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# USES AD INFINITUM

By J. M. SHULMAN

IN the story of the discovery of Bakelite it is related how the discoverer, Dr. L. H. Baekeland, having formed the elusive substance after a long and laborious search, counted up a total of forty-three industries where he thought it could be used. As is so often the case with a preliminary survey of this nature, this one of Dr. Baekeland's was ultra-conservative. Today it would be a real task to count forty-three industries in which Bakelite in one or more of its forms could not be used. So widespread is its use today and for such a multitude of purposes, that to follow it in all its forms into all the places where it has found and has yet to find service would be an endless journey.

First brought to light in a period of crying industrial need for something of its nature, when once discovered the applicability of Bakelite knew no bounds. It was quick to invade every field of science, manufacture, art, and commerce, and even now at this stage of its relatively brief period of existence there is much reason to believe that a large part of the "invasion" is yet to come. An investigation of almost any modern home, factory, office building, or transportation conveyance will reveal Bakelite serving some practical or ornamental purpose in a surprising number of places,

*Coffee Table with Top and Sides of Laminated Bakelite*



—Courtesy of The Bakelite Corp.

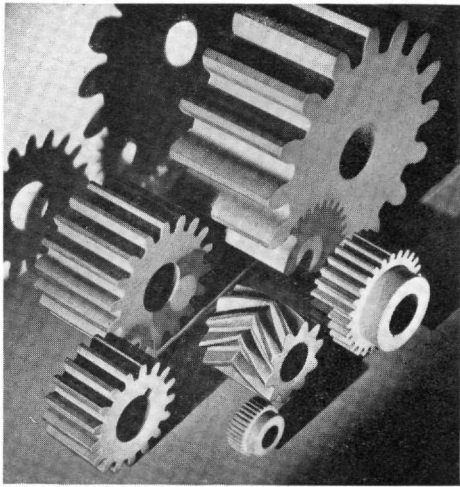
and what is even more significant, will reveal countless further places for its possible application.

In their primary state the original substances from which Bakelite materials are made are similar in some of their physical characteristics to natural resins. However, in most of their properties and in constitution there are distinct differences. For this reason the term "resinoid" has been adopted and is applied when referring to the basic constituent of all Bakelite materials. The industrial development of resinous materials constitutes one of the most noteworthy achievements of organic chemistry.

Bakelite products can be classified into a number of different forms, in each of which the desirable properties of the basic resinoid are modified or amplified to meet specialized requirements. The forms in most general use commercially are cast resinoids in transparent, translucent, and opaque effects; molded products; laminated products of which sheets, tubes, and rods are standard forms; and liquid products of the heat hardenable type—varnish, lacquer, enamel, and cement. The unique combination of desirable properties possessed by Bakelite materials shows in a striking way the reason for the versatility and the wide adaptability of Bakelite products. Molded materials are characterized by high heat resistance, hardness to any desired degree over a wide range, excellent dielectric properties, high tensile strength, chemical resistance, and lightness in weight. Laminated materials are hard, water resistant, heat resistant, chemically inert, and good in dielectric strength. Liquid products based on Bakelite provide an unusual degree of resistance to sunlight and weathering, moisture resistance, chemical resistance, retention of elasticity, and resistance to abrasion or chipping.

Bakelite molded products were early recognized by the electrical industry as the solution to many insulation problems. It is a significant fact and an interesting part of Bakelite's history that a prominent American manufacturer of electrical instruments was the first to install molded Bakelite in electrical mechanisms for commercial use, and that this manufacturer has used it ever since, for the most delicate apparatus. In the fields of electric power and communications Bakelite has assumed great importance, both in its constructional functions as panels, frames and bases, and as insulation material for the working parts. Its ability to hold its shape to extreme accuracy, its high grade insulating qualities, its finish, and its adaptability for precision molding make it preferable to hard rubber in almost all cases where the latter might be used.

Automobiles use molded Bakelite in dozens of



—Courtesy of The Bakelite Corp.

