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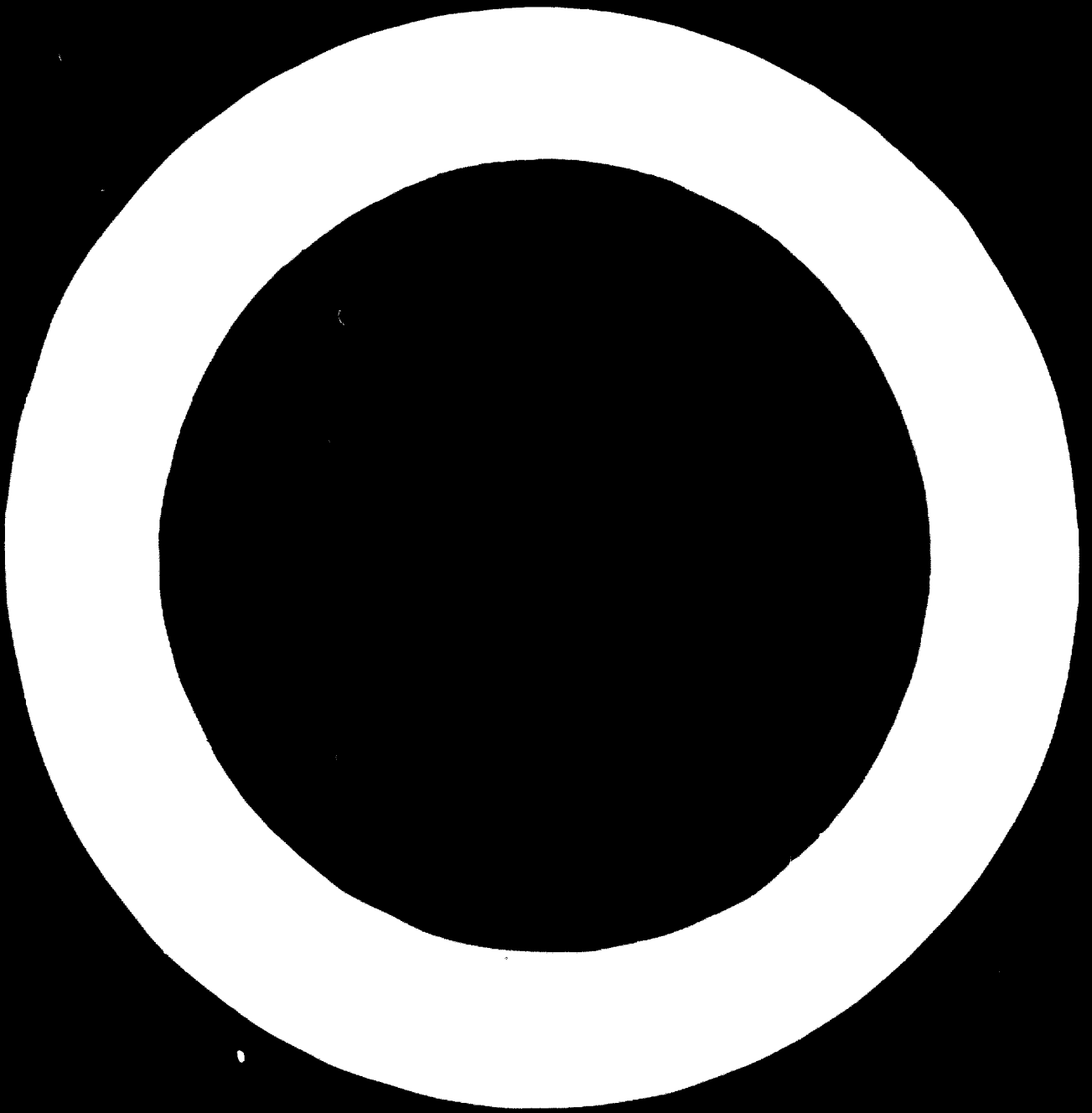
SYNTHETIC LEATHERS^{1/}

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SYNTHETIC LEATHERS

by

Gunna Södermann

The main qualities of the most used synthetic leathers are:

PVC-coated fabrics: In general the basecloth of these fabrics is a cotton cloth with different yarn counts, density and tying-up or different kinds of knitted fabrics, depending on usage.

