This invention relates to the manufacture of paper and the treatment thereof, and with regard
to its more specific features, treated paper which
is coated or surfaced.

One object of the invention is to provide a
flexible product. Another object of the invention
is to provide a paper which has high wet
strength. Another object of the invention is to
provide a paper particularly adaptable for use
as a flexible covering of high strength and abil-
ity to resist the action of water. Another ob-
ject of the invention is to provide a flexible prod-
uct which will not deteriorate rapidly with age.

Another object of the invention is to provide
a paper particularly suitable for hanging and
useful in the building trades. Another object of
the invention is to provide a paper particularly
suited for use as a covering for boxes, contain-
ers and the like. Another object of the inven-
tion is to provide a paper particularly suitable
for table covers and the like. Another object of
the invention is to provide a paper particularly
applicable to manufacture into artificial leather,
velveteen and the like. Another ob-
ject of the invention is to provide a paper hav-
ing some or all of the characteristics indicated
and in condition to receive a coating, for exam-
ple, of abrasive grain. Another object of the
invention is to provide a flexible base adaptable
to receive a finishing coating or coatings applied
to one or both sides and adapted to cooperate with
one or both coatings, for example, varnishes,
resins and lacquers.

Another object of the invention is to provide
a product for one or more of the uses set forth
above which is water-resistant. Another object
of the invention is to provide a product for one
or more of the uses set forth above which shall
resist cracking. Another object of the invention
is to provide a product of the character indi-
cated, in which the coating shall not readily peel
off the backing. Another object of the inven-
tion is to provide a process for the production of
paper of the type indicated, facilitating rapid
production thereof. Another object of the in-
vention is to provide a process of treating paper
which plasticizes the paper. Other objects of
the invention are to provide a simple, inexpensive
and safe process for the production of the prod-

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ucts specified and which can be readily controlled
in commercial use. Other objects will be in part
obvious or in part pointed out hereinafter.

The invention accordingly consists in the fea-
tures of construction, combinations of elements,
and arrangements of parts, and in the several
steps and relation and order of each of said steps
to one or more of the others thereof, all as
will be illustratively described herein, and the
scope of the application of which will be indic-
ated in the following claims.

In carrying out the invention I make use of any
known machine for the production of paper from
stock, for example, a Fourdriner machine or a
cylinder machine.

I have found that the correct preparation of
the base paper stock is important and as an
illustration of my process, detailed instruc-
tions will be given for the manufacture of 40 lb. paper.
The paper stock used may be rope, jute, chemic-
cal wood pulp, purified wood pulp, cotton or
various combinations of these and other suitable
fibres. By way of illustration a suitable furn-

ish may consist of 60% rope fibre suitably
cooked as is known in the art and 40% of a good
grade of kraft pulp. The furnish is introduced
into a beating engine and the paper stock is
beaten to the required degree. By variations in
the beating practice, the penetration of the oil,
varnish or other material described hereinafter
may be controlled. In some cases it is desirable
that there be considerable penetration of the
paper base by the oils or similar treating bodies
hereinafter described, while in other cases less
penetration is desired, and the oil applied serves
primarily to seal the surface pores.

The time of beating required will depend to a
considerable extent upon the pulp used and
its previous preparation and treatment. In
many cases pulp which has been beaten to about
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a Schopper-Riegler test of 30 degrees and jor-
daned to 60 degrees will be satisfactory. After
the paper pulp has been sufficiently beaten, it is
run through a Jordan to a Fourdriner paper
machine and the sheet is formed in the usual
way, dried in the usual way and taken down in
the form of rolls slit to any convenient width.
The paper so prepared may be treated with suit-
able oils as hereinafter described.

Instead of using paper as described and espe-
cially where a high wet strength is required in
the final product, the paper may be treated as
described in co-pending application, Serial No.
88,267 filed July 6, 1936. In this case the paper
stock is beaten to a Schopper-Riegler test of
about 30 degrees and the paper is formed, dried
and taken down as described. It may then be
treated on tub sizing equipment or similar paper
treating equipment with a 1% solution of viscose
as cellulose which has been pre-treated with
sufficient boric acid to practically neutralize the
alkalinity of the viscose solution. Ammonium carbonate may then be added in sufficient quantities such that the liberation of carbon dioxide on the dryers may tend to complete the regeneration of the cellulose, such completion of regeneration being subject to control through the amount of ammonium carbonate added.