*Group of Bakelite Laminated Gears and Pinions*

places, particularly in the ignition system. Distributor heads, horn button and switch assemblies, ignition coil cases, spark plug covers, button starter cases, and insulation parts for switches and instruments all are made of Bakelite. One of the recent innovations in automobile accessories is a beautifully designed heater of Bakelite, somewhat radical in shape and appearance as compared with the older forms of heaters but entirely in harmony with the modern trend of streamline automobile styling. Mar-proof, rattle-proof, and rust-proof, the Bakelite heater is an attractive addition to the interior of a car, and the one-piece construction of the molded housing permits an actual saving in assembly costs.

Laminated Bakelite has broadened the application field of Bakelite by so great an amount that the list of services performed by the laminated material alone is almost endless. On the score of lightness and certain other advantages this material has replaced metal itself in many functions and has given service in a way which has often put metals to shame. Gears made of the laminated canvas product have demonstrated their ability to outlast brass, bronze, and cast iron with their own inherent strength, and furthermore to do the heavy work of these metals without the crashing racket which ordinarily accompanies the meshing of metal gears. Bakelite gears are used extensively in high speed drives. On motors ranging from a fractional horsepower to 100 horsepower pinions of Bakelite laminated serve to drive practically every type of industrial equipment including lathes, boring mills, planers, punch-presses, milling machines, crane bridge motors, shears, ball mills, and high pressure pumps. In automobiles they are found composing timing gear trains, and they have been found to provide what is probably the most efficient type of front end drive for the automobile.

For electrical purposes where greater mechanical

strength is required than that provided by molded Bakelite, the laminated form is ideally suited. In power stations this form is used in all types of circuit breakers and switches, insulating bushings, and as insulation for bus bars. In the latter capacity Bakelite tubing is slipped over connector end leads, thus saving tape-winding time and offering the additional advantage of being easily demountable when repairs are necessary. As a material for instrument panels it will not crack or chip when drilled or when subjected to sudden impact.

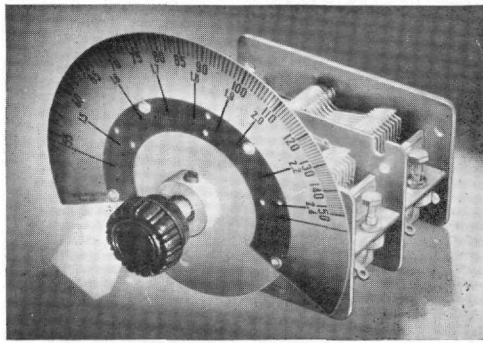
One of the more recent utilizations of laminated Bakelite is in the manufacture of furniture and interior decoration design patterns. In this field the material presents the invaluable advantages of being unaffected by alcohol and other solvents and unmarrable by lighted cigarettes. These features have led to its extensive use by manufacturers of bars, tables, desks, and other similar pieces of furniture, particularly where the furniture is subject to severe service as in restaurants and hotels. The pleasing and modernistic appearance of Bakelite furniture is a factor which is likely to make this application more and more important in the future.

The color, texture, and waterproof characteristics of laminated Bakelite make it ideally adaptable for wall surfaces in building construction and interior decorating. It has also been successfully used for doors, baseboards, kick plates, store fronts, picture molding, counters, and partitions between rooms. Its use as a veneer or surface sheet on metal, wood, fibre, and other products makes it possible to obtain an ex-

*Radio Cabinets*



—Courtesy of The Bakelite Corp.



—Courtesy of The Bakelite Corp.

### *Translucent Printed Radio Dial*

tremely durable surface, the attractiveness of which is not the least of its desirable qualities. The decorative effects possible by the combined use of highly polished inlays of different metals and the rich, lustrous finish of laminated Bakelite in a wide range of colors are limited only by the ingenuity of the designer.

That the midget household radio receiver is undoubtedly here to stay is evidenced by the ever-increasing number of small radio cabinets on the market. Many of the small sets sold today are housed in Bakelite cabinets of attractive colors. Whether or not the Bakelite cabinets are more pleasing than modernistic wooden cabinets is a matter of personal taste, but it cannot be denied that the small Bakelite radios are objects of beauty which go well with the interior styling of any room in the modern home.