The layer of coating is either so called compact or expanded.

PU-coated fabrics: In these fabrics the basecloth is always to some extent napped. The material is cotton or nylon. Both knitted fabrics and usual cloths are being used.

Then we have one group, namely foils, which are nowadays used quite seldom. The material is of PVC and the thickness of the foil is $\frac{1}{2}$ mm at the minimum. In general it is more, and then handling is not so pleasant. The tear strength is not the best possible, either. This is due to the fact that there is no basecloth in the foil. Therefore, these foils are used only for quite hard and very cheap chairs.

The most important group of the synthetic leathers today is PVC-coated fabrics. PU-fabrics are, however, very competitive and their usage continues to increase.

These two qualities are manufactured by coating a cloth with plastic paste, after which there comes a heating process.

You will get an idea of a spreading machine in the following picture.

So-called compact coatings are mainly manufactured with this method. In the last few years so-called "transfer" coating has become more general. In this method the topcoat of the end product is spread on a silicon treated special paper and dried in the heating oven. The basecoat is spread on the topcoat and afterwards the base cloth is laminated. This is followed by heat treatment in the oven, after which the end product is separated from the paper and both are separately wound.

In figure No. 2 you can see a scheme of this kind of machine which is called "tandem" machine. This method is used in the manufacture of the expanded PVC-fabrics and the greater part of the PU-coated fabrics.

In addition to this there are machines for printing, lacquering and embossing, which are used to make the product look more like leather. I want to point out that synthetic leathers are not a substitute for real leather but are to be accepted as complementary materials.

What then are the characteristics in these products which the upholstery industry must take into consideration? These characteristics can be divided into two groups: chemical and mechanical. The following facts must be examined in the first group:

Stability to light: This means that the colours must not change in the sunlight or the changes must be quite small. In the international scale the value 6 is good and the value 8, which is the maximum, is excellent.

There must not be any migration in the colour pigments: This means that pigment particles must not "pop up" to the surface. This migration is observed when wiping with a white cloth. The cloth becomes coloured.

Bronzing is also shown in the same way. Hereby the plastic surface has, as the name already suggests, a metallic, bronzed appearance. When the plastic is wiped with a wet cloth we can establish that pigment does not dissolve in water.

Synthetic leathers are resistant to most normal chemicals.

However, to those working in the furniture industry the effect of glues is of great interest. A previous lecturer has told you about glues in detail. Accordingly, I just want to mention the following facts:

After the wood glues have dried they do not affect synthetic leathers. When wet, glues with a high acidity or those containing strong solvents or sulphur can discolour synthetic leather. One of the most popular glues, polyvinylacetate dispersion, can even be used for gluing the synthetic leather itself onto wood without any risks.

PVC is sensitive to strong solvents, for instance, thinners and alike. Petrol or gasoline, fats and oils have a harmful effect on PVC. PU can resist chemicals much better.

Here in the Northern countries we have to pay special attention to cold flexibility. PVC becomes stiffer at lower temperatures and cracks at about - 40 C (= - 40 F). PU has much better cold flexibility.

In the warmer countries where the relative humidity of air is higher, the hydrolysis property must be taken into account.

The tests are carried out in a laboratory where the relative humidity is 10 % and the temperature + 70° C. These tests continue for seven days. Plastic must in no case crack. After the hydrolysis test, an abrasion test is made and gives after 3000 revolutions a result which shows that the surface has naturally changed and got a dull appearance, but the leather must not crack.

This test is carried out mainly according to the test method of Polyuretan-Gesellschaft Lemförde mbH & Co, 45 Osnabrück, Mellerstrasse 72-74.

