 99 to 90% of acetone respectively, and preferably a solvent mixture containing substantially 5% of diacetone alcohol and 95% of acetone. The concentration of the solution is such that preferably it contains about 25% of the cellulose acetate. The cellulose acetate and the solvent are mixed with thorough agitation for about 5 to 6 hours to obtain a sufficiently homogeneous solution. The solution is then filtered and spun in a dry spinning machine wherein the solvent is evaporated off at a temperature of 55° to 70° C, and preferably at such rate that 90 meters of filament or yarn are formed per minute. The thread or yarn thus formed is gathered up and wound or reeled. The yarn produced in this manner contains diacetone alcohol which has not evaporated off at the spinning temperature, and displays all the desirable characteristics of readiness to wetting, ease of dyeing and self lubricating properties as the yarn made in accordance with Example I. This yarn after washing in five changes of water at 40° C, has a dry tenacity of 1.4 grams per denier as against a tenacity of 1.3 for yarn prepared from solutions not containing the diacetone alcohol.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of this invention.

Having described our invention what we claim and desire to secure by Letters Patent is:

1. The method of producing yarns containing organic derivatives of cellulose which comprises spinning the organic derivatives of cellulose in a mixture containing a volatile solvent therefor and a relatively non-volatile polyhydric alcohol that is a non-solvent for the organic derivatives of cellulose and is soluble in water.

2. The method of producing yarns containing organic derivatives of cellulose which comprises dry spinning a solution of the organic derivatives of cellulose in a mixture containing a volatile solvent therefor and a relatively non-volatile polyhydric alcohol that is a non-solvent for the organic derivatives of cellulose and is soluble in water.

3. The method of producing yarns containing cellulose acetate which comprises dry spinning a solution of the cellulose acetate in a mixture containing a volatile solvent therefor and a relatively non-volatile polyhydric alcohol that is a non-solvent for the cellulose acetate and is soluble in water.

4. The method of producing yarns containing cellulose acetate comprising dry spinning a solution of the cellulose acetate in a mixture containing acetone and glycerol.

5. In a method of producing yarns containing cellulose acetate, the step of dry spinning a so-
lution of cellulose acetate in acetone which solution also contains a glycol.

6. In a method of producing yarns containing cellulose acetate, the step of dry spinning a solution of cellulose acetate in acetone which solution also contains diethylene glycol.

7. Yarn containing organic derivatives of cellulose and a relatively non-volatile polyhydric alcohol that is a non-solvent for the organic derivatives of cellulose and is soluble in water.

8. Yarn containing cellulose acetate and a relatively non-volatile polyhydric alcohol that is a non-solvent for the cellulose acetate and is soluble in water.

9. Yarn containing cellulose acetate and a glycol.

10. Yarn containing cellulose acetate and diethylene glycol.

11. The method of producing yarns containing organic derivatives of cellulose, which comprises spinning a solution of the organic derivative of cellulose in a medium containing a volatile solvent therefor and a proportion of from 1-30% of a relatively non-volatile polyhydric alcohol that is a non-solvent for the organic derivative of cellulose and is soluble in water.

12. The method of producing yarns containing cellulose acetate, which comprises dry-spinning a solution of cellulose acetate in a medium containing a volatile solvent therefor and a proportion of from 1-30% of a relatively non-volatile polyhydric alcohol that is a non-solvent for the cellulose acetate and is soluble in water.

13. The method of producing yarns containing cellulose acetate, comprising dry-spinning a solution of cellulose acetate in a medium containing acetone and a proportion of from 1-30% of a glycol.

14. The method of producing yarns containing cellulose acetate, comprising dry-spinning a solution of cellulose acetate in a medium containing acetone and a proportion of from 1-30% of diethylene glycol.

15. The method of producing yarns containing cellulose acetate, comprising dry-spinning a solution of cellulose acetate in a medium containing acetone and a proportion of from 1-30% of glycerol.