

# Photoelastic 'rainbows' see flaws in sheet metal designs for industry

NEW YORK — "They don't build things like they used to — there's not enough metal in it."

Everyone hears that talk and it's true that most products contain much lighter sheet metals, castings and forgings than they used to. Better alloys are the main reason but design has played a big role and that brings up the question of how the designer can prove his ideas for new shapes that will stand stress and strain better.

He used to have to prove his case first mathematically, then prove it in actual use after building the car, airplane, boat or piece of machinery.

He still must work out his designs mathematically but now the electronic computer does the donkey work.

And slowly, since the 1930s, new methods of using the polariscope and photoelastic simulation materials have been developed to test designs for their stress and strain resistance by means of colored light. The process generally is called photoelastic stress analysis.

Dr. Felix Zandman, president of Vishay Intertechnology, Inc., of Malvern, Pa., who brought some of this technology to the United States from France, is a leader in the field. His company has developed a new method of using a flexible photoelastic film that is glued to finished components. The component then is vibrated, jolted and otherwise tested almost to the point of destruction.

Under the polariscope, this produces brilliant, rainbow-like patterns of polarized light that reveal the direction and measurable intensity of stress at any point in the component.

The designer then can redesign the part to reinforce those areas where stresses are great or eliminate surplus metal where the stress analysis shows it is not needed.

The photoelastic film is an epoxy product. The use of photoelastic stress analysis started on a small scale in the 1930s, Zandman said, with the use of photoelastic epoxy putties to make models of parts or whole assemblies to be tested under the rays of the polariscope. But that still didn't give sufficient proof of how the actual forging, casting or assembly would perform.

The next step was the development of rigid photoelastic films that could be glued to the part to be tested under the polariscope. The trouble with this was the film would work only on perfectly flat parts.

Nevertheless, the use of photoelastic stress analysis grew, first in the aircraft industry, then in automobile factory design departments. It also spread into shipbuilding and some other industries.

This spread to other products was slow because the process was limited. It is not possible to use brush-on film because, in order to get sufficiently accurate test results, absolute control of the thickness of the photoelastic film is necessary.

But Zandman says now that flexible photoelastic films can be molded and glued to practically any shape, photoelastic stress analysis is becoming a design tool for an enormous range of products of all sizes.

It's inexpensive. The equipment can be bought for around \$5,000. But Zandman emphasizes, "It's a design tool entirely, it isn't useful for production quality control."



## Slightly used coffins?

# Dying business ailing

DENVER — Everybody has problems. To prove it, listen to coffin maker Allen Law. Fewer people are dying since he got into the trade more than 50 years ago and that's bad for business.

"The thing that has hurt us is that the death rate is down," he said. "It's down significantly."

The death rate was 15 per 1,000 when I started back in 1927, and now it's down to eight or nine per 1,000 with all the new drugs and things. This has had a significant impact on business."

The Law & Sons Casket Co. in Denver designs, manufactures and decorates thousands of coffins annually and sells them wholesale to undertakers in 10 Western states.

Law was reluctant to say what the lowest priced coffin his company makes sells for, but he did say the luxury models can go as high as \$5,000.

"They make some fancy caskets, they really do," he said.

"Some are made out of steel, some are made out of hardwood — oak, cherry, poplar — and some are made out of lumber materials and particle board. The metal ones are painted, and the wooden ones are covered with cloth," he said.

"The interiors are finished in silks, velvets, satins — people like that — and crepes. Men seem to go

more to the grays and browns, and women to the blues and other colors."

A delicate business, certainly. Law, who learned the trade from his father, knows that, and for many years accepted the apprehensiveness felt by the public toward his calling — an apprehensiveness he said has now diminished.

There is no month that is busier than any other in Law's business, but one season brings more calls than most: Halloween.

"Along about September, especially, that phone will start ringing," he said. "They call down here and ask if we can loan them a casket for Halloween, but we won't loan them out."

CONCORD, N.H. — Even the cost of money is going up these days.

A West Lebanon coin dealer has paid \$7,100 for a 1907 \$20 gold coin designed by the artist Augustus St. Gaudens. The price set a state record.

The coin, bought Friday by Richard Guignard, was a gold double eagle whose previous owner asked to remain anonymous. Guignard said 11,250 were minted and "most of them are lost now or damaged."

St. Gaudens, whose Cornish home now is a national historic site, gave many of the coins away to dignitaries, Guignard said. "The coin was made in New Hampshire and it stays in New Hampshire."

The previous high state price paid for a single coin was \$1,700 in 1976, auctioneer Edward Lewis said.

1907 coin gets record \$7,100

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