Paints and varnishes based on Bakelite resins are responsible for a high degree of success in the present-day attack on the age-old problem of protecting surfaces. Time-honored materials have often proved inadequate in meeting the increasingly severe requirements demanded by industrial users of these products. The Bakelite resins, while not a complete solution to all surface protection problems, have nevertheless definitely established themselves as belonging in paints and varnishes just as surely as do any of the other materials, because their properties coincide so exactly with modern demands.

In the manufacture of modern grinding machinery Bakelite resinoids have provided a bonding material better than anything previously known. The superiority of Bakelite wheels was recognized immediately after they were first made available to industry, and since then their commercial importance has rapidly increased. The statement was made a number of years ago by a prominent manufacturer of abrasive wheels that "Probably one of the most important forward strides in the industry was the introduction of high-speed Bakelite bonded wheels." The high mechanical strength of Bakelite wheels permits extremely high grinding speeds along with corresponding increase in production efficiency where these wheels are used. In snagging castings and in rough grinding, wheels

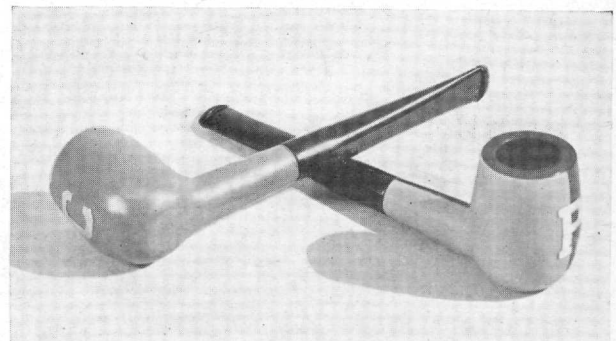
bonded with Bakelite resinoids can be operated at 9,500 surface feet per minute, whereas the wheels formerly used were ordinarily operated at 6,500 feet per minute. Bakelite cut-off wheels are operated at a surface speed of more than three miles a minute.

It is now recognized that the comparatively new high-speed wheels bonded with Bakelite resinoids are adapted to almost every type of grinding. Some of the more recent applications are their use in grinding valve stems, sharpening or "gumming" saws, forming and sharpening high-speed tools and cutters, making gears and cutlery, all types of disc grinding including the seats of coiled springs used in the "knee" action on motor cars, and coping and molding granite and marble. This is only a partial list and the uses are continually expanding.

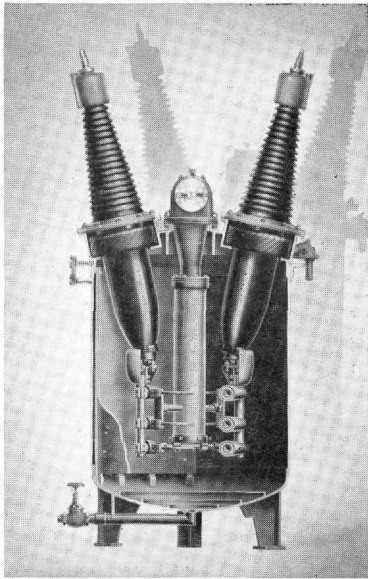
It is only natural that Bakelite, especially the laminated form, having the properties of high mechanical strength, light weight, and durability should find its way into aircraft construction. It has been found an ideal material for many parts of an airplane—cable pulleys, cable fair-leads, bearing spools for wingfitting attachment bolts, and shims for engine attachment bolts. Being relatively non-absorbent and capable of resisting corrosion, besides having a significant weight advantage, Bakelite is far superior to metal for pulleys and fair-leads. Because it is uninjured by gasoline or moisture it has been readily adopted for engine mount shims. Many of the newer passenger planes have Bakelite laminated sheet material for the interior paneling.

Some of the new uses constantly being found for Bakelite are so unusual and of such importance that they constitute a story in themselves. For example, there is the case of a certain railroad serving the mid-western and eastern United States, which constructed a roundhouse in a metropolitan area around which the city grew with unforeseen rapidity. In time the problem of smoke from the locomotives became a serious one. It was attempted to solve the problem by placing hoods over the smoke stacks of locomotives in the roundhouse so that the smoke could be drawn away by suction and forced through a smoke-washing tun-

### *Smokers' Pipes*



—Courtesy of The Bakelite Corp.



