

UNITED STATES PATENT OFFICE

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PROCESS FOR INCREASING TENSILE
STRENGTH OF CELLULOSE AND PROD-
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5 Claims. (Cl. 8—20)

My invention relates to a process for improve-
ment in the properties, particularly the tensile
strength, of cellulose materials, such as cotton,
and to the product resulting from said process.

5 My invention consists in subjecting cellulose or
textiles of cellulose materials to artificially pro-
duced ultra-violet radiation under controlled
conditions effective to render the fibres of cellu-
lose of greater tensile strength than they possess
without this treatment.

10 It is commonly accepted that cellulose or textiles
of cellulose are subject to deterioration, usually
manifested as a loss in tensile strength, by the
action of natural agents such as sunlight, and
15 that the ultra-violet component of sunlight is
charged with the greatest disintegrating effect
(Johnson Textile Fabrics—page 309; Journal
Society of Dyers and Colourists, Vol. 33, 1917,
page 17; and Der Textilberichte 1924, page 745).
20 Ultra-violet radiation is charged with the develop-
ment or formation of oxycellulose which is a com-
pound similar to that produced by overbleaching
and which, by reason of its structureless, brittle
or friable properties, is lacking in strength and
25 hence reduces the tensile strength of the cellu-
lose.

In accordance with this invention, however,
cellulose is not only not weakened, but materially
increased in tensile strength by subsection to, or
30 treatment by, ultra-violet radiation under con-
trolled conditions. This increase in the tensile
strength properties is accomplished by exposure
of the fibres or fabric to intense ultra-violet radia-
tion of proper quantity and quality for a period
35 prior to the detectable formation of oxycellulose.
If the treatment is prolonged until oxycellulose
is detectable, the process of deterioration sets in
and the cellulose fibres are weakened instead of
being strengthened. With a 110-volt quartz mer-
40 cury vapor lamp, operating at maximum intensity,
about 70 volts, and suspended substantially six
inches from the fibres or fabric, the period of ex-
posure has been found to materially increase
tensile strength through a range of from eight-
45 tenths of a second to four and one-half seconds.
The period during which oxycellulose does not
form, or at least is not detectable, may extend as
long as fifteen or twenty minutes, depending upon
such factors as the texture and number of fibres,
50 the relative surface exposed and the intensity
and quality of ultra-violet radiation, but as the
length of time of exposure approaches the point
of formation of detectable oxycellulose, the de-
gree of increase in tensile strength becomes less.
55 Therefore, during this period prior to the forma-

tion of detectable oxycellulose, the maximum in-
crease in tensile strength of the cellulose deter-
mines the point at which to stop the treatment.
As an instance of the efficacy of this method of
increasing tensile strength of cellulose, cotton
60 fibres which have been given treatment equivalent
to that which they would receive as fabric in the
usual laundering process, have been increased in
tensile strength as much as 21.21% when exposed
for a period of eight-tenths of a second to the
65 ultra-violet radiation from a 110-volt quartz mer-
cury arc lamp at six inches distance from the
material.

During this period prior to the formation of
oxycellulose detectable by the known methods
70 of detection, a change in the cellulose takes
place which increases the tensile strength very
materially. I do not rest my invention upon any
theory as to what the character of the change
is, but tests indicate that by virtue of the ultra-
75 violet radiation the alkali soluble component of
cellulose, generally designated beta-cellulose, is
decreased by conversion into the alpha-cellulose
component which has the property of greater
tensile strength, and the additional alpha-cellu-
80 lose formed by this conversion contributes to the
total strength of the fibre.

This treatment of cellulose can be applied after
the cellulose is prepared into commercial fibres,
such as thread or cord, or woven into fabrics, and,
85 because of the fact that the exposure to ultra-
violet is relatively brief, the process does not
slow down or otherwise affect the production of
commercial material.

My invention is also applicable, for instance, 90
to the treatment of clothes in process of being
laundered in commercial laundries, for the reason
that the factors in the process can be arranged
to conform to standard laundry practice with re-
spect to the speed at which clothes are handled 95
in any of the steps or stages in the laundry opera-
tions.

I claim:

1. The process of imparting the property of 100
increased tensile strength to cellulose, which con-
sists in subjecting cellulose to the action of arti-
ficially produced ultra-violet radiation and con-
trolling the action thereof to prevent the forma-
tion of detectable oxycellulose in said cellulose.

2. The process of imparting the property of 105
increased tensile strength to cellulose, which con-
sists in subjecting the cellulose to the action of
artificially produced ultra-violet radiation of given
volume and intensity for a period of time and 110

stopping said action prior to the formation of detectable oxycellulose.

3. The herein described process which consists in strengthening cellulose fibre by exposing the cellulose to the action of ultra-violet radiation of given volume and intensity produced by a mercury vapor arc in quartz at a distance of substantially six inches from said arc and controlling the time of exposure to avoid the formation of detectable oxycellulose in said cellulose.

4. The herein described process which consists in strengthening cellulose fibre by exposing the cellulose for a period of time not in excess of fifteen minutes to the action of ultra-violet radiation such as produced by a mercury vapor

arc in quartz at a distance of substantially six inches from said arc, and of such volume and intensity as will not, during said period of exposure, form detectable oxycellulose.

5. The herein described process which consists in strengthening cellulose fibre by exposing the cellulose to the action of ultra-violet radiation such as produced by a mercury vapor arc in quartz at a distance of substantially six inches from said arc for substantially eight-tenths of a second, and of such volume and intensity as will not form detectable oxycellulose during said period of exposure.

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