A strip caster in France nears commercial stage

Customers are evaluating type 304 stainless steel from the Thyssen/Usinor Sacilor strip caster

PHILIP BURGERT

After more than five years of pilot testing, the strip caster developed by Thyssen Stahl and Usinor Sacilor SA is moving toward commercial-quality production next year. The project should lead to a "revolution in the manufacturing process" as soon as 1998, a Thyssen executive recently said after a conference in Düsseldorf, Germany.

Pipemaking subsidiaries of both companies and other customers have evaluated strip-cast steel from the pilot line, said R.W. Simon, head of r&d for Thyssen Stahl of Germany. The feedback from the evaluations has been "basically OK," Simon said. The pilot line is operating under the project name Myosotis at Usinor's Ugine SA stainless-steelmaking plant in Isbergues, France; the plant has an electric furnace. It has produced type 304 stainless-steel strips that are as long as 5.9 kilometers (3.6 miles), as thin as 