Brighter Bakelite

Saturday, February 27, 2016

Bakelite, or wood?

You may have seen them.

You may own them;

Those pieces that look like wood, but feel and even smell like Bakelite.

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About Me

Jesse Fowler

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Maybe you have heard that they are Bakelite treated to look like wood..

Well, I have done a lot of research into what exactly they are. The answer is.....

BOTH!

They are wood that has either been impregnated with Phenolic resinoid and laminated, or that has been just laminated with it.

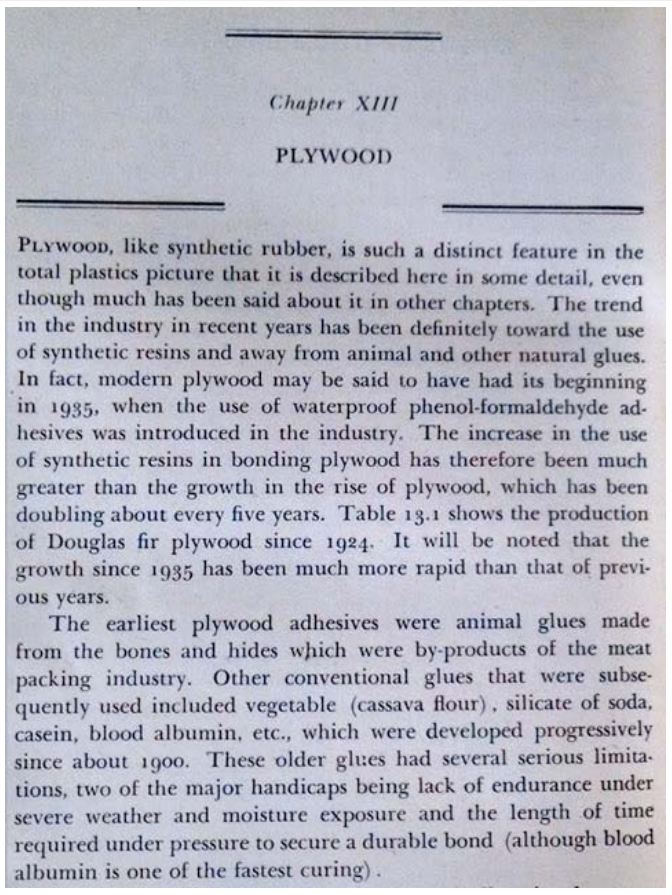
In a career in antique furniture reproduction and helping to build a wooden Yacht form the keel up, I had learned a lot about woods, and about treated woods. That sparked a curiosity about impregnated woods back in the early 1990s. I was fascinated with airplane propellers that were as hard and smooth as stone, and laminates that were smooth all the way through, even when cut.

At that time, I was interested in Bakelite, and had a few pieces, but never put the two together, per se.

With the woodworking experience, I knew how to research, and what to look for to get my answers about the collection of about 50 pieces of Wood/ Bakelite laminates I have.

If you have read about the history of Bakelite, you may remember that the first viable formula was wood soaked in the formula. Mr. Baekeland tried it because the first formula was too brittle.

I will let the books I have on the subject tell the story of Phenolic wood laminates. This information is comprised from books I own from 1939, 1941, 1942, 1945, 1946, and 1948, and will be in quotes.