—Courtesy of The Bakelite Corp.

*Oil Circuit Breaker with Spindler and Expulsion Chamber Sleeves of Laminated Bakelite*

nel. Every material tried in constructing the tunnel was attacked by the sulfurous acid fumes emitted from the coal-burning locomotives' smoke stacks and lasted only a short time. A sample of Micarta, one manufacturer's trade name for laminated Bakelite, was placed in the tunnel and kept there for six months. When removed for inspection there was not the slightest sign of corrosion or any evidence of deterioration by erosion. A new tunnel was constructed of Micarta and after three years of continuous service the Bakelite material was still in excellent condition.

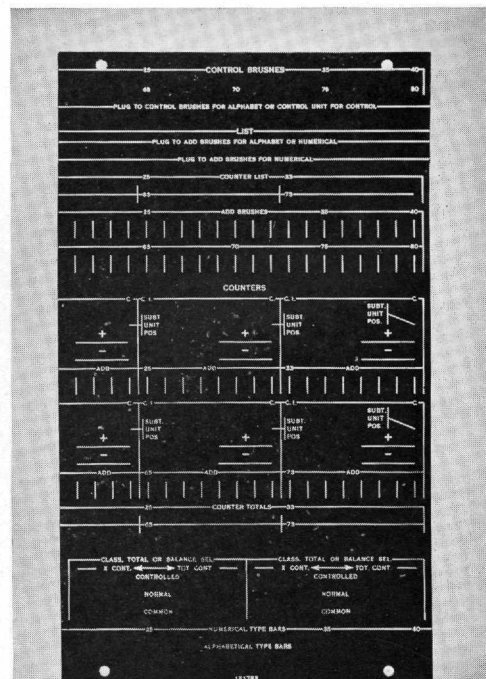
Among the most beautiful of the Bakelite products are articles made of the transparent molding materials. These materials make it possible to produce ornamental objects having an unusually attractive depth of color and lustre in colors of amber, ruby, green, and tortoise-shell. Mottled and cloudy effects and also some opaque colors can be produced. One class of the transparent Bakelite has such a high index of refraction that it approaches that of the ruby. Molded parts produced from it have a degree of reflected light ordinarily observed only when examining rare jewels. The introduction of transparent molding materials has opened up a complete new field for the application of plastics. These materials now find use as automobile tail and dome light lenses, elevator signal indicators, traffic light signals, instrument housings, transparent liquid containers, furniture drawer pulls, knobs and handles, gauge glasses, lamp shades, buttons, chemical graduates, novelty items, and sales demonstrators.

The most recent development in the field of Bakelite research is a new plastic called Bakelite polystyrene, which possesses several properties long sought in other types of molding materials. Because of its

unusually desirable electrical characteristics, this new material is of special interest for its possibilities as they affect the electrical industry. Bakelite polystyrene has a power factor of less than .0002 at frequencies extending from those used in power transmission to the radio broadcast frequencies, and a dielectric constant of 2.60 for the same range of frequencies. Its dielectric strength is high, more than 500 volts per mil; its resistivity over ten million megohm centimeters. Besides these remarkable electrical properties, this material provides the important merits characteristic of other bakelite products such as uniformity in molding, high resistance to water and chemicals, high durability and toughness.

Bakelite polystyrene in its pure state is colorless and possesses a transparency approaching that of glass. It is not yet available in colors, nor for optical use, since it was initially produced to meet demands for electrical insulating and chemical resisting properties. However, it is very easily colored and will probably be produced in a full range of colors within a short time. Unlike many of its predecessors, Bakelite polystyrene is thermoplastic, retaining an ability to be softened and distorted at fairly high temperatures, thus adapting it to certain uses where ordinary molding materials could not be used. Parts of the ordinary type made of polystyrene will withstand temperatures up to 176 degrees F. without distortion when the load involved is simply their own weight. With the announcement of Bakelite polystyrene the field for the plastics industry is once again broadened.

*Control Panel of Laminated Bakelite with Aluminum Printing*



—Courtesy of The Bakelite Corp.