As far as I know there are no international standards today.

So-called "fogging" appears in PVC-products which are used in car upholstery. Plasticizers evaporate in high temperatures (also here in the Northern countries the temperature in a car can be + 60° C when the car has been a long time in the sunshine) and condenses on the screen and windows. It is very difficult to remove this thin condensed film, which hampers visibility.

These are in principle the most important chemical characteristics of the PVC-fabrics and concern naturally the plastic itself. The basecloth must in some cases be impregnated to resist mildew and bacteria.

One of the mechanical characteristics is the feel associated with stiffness or flexibility. It is difficult to specify this further, but I am sure that you know what I mean. The material must feel nice and attractive. It must have the right softness. It is generally best to use harder leather for a harder chair and soft leather for a soft chair.

Normal PVC-leather does not let air through. Therefore, many persons feel that it is uncomfortable to sit a long time in a chair covered with PVC-material. Efforts have been made to avoid this impermeability, for instance by perforating the plastic or by mixing certain chemicals in the paste. These chemicals then dissolve in a later process and small pores and canals appear in the plastic. These are the so-called poromeric materials. In my opinion these efforts have not been very successful.

A better material is expanded PVC which means that the PVC is foamed and has a thin skin on top. When this top layer is perforated, we get a better and nicer material and it is much more comfortable to sit in a chair which is covered with this kind of leather. Further, in the expanded PVC-products the basecloth is mainly of knitted fabric which improves the feel of the product.

Among PU-materials there are some qualities which "breathe" and some which do not. You can make a test with a cigarette to verify this.

The test is very easy. Take your mouth full with smoke. Press the test piece tightly on your lips and blow. If the smoke comes through the test piece it shows that the piece is porous or perforated.

The tensile strength of synthetic leathers is very important. No standard values can be mentioned, because different kinds of chairs and couches require different strengths. Also the manner in which the material has been assembled has some effect. When talking about tensile strength, elongation is also taken into account. This is of importance when soft and semi-soft furniture have been covered with synthetic leathers. It is to be noticed that the bigger the elongation is, the smaller the patterns have to be when they are cut. The ideal is, of course, to obtain the same degree of stretch in both warp and weft direction. This is an ideal situation which seldom happens. If the elongation is right the leather can be nicely tightened over round edges. However, the elongation must not be too small or too large, as pleats then form.

In our factory elongation is specified as follows:

in warp direction	35 - 70 %
in weft "	50 - 100 %

The upholstery quality NV is the best. This fact is shown in table 1 (annex).

Plastic must, of course, have a good abrasion resistance. We are carrying out tests with the American Taber Abraser (Model 503) and have as a norm for the upholstery materials 3000 revolutions or more.

You will get more information of the equipment and the test from the manufacturer:

Taber Instruments, A Telenyde Company, North Tonawanda,
N.Y. 14120, U.S.A.

Finally I want to mention seam strength. It is usual that the leather is sewn first and then assembled. I am not aware of any norms but the furniture manufacturers have themselves made their trials. I recommend, however, that long stitches be used and the thread not pulled too hard.

A very detailed test of all the upholstery materials is made by Furniture Industry Research Association, Maxwell Road, Stevenage, Hertfordshire SG1 2EW, United Kingdom. Among other things, the following tests are made:

- Composition
- Construction/Thickness
- Tensile strength at break
- Extension " "
- Tear strength
- Seam strength
- Martindale resistance to wear
- " " " scuffing
- Flex cracking
- Coating adhesion
- Coating weight
- Tension set/Surface drag
- Colour fastness rubbing
- Colour fastness light
- Resistance to light degradation
- Thermoplasticity and resistance to solvents
- Hydrolysis

One question which is often asked is how are synthetic leathers best cleaned. The best and most simple way is to use water, soap or detergents and soft brush or cloth. If this cleaning is not successful then you can try to do it with alcohol. If this method does not help, then you had better turn to the manufacturer of the material for advice.