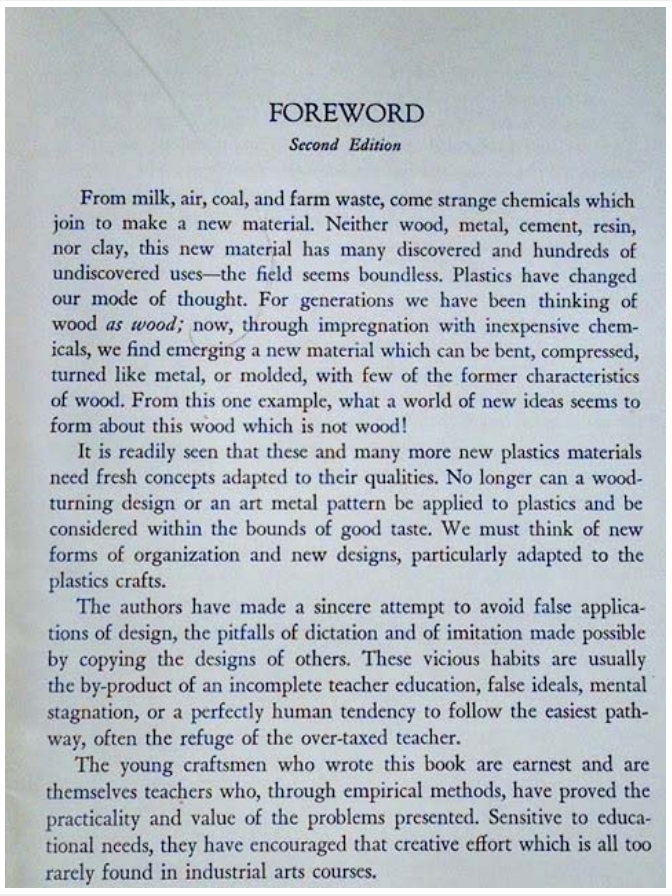
Chapter XIII

PLYWOOD

PLYWOOD, like synthetic rubber, is such a distinct feature in the total plastics picture that it is described here in some detail, even though much has been said about it in other chapters. The trend in the industry in recent years has been definitely toward the use of synthetic resins and away from animal and other natural glues. In fact, modern plywood may be said to have had its beginning in 1935, when the use of waterproof phenol-formaldehyde adhesives was introduced in the industry. The increase in the use of synthetic resins in bonding plywood has therefore been much greater than the growth in the rise of plywood, which has been doubling about every five years. Table 13.1 shows the production of Douglas fir plywood since 1924. It will be noted that the growth since 1935 has been much more rapid than that of previous years.

The earliest plywood adhesives were animal glues made from the bones and hides which were by-products of the meat packing industry. Other conventional glues that were subsequently used included vegetable (cassava flour), silicate of soda, casein, blood albumin, etc., which were developed progressively since about 1900. These older glues had several serious limitations, two of the major handicaps being lack of endurance under severe weather and moisture exposure and the length of time required under pressure to secure a durable bond (although blood albumin is one of the fastest curing).

Yeah.. they used to use BLOOD! Now, we can say that Phenolics are humane!



FOREWORD

Second Edition

From milk, air, coal, and farm waste, come strange chemicals which join to make a new material. Neither wood, metal, cement, resin, nor clay, this new material has many discovered and hundreds of undiscovered uses—the field seems boundless. Plastics have changed our mode of thought. For generations we have been thinking of wood *as wood;* now, through impregnation with inexpensive chemicals, we find emerging a new material which can be bent, compressed, turned like metal, or molded, with few of the former characteristics of wood. From this one example, what a world of new ideas seems to form about this wood which is not wood!

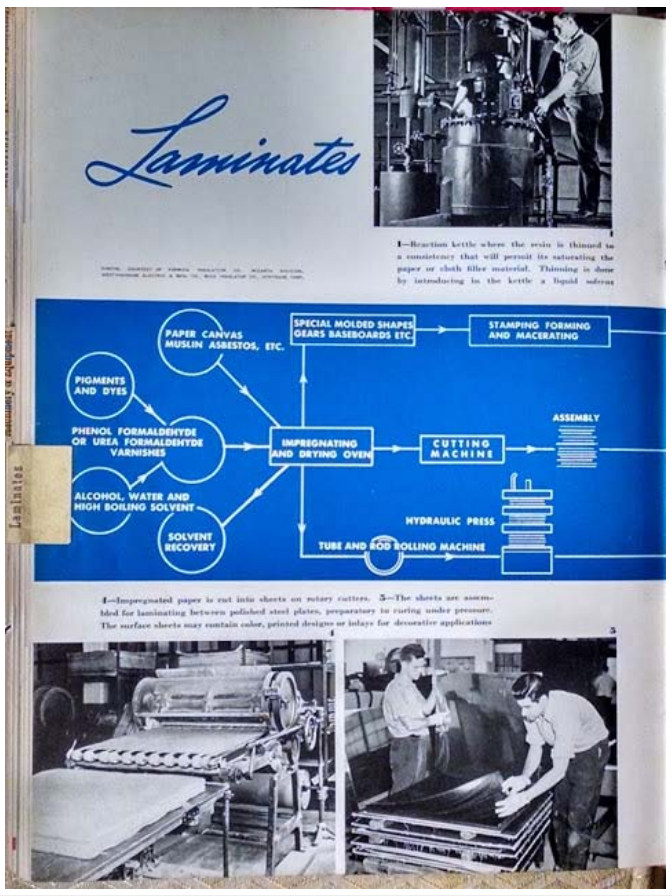
It is readily seen that these and many more new plastics materials need fresh concepts adapted to their qualities. No longer can a wood-turning design or an art metal pattern be applied to plastics and be considered within the bounds of good taste. We must think of new forms of organization and new designs, particularly adapted to the plastics crafts.

