

Radial tire spawned industry revolution

No technical breakthrough in the last half century can match the radial in its impact on tire manufacturing.

Since the longer-wearing tire's commercial introduction by Groupe Michelin forty years ago, manufacturers have spent millions of dollars worldwide retooling some former bias-ply plants for radial production while closing others made no longer necessary by reduced customer demand.

The radial technical breakthrough:

- Brought the most costly production changeover in pneumatic tire history;
- Persuaded some companies to cease tire manufacturing;
- Hastened the closing of more than 50 tire plants worldwide;
- Altered the pecking order among tire makers.

Moreover, the radial passenger tire marks its 40th anniversary this year. (1988)

Since its introduction in 1948, at least one former U.S. tire maker—Gates Rubber Co.—left the tire business in 1973 in favor of less capital-intensive markets. Some smaller firms, such as Mansfield Tire & Rubber Co., went out of business. Others were bought by larger manufacturers during the shakeup that followed.

Still others, such as Armstrong Rubber Co. in the U.S., decided to compete as “niche” players rather than across the board in the “high stakes” game of manufacturing radials.

While introduction of radials put turmoil into the industry, the tires found consumer acceptance for such reasons as:

- A 10% improvement in fuel economy because of decreased rolling resistance;
- Superior starting and stopping traction; plus,
- Improved handling and cornering.

The all-steel reinforced passenger radial was developed and patented by Pierre Marcel Bourdon of Michelin in 1946 and brought to the market two years later as the Michelin X radial.

The radial is so named because its reinforcing cords run at “radial” (or 90-degree) angles to the wheel. Then, in order to keep the tire's body from flattening out under load, a restraining belt is placed over these radial cords, running around the circumference of the tire and under the tread.

This arrangement permits the tread and sidewalls to work separately, combining maximum sidewall flexibility with minimal tread squirm, while keeping the tread grooves open while in contact with the road surface.

Radial-ply construction dates back at least to 1913 when the concept was first patented by Christian Hamilton Gray and Thomas Sloper of India Rubber, Gutta Percha and Telegraph Works Co. in Silvertown, England.

In their patent specification, the two acknowledged they weren't the first to consider placing reinforcing cords radially in the body of the tire. However, Gray and Sloper are considered the first to brace the radial casing with a restraining belt to furnish stability.

Unfortunately, they were prevented from making the design a reality by the outbreak of World War I and the absence of adequate materials at that time.

Thus it was 35 years later before the radial tire came onto the market at the hands of Michelin, which became involved as a result of its majority ownership of Citroen, the French auto maker.

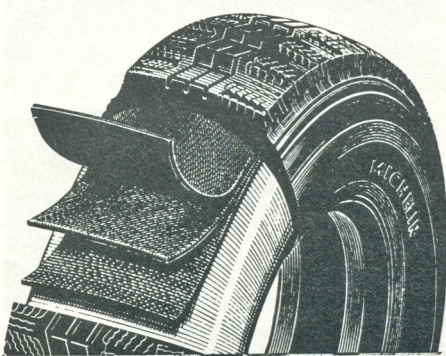
At the time, Citroen was pioneering front-wheel drive and finding the concept extremely hard on conventional bias tires.

Early experiments by Michelin indicated that radial construction might be an answer since preliminary tests promised increased tread life, lower rolling resistance and higher cornering speeds than conventional bias-ply tires.

Michelin developed a tire with virtually no sidewalls, the connection between its tread and bead consisting of a thin sheet of flexible rubber with radially arranged wires embedded in it and just strong enough to contain the inner tube.

This experimental tire proved to have extremely low rolling resistance, its sidewalls rather than tread offering the major contribution to rolling efficiency, according to researchers.

Tire engineers then went to work further stabilizing the tread, electing to use steel wire in the restraining belt as well as the tire's body reinforcement.



MICHELIN X RADIAL 1948

Here, the company's earlier years of experience using steel belts on pneumatic railroad tires proved an asset. Soon they had perfected the Michelin X radial, which was introduced in 1948.

For the next 20 years, Michelin's method of using steel wire in the radial's restraining belt was carefully protected by patent.

As a result, other European tire makers turned to textile-belted radials, which were superior to bias tires and less expensive to produce than steel-belted radials.

Thus radial construction began to take hold in Europe during the late 1950s. A decade later, Uniroyal followed Michelin's lead by also developing an all-steel reinforced radial line. And, one by one, other European-based tire makers joined the move to all-steel radial reinforcement.

In the United States, however, radial construction was not immediately accepted by tire manufacturers. In fact, it wasn't until the 1970s, when radials were suddenly blessed with the acceptance of Detroit's auto makers, that U.S. tire companies undertook a massive conversion to radial production, at the same time closing many former bias tire plants.

While B.F. Goodrich had announced plans for domestic manufacture of radials as early as 1965, it wasn't until 1978 that such tires accounted for more than half of industry production in the U.S. By that time Europe's radial production had passed the 90% mark.

The resistance of North America's tire makers to the radial was not entirely without reason.

First, radial production promised to be more expensive than that of bias-ply tires, and it couldn't be carried out using the same equipment.

In fact, the cost of industry wide conversion to radials in the U.S. was estimated in 1971 at between \$400 million and \$500 million.

Moreover, radials, due to their different performance characteristics, couldn't be used interchangeably with existing bias-ply tires and thus had to be sold in sets of four, further complicating matters.

Also at the time, most U.S.-made cars were not designed to accommodate radial tires, which characteristically delivered a harsher ride at low speeds, a prospect that didn't delight auto makers and, therefore, did nothing to further the radial's chances in the OE market.

Meanwhile, the bias-belted tire, introduced by Armstrong in 1965, seemed a suitable compromise, promising better treadwear than conventional bias tires while also offering a softer ride than radials on then-current car suspension systems.

Furthermore, the bias-belted tire could be made on existing bias-ply equipment. So why not, reasoned bias-belted proponents, take advantage of this fact to convert to radials on a more gradual and less traumatic basis?

Most tire makers liked this suggestion. So also did most auto manufacturers at least for a time.

Industry leader Goodyear, for one, predicted that bias-belted tires would continue to dominate the U.S. market well into the late 1970s. However, the demand for radials increased much more rapidly than most U.S. makers anticipated as things turned out.

With the petroleum crisis in 1973 and regulations to increase fuel economy imposed by the U.S. government, Detroit auto makers suddenly decided that radials should go on new cars to increase their fuel-efficiency. This caught U.S. tire suppliers off guard and changed the product mix of the OE passenger tire market almost overnight.

Bias-belted tires, previously the dominant construction in the original equipment market, declined precipitously from 64% of the market in 1973 to 45% the following year before yielding dominance to radial tires in 1975.

Today, with the exception of temporary spares, radials account for virtually 100% of OE passenger tire shipments in the U.S. and nine out of 10 replacements.