I have mentioned different types of plastic materials and want to point out some facts about different possibilities of where to use these materials:

Compact PVC can be used as upholstery material for very cheap furniture in public buildings, such as in hospitals, railway stations and so on. In Finland the percentage of this kind of compact PVC usage is only about 10.

Expanded PVC can be used for better furniture in public buildings and also for the furniture at home. The share of market is about 80 %.

The share of market of PU-materials is only about 10 %, but it will increase and since it is so much similar to leather, I think, that it will be a popular material for furniture at home in the near future.

Prices are changing much, but if we assume that the price for compact PVC is 1 then the price for expanded PVC could be about 1,5 - 2 and that for PU 2,5 - 3.

Property specifications of the base cloth and of the finished synthetic leather qualities which have been mentioned in the text.

Quality	HK 45	TK 60	L	NL	NV
Baselcloth yarn tex No./threads/cm			napped	napped	napped
warp	38/25	knitted	28/27	28/26	knitted
weft	38/24	cotton	52/31	52/21	nylon
weight g/m ²	210	135	250	185	125
width cm	135	140	145	130	145
Tensile strength warp/weft kp/5 cm	70/45	16/8	58/88	49/51	25/36
Elongation " " %	12/21	76/170	7/27	7/26	80/70
Tear strength " " kp	1,8/1,6	1,1/-	1,8/2,0	3,4/2,9	1,9/1,9
Coating	PVC comp.	PVC exp.	PVC	PVC	PVC
weight g/m ²	430	600	80	80-90	100
total thickness mm	0,7	1,1	0,85	1,2	0,7
Tensile strength warp/weft kp/5 cm	82/62	35/17	45/83	45/45	29/39
Elongation " " %	12/44	32/190	7/28	6,1/30	70/82
Tear strength " " kp	1,9/1,8	1,8/2,4	2,1/2,0	3,3/3,9	1,7/2,0
Cold flex. °C	- 42	- 33			
Abrasion revolutions	> 5000	> 8000	3000	7 0000	5000

HK 40, TK 60 etc. are names of the different upholstery materials manufactured by Oy Finlayson - Forssa Ab, Forssa, Finland. The base cloth is specified first in the table followed by the tensile strength, elongation and tear strength of the base cloth. Then comes the type of coating and the weight, and finally the thickness and properties of the end product.

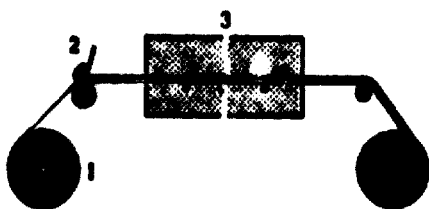


Fig.1 Spreading machine for "direct coating" : 1. base cloth; 2. spreading
3. heating oven