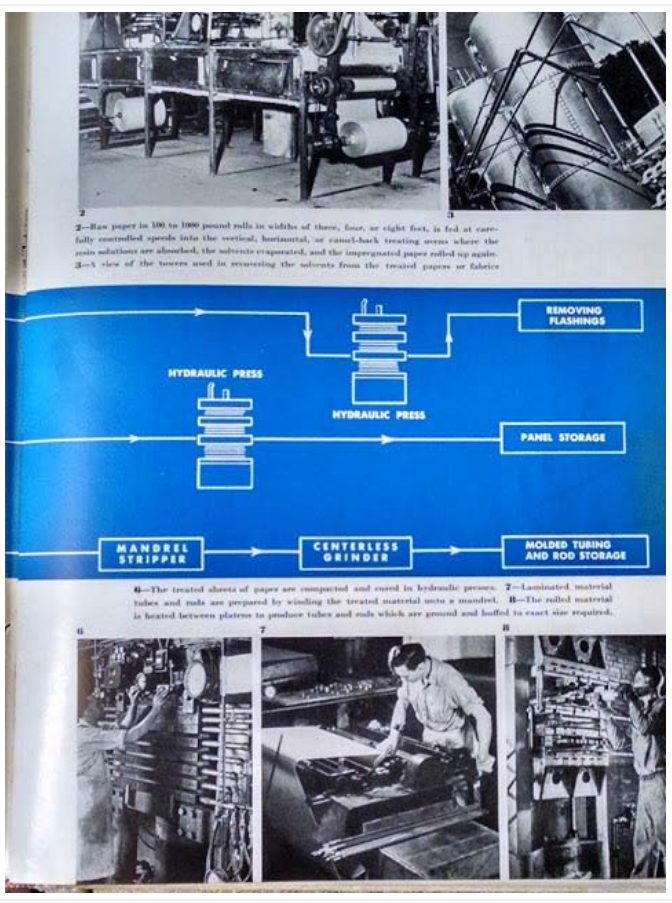
The authors have made a sincere attempt to avoid false applications of design, the pitfalls of dictation and of imitation made possible by copying the designs of others. These vicious habits are usually the by-product of an incomplete teacher education, false ideals, mental stagnation, or a perfectly human tendency to follow the easiest pathway, often the refuge of the over-taxed teacher.

The young craftsmen who wrote this book are earnest and are themselves teachers who, through empirical methods, have proved the practicality and value of the problems presented. Sensitive to educational needs, they have encouraged that creative effort which is all too rarely found in industrial arts courses.