In lieu of the foregoing treatment, viscose may be added in the beater but I have found that better results are usually obtained by adding the viscose to the paper after the web is formed. In some cases it is an advantage to add the viscose to the beater in that the fibres furnish may then be beaten to any required degree to produce the desired resistance to penetration by the treating oils subsequently applied. As another alternative, instead of adding the viscose as a separate operation after the paper has been removed from the paper machine, the viscose solution may be added after the paper has had only part of the water removed or during its passage through the drying cans by the customary arrangement for tub sizing on a paper making machine.

In lieu also in some cases treat the paper made, either with or without the wet strength treatment, with a water solution of sorbitol or of triethanolamine oleate to soften or plasticize the backing before the coating operation hereinafter described is carried out.

In lieu of viscose as just described, the paper web may be treated with a solution of glue and glycine to which has been added paraformaldehyde to tan the glue. The glycine serves as a plasticizer for the very brittle glue and also serves to soften the cellulose fibres. Instead of glycine, triethylene glycol may be used as a plasticizer for the glue, this material like glycine serving to plasticize both the cellulose backing and the glutinous adhesive. Instead of paraformaldehyde I may also use formaldehyde or hexamethylenetetramine or chrome alum to tan the glue.

In lieu of viscose or the glue-glycine treatment previously described, I may treat the paper web with a solution of hide glue, such as for instance a 10% solution of 62 milliposc hide glue and 20% sorbitol in water. In this case the application should be applied to the paper web at a temperature of about 125° to 150° F. The paper is then dried and may be treated with a water solution containing 10 to 15% formaldehyde to tan the glue. The paper is again dried and calendered. The sorbitol is less subject to changes in effectiveness with changes in the moisture content of the atmosphere and is further less volatile and more permanent than glycine or triethylene glycol. For this reason sorbitol is a preferred material for softening glue and for softening the cellulose sheet and fibres therein.

It will be apparent to those skilled in the art that many variations may be made in the process of forming the paper. Likewise, many variations may be made in the softening process and in the process of producing high wet strength.

I have discovered that certain oils which cure to a flexible jelly state have peculiar advantages for my purpose. While certain non-drying oils such as castor oil find some application in this invention, I prefer to use the semi-drying oils such as deyelled linseed oil or blown soyas bean oil. By deyelled linseed oil I mean an oil that has been produced by partially cracking a jelled linseed oil to destroy the firm lined oil jelly and produce instead thereof, a viscous but definitely fluid product. Such deyelled linseed oil, soyas bean oil and similar semi-drying oils, when dried or set, tend to form a very hard jelly but under ordinary conditions of drying or curing do not set up to give a final product which is as hard or tough as China-wood oil similarly cured, China-wood oil being definitely in the class of drying oils. It will be understood hereinafter and in other sections of this invention that various or other reactions which eventually result in a comparatively hard brittle film. Paper treated with a controlled quantity of the semi-drying oils is well adapted to cooperate with a variety of principles of treatment as hereinafter explained. The product formed is definitely more flexible than a product similarly made with drying oils and varnishes. While paper treated in accordance with this invention is generally less flexible than that described in co-pending application Serial No. 89,267 filed July 6, 1936, and formed by saturating paper with a water emulsion of semi-drying oils, for many purposes the product made in accordance with the present invention is satisfactory and cheaper. Generally speaking, the process of the present invention is more economical, especially in regard to the quantity of treating oils used.

While the emulsion and alternate processes described in the aforesaid application are usually carried out with porous papers known as saturating papers, the present process may be and often is carried out with less porous papers, and may be used to advantage with papers that are relatively resistant to oil penetration, as for example, as presize and backsize coating treatments.

As an illustration, the treatment of 40 lb. paper will be described in detail. Lighter or heavier papers may, however, be used according to the product desired. The porosity of the paper may vary within limits determined by the product intended, as for instance, the extent of penetration of oil required.

From considerations of both economy and quality of the product, I often find it advisable to add to the paper, oil treatment to the extent of from about 20 to about 50% of the base paper weight. A preferred oil is heavy blown soya bean oil. A suitable viscosity for the soya bean oil used by way of illustration is from about 18 poises to about 40 poises at 140° F. For the quantity of oil that will be incorporated in this illustration, the base paper stock before treatment may have an air resistance of about 50 to about 90 as determined by the Gurley densimeter.