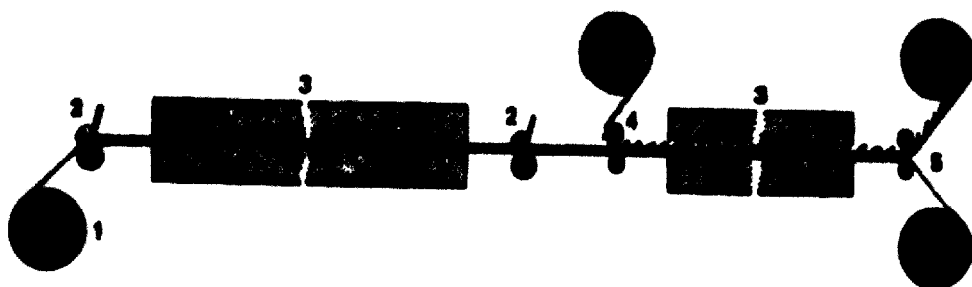
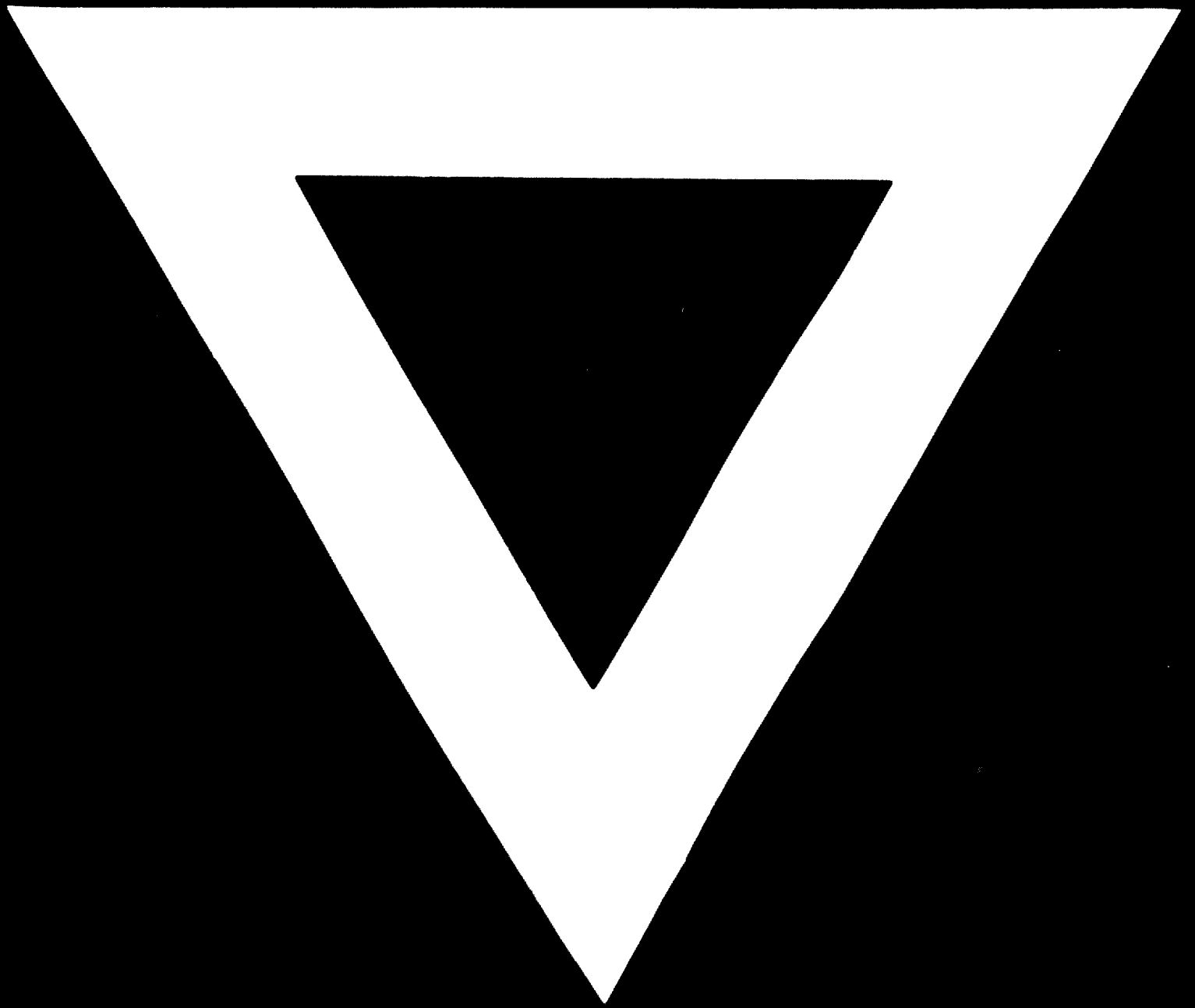


Fig.2 Tandem spreading machine for "transfer coating" : 1. paper;
2. spreading; 3. heating oven; 4. cloth lamination; 5. separation



Fig.3
Cigarette test





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