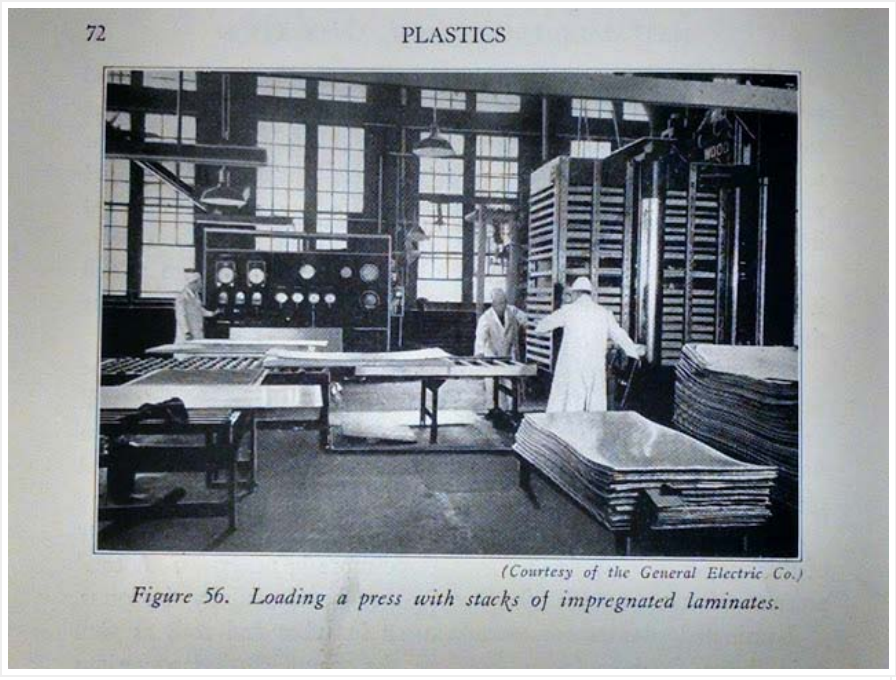
"Plywood is built up of layers or thin slices of wood called veneers, glued together with the grains alternating at right angles. The layers of this type of plywood generally separate when exposed to moisture.

The difference between a plastic laminate an an ordinary plywood is that the core material (wood veneers, paper, linen, etc..) is impregnated with resin so that this is continuous right through, not just a glue line. Several companies now manufacture a synthetic resin adhesive which is used in the bonding of plywood. The most common resin adhesives for bonding of plywood are the Phenol-Formaldehyde and the Urea-Formaldehyde adhesives.
In the manufacture of laminated sheets, the base layers are first saturated with a liquid resinoid, or they may be sprayed with a resinoid surface coating."

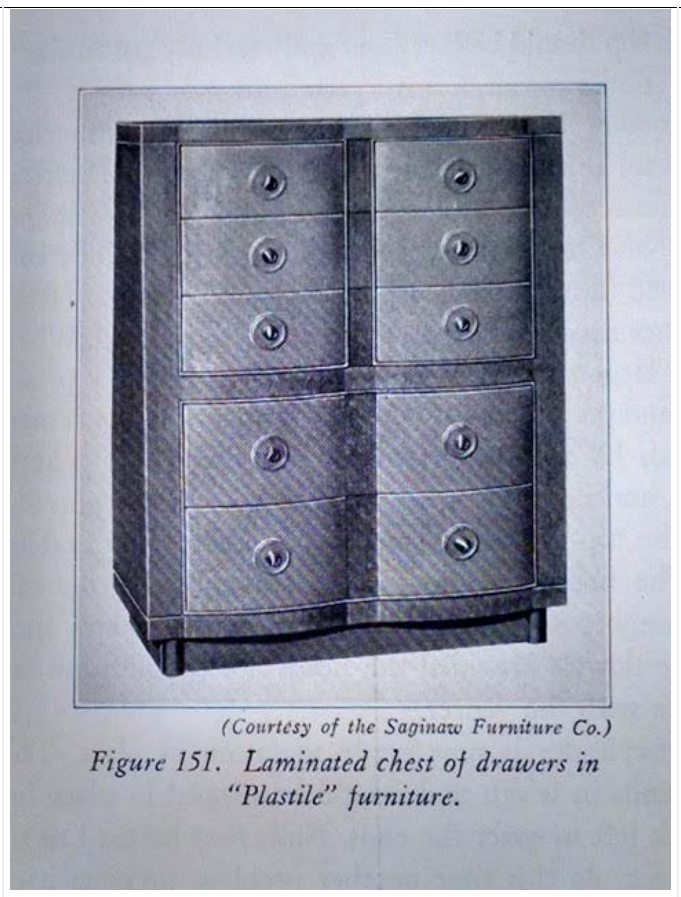




"Once the sheets have been impregnated, they are arranged in stacks of the necessary size to produce sheets of the desired thickness."



"Poplar, Birch, and Spruce, Avodire, Maple, Walnut veneers, low in natural resin content are being employed in the development of resin bonded structures. In some outside facings, Mahogany veneers are employed for hardness. Thickness


(Courtesy of the Saginaw Furniture Co.)
Figure 151. Laminated chest of drawers in "Plastile" furniture.