The oil may be applied by means of the usual tub sizing equipment but I find a double sizing machine such as is used in the waterproof sandpaper industry very satisfactory. The entire coating of the oil may be applied to one side of the paper and allowed to penetrate more or less into and through the paper. I usually prefer to add some oil to both sides of the paper as by means of a double size, applying about two-thirds of the oil to the cost side of the paper and one-third of the oil treatment to the back side of the paper. By the cost side of the paper I mean the side to which abrasive grains will be subsequently attached by the usual adhesive.

To render the heavy blown oil readilyetable, the viscosity is reduced by either heating or adding solvents such as Varnolene or by a combination of heating and solvents. A suitable temperature for the application of the oil or solution of the oil is about 140° F. A satisfactory
solution is 65% bean oil and 35% Varnolene. In this particular example about 30% of blown oil is added to the paper, the percentage being based upon the original weight of the paper stock.

After the oil is applied to the paper, the paper is passed to a drying room and festooned. It is held in the form of festoons and dried for a period of from about 4 to about 24 hours at a temperature of about 130° F. to 160° F. The paper is then taken down in the form of rolls and is ready for coating.

Treated paper prepared in accordance with the present invention may be coated with various coating materials to produce products for many applications. The treated paper may be used as a base for suitable coatings to produce a very satisfactory substitute for olicloth, floor coverings and other uses hereinbefore specified.

Suitable coatings may consist of:

(a) Mixtures of blown linseed oil, pigments and thinners to which driers may or may not be added.

(b) Mixtures of lacquers and suitable pigments as, for instance, the nitrocellulose lacquers containing plasticizers, gums, pigments and volatile thinners in suitable proportions.

(c) Many varnishes compounded with pigments. The varnishes may be essentially rosin-China-wood oil varnishes or they may consist of the oil modified glyptals or varnishes prepared from drying oils and the oil soluble phenol-aldehyde types of resins.

Prior to applying the pigmented coating I may apply a sizing coat of lacquer or varnish, compatible with the pigmented coating and the treated paper. After the pigmented coating is applied, I may apply a clear coat of lacquer or varnish over the pigmented undercoat.

A variety of coatings and methods of coating may be used either with or without pigments or other coloring matter. One advantage of my product for olicloth and floor covering and other like uses is the wet strength treatment added during the fabrication of the paper. In case of accidental wetting or wetting during washing of the coated surface, the wet strength treatment makes the paper more resistant to disintegration, tearing or breaking when wet.

As a backing for flexible waterproof sandpaper, such is described and particularly claimed in my co-pending application Serial No. 90,954 filed July 16, 1938.

Coatings may be applied to the treated paper prepared in accordance with this invention to produce many other useful articles, for example, certain types of artificial leather may be prepared by coating my treated paper.

In stating certain theories of the invention, it should be understood that such constitute the best explanation of the results achieved now known to me and the scope of the protection is not to be limited thereby.

It will thus be seen that there has been provided by this invention a method and an article in which the various objects hereinafore set forth together with many thoroughly practical advantages are successfully achieved. As various possible embodiments might be made of the mechanical features of the above invention and as the art herein described might be varied in various parts, all without departing from the scope of the invention, it is to be understood that all matter heretofore set forth is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. A flexible coated paper including a paper backing containing an agent adapted to impart wet strength to the sheet and an agent adapted to soften the sheet, containing semi-drying oil, said semi-drying oil being present to the extent of 20% to 50% of the base paper weight, and a surface coating selected from the group consisting of paints, lacquers, varnishes and resins, said composite article being durable and water resistant and not subject to cracking when bent, the bond between the surface coating and the treated base paper being of a nature to resist cracking and peeling when the article is subjected to flexing and bending in normal handling and use.

2. A flexible coated paper including a paper backing containing an agent adapted to impart wet strength to the sheet, containing semi-drying oil, said semi-drying oil being present to the extent of 20% to 50% of the base paper weight, and a surface coating selected from the group consisting of paints, lacquers, varnishes and resins, said composite article being durable and water resistant and not subject to cracking when bent, the bond between the surface coating and the treated base paper being of a nature to resist cracking and peeling when the article is subjected to flexing and bending in normal handling and use.

3. A flexible coated paper including a paper backing containing an agent adapted to soften the sheet, containing semi-drying oil, said semi-drying oil being present to the extent of 20% to 50% of the base paper weight, and a surface coating selected from the group consisting of paints, lacquers, varnishes and resins, said composite article being durable and water resistant and not subject to cracking when bent, the bond between the surface coating and the treated base paper being of a nature to resist cracking and peeling when the article is subjected to flexing and bending in normal handling and use.

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