Dresser most likely finished in Mahogany.

of veneers range from 1/48" to 1/8". "

"Laminated Plastics is made from superimposed layers of fibrous or porous sheets coated or impregnated with resinoid and becomes a solid mass by the application of heat and pressure in a large hydraulic press. Up to 8X20 feet Heat is usually applied through steam platens on the top and bottom and top of the stack, but sometimes dielectric heat is used. A typical press may produce sheets 3' X 8' in size and a variety of thickness varying from 1/16" to 1" or more in thickness. A total pressure of over 5 million pounds may be exerted by the press. Laminated plastics forms have an advantage over the other plastic forms in that they receive the benefit of mechanical reinforcement from the laminations; then, too, they possess the insoluble and infusible properties of the resinoid binder. By varying the process of manufacture, a laminated sheet may have the appearance of the non plastic layer, (such as wood or canvas). They serve to broaden the scope of plastics in the styling of numerous machines and accessories. They are easily kept clean and maintain a permanence of finish that exceeds even the qualities of other surface coating materials.

In 1926, Dr. Goldschmidt developed the Tego process for manufacturing plywood articles. Practical commercial bonding of plywood with synthetic resins began with the introduction in this country (USA) of a Phenol- Formaldehyde resin in sheet form, first manufactured in this country in 1935 after several years of successful service abroad. In 1941, the Forest Products Laboratory of the U.S. Department of Agriculture, located at Madison Wisconsin, was given a million dollar grant for research on wood products. Net result: two new kinds of plywood material, impregnated wood, called Impreg, and compregnated wood, called Compreg. Impreg is plywood that has been given a bath in resin under pressure which forces the resin into the wood cells where it enters into a molecular alliance with the molecules themselves. Compreg is also given a bath under pressure, but the pressure is stepped up to 250 pounds per square inch. The American Compreg is made by applying the resin in the Phenol-alcohol stage of condensation and the smaller, more highly polar molecules penetrate into the cell walls of the wood. The result is substantially a new material- neither a plastic or a wood, but with the beauty of the wood's grain and texture, yet possessing the fire, heat, moisture, and bacterial-resisting virtues of a phenolic plastic."

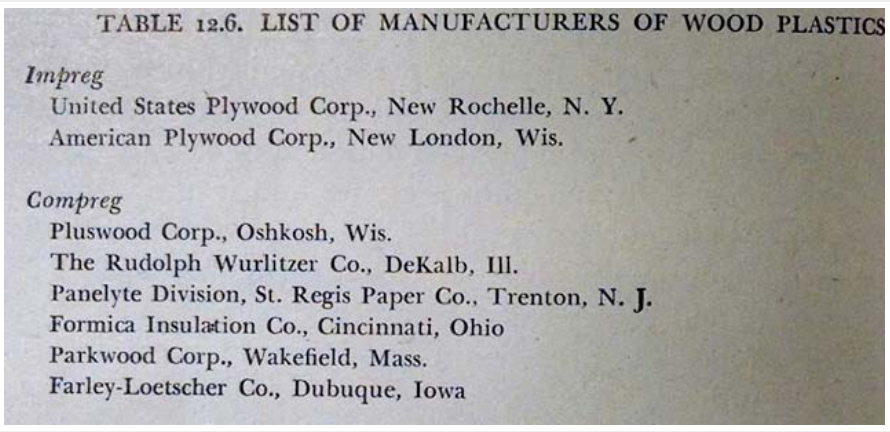


TABLE 12.6. LIST OF MANUFACTURERS OF WOOD PLASTICS

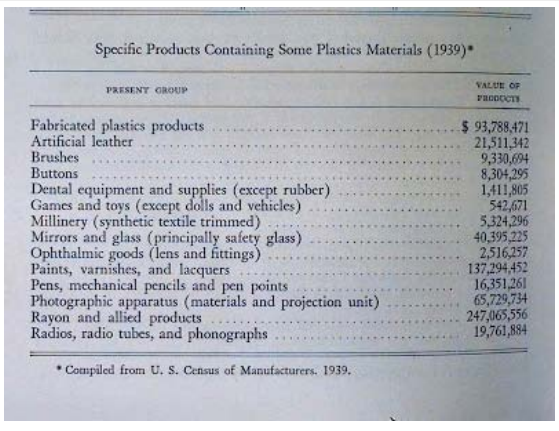
Impreg
United States Plywood Corp., New Rochelle, N. Y.
American Plywood Corp., New London, Wis.

Compreg
Pluswood Corp., Oshkosh, Wis.
The Rudolph Wurlitzer Co., DeKalb, Ill.
Panelyte Division, St. Regis Paper Co., Trenton, N. J.
Formica Insulation Co., Cincinnati, Ohio
Parkwood Corp., Wakefield, Mass.
Farley-Loetscher Co., Dubuque, Iowa

"Pregwood is another Formica developement with great possibilities. This is a product in which laminations of actual wood are impregnated with Phenolic resins and pressed into solid sheets. This tough material has also been used for Military skis. Phenolic plywood resins were turned out at an annual rate of about 36,000,000 pounds. This was used to make approximately 600,000,000 square feet of 3 ply material use in boats, hutments, decking, gliders, and power aircraft, etc..

One of the strongest plastics products is Pregwood, an impregnated wood. Pregwood has a tensile strength of 30,000lb. per sq. inch. Pregwood actually shows up better on this basis than chrome-molybdenum steel with 22,900, or Aluminum alloy, at 22,100."

"Production of all plastics materials in 1944, according to the War Production Board, was about 800,000,000 pounds. of this, over 400.000.000 pounds was in structural or rigid plastics. Resins for the paint, varnish, and lacquer industry; this is probably the largest single outlet for the plastics industry."


Specific Products Containing Some Plastics Materials (1939)*

PRESENT GROUP	VALUE OF PRODUCTS
Fabricated plastics products	$ 93,788,471
Artificial leather	21,511,342
Brushes	9,330,694
Buttons	8,304,295
Dental equipment and supplies (except rubber)	1,411,805
Games and toys (except dolls and vehicles)	542,671
Millinery (synthetic textile trimmed)	5,324,296
Mirrors and glass (principally safety glass)	40,395,225
Ophthalmic goods (lens and fittings)	2,516,257
Paints, varnishes, and lacquers	137,294,452
Pens, mechanical pencils and pen points	16,351,261
Photographic apparatus (materials and projection unit)	65,729,734
Rayon and allied products	247,065,556
Radios, radio tubes, and phonographs	19,761,884

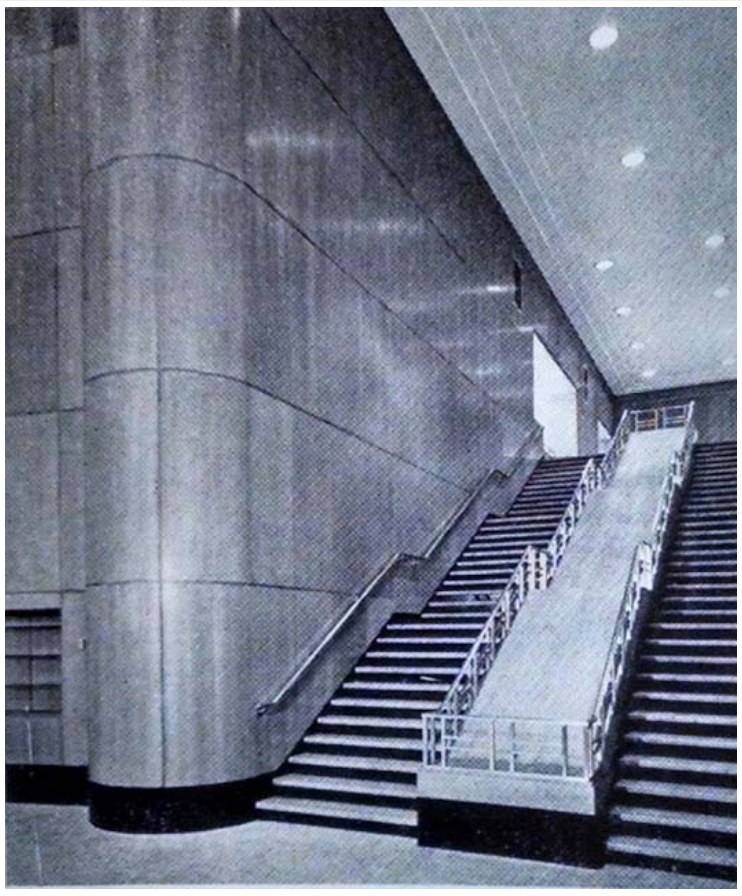
* Compiled from U. S. Census of Manufacturers. 1939.

More Phenolic plastics were made for this purpose than any other.

When polymerizing the laminate formulas, they are completely hardened. This is different than Jewelry grade Phenolics, which are not completely polymerized because they would be too brittle. Bakelite that has seen a lot of heat cracks and breaks easily. That is why a lot of flatware is split at the point where the metal shank was inserted.

The greatest probable use for resin-bonded plywood is for building construction, and it has found its place in the exteriors of houses, gasoline stations, farm buildings, store fronts, portable buildings of various types, trailers, garage type doors, water tanks, roofing, door fronts. It is playing an important part in the interior construction of refrigeration plants for walls, partitions, doors, etc.

Phenolic resin plywood, giving a water-proof bond and being practical for use in lighter sections or thicknesses than standard lumber, is used extensively in boat building. In concrete forms it is found economical because the large sections are easy to handle and it is practical for fairly long re-use. Resin-bonded plywood was used for gusset plates on the San Francisco bridge and for concrete forms on the Puget Sound Bridge near Tacoma, Washington. The forms were used fifteen times, submerged ninety-three days in salt water and remained intact and were still usable.



"Githeus-Kealy , architects, have used resin bonded wood panels as structural, decorative material in the new Brooklyn Central library. Bonding material by Resinous Products & Chemical Co. (Photo courtesy of American Plywood Corp.)" [1941]

"Complete house, inside and out, is constructed of Resnprest Durez bonded plywood. Note the smooth rounded surfaces"

"Of course, only thermoplastic materials have value as scrap, since they can be melted down, and used again, whereas the thermosetting materials have no further value after once being used. However, scrap materials will doubtless continue to be made and sold for technically unimportant parts or consumer goods. Like most processes, laminating is most economical when done on a large scale."

I believe that most of the laminated Phenolic jewelry was made from scrap, since it was never mentioned other than as a "novelty" in the many books I've read about phenolics.

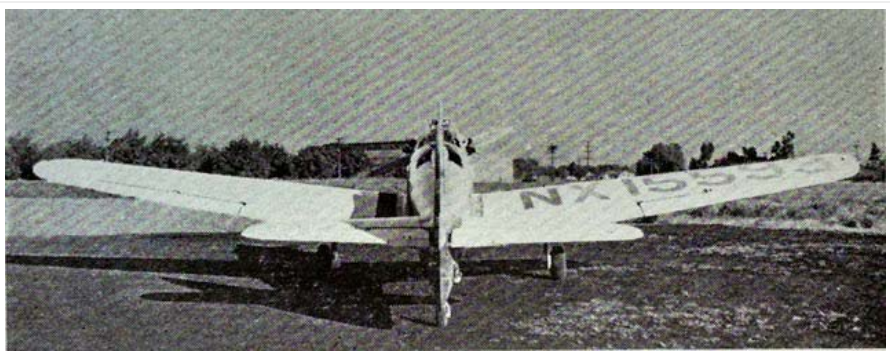
Belt made from Phenolic impregnated wood.

Earrings made from "Bakelite" impregnated, laminated wood.

Bakelite laminated Mahogany brooch.

Mid Century Modern Brooch of Phenolic laminated woods and Lucite.

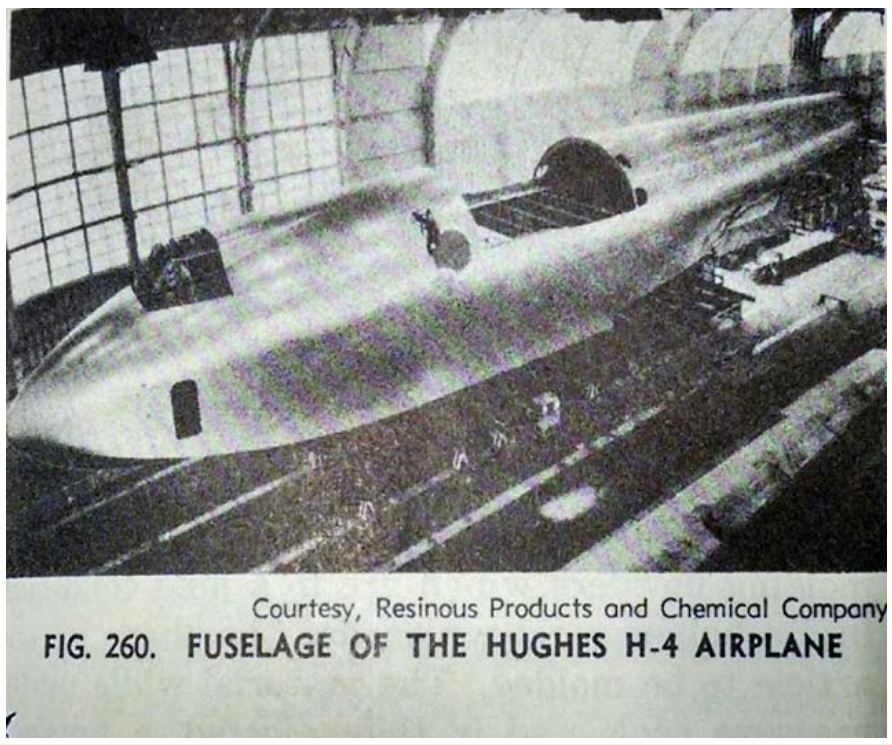
Many planes were made with Resin bonded wood, mostly Spruce. This is how the "Spruce Goose" got it's derisive nickname by the media, although it is made mostly of Birch.



Timm Aircraft training plane built of phenolic resinoid bonded plywood.

If someone in your family flew for the Military in WWII, they most likely had been in, or flew a Bakelite plane!

"One of the most unusual applications of the resin bonded plywood is in the construction of the Hughes H-4 airplane."



Courtesy, Resinous Products and Chemical Company

FIG. 260. FUSELAGE OF THE HUGHES H-4 AIRPLANE

Courtesy, Resinous Products and Chemical Company

FIG. 261. WING OF THE HUGHES H-4 AIRPLANE

The largest piece of Bakelite in the world!

I was extremely lucky to have been able to talk with one of the engineers that was in charge of the lamination of the Hughes H4 "Hercules" at the Evergreen Aviation Museum in McMinnville Oregon. I was dressed in all 1940s, suit, tie and hat, which usually makes it easier to talk with museum administrators. ;-)
You bet I rubbed and smelled the plane! Unfortunately, it didn't test positive because of the paint.
I did smell his sample piece of laminate that was bent in an L shape. He thought I was weird, and didn't really get what I was saying about jewelry and such made of Phenolics.

"Duramold is a composite material process developed by Virginius E. Clark. Birch plies are impregnated with phenolic resin, such as Haskelite and laminated together in a mould under heat (280°F) and pressure for use as a lightweight structural material. Similar to plywood, Duramold and other lightweight composite materials were considered critical during periods of material shortage in World War II, replacing scarce materials like aluminum alloys and steel." - Evergreen Aviation Youtube video of the H4.

As a side note; the Engineer I spoke to was the fourth person to know that this plane was going to fly. Howard Hughes didn't tell anyone so that there would be no chance of stopping him. As they were taxiing across the water, the engineer was in the tail of the plane with the operator of that section. At that time, they didn't have the technology to physically connect the cockpit controls all the way to the tail of the plane, so he had to radio a man and tell him how to move the rudder and elevators.
When he gave the signal to set the elevators at a certain angle, he turned to the engineer and said "Hang on. We are going to fly!".

It makes perfect sense that people saw the beauty in the scrap, just as they did with the overspray that built up from painting cars, and made jewelry from it.
I love my job, and enjoy digging up these little to unknown facts about Phenolic resiniod jewelry!

For more fine examples of these and other Bakelite jewelry check this out!

Thank you for reading and supporting my love of this material!

Posted by Jesse Fowler at 8:44 PM

Labels: bakelite, Bakelite and wood, Bakelite wood jewelry, phenolic laminates, polished bakelite, wood Bakelite, wood jewelry, wood laminate jewelry, wood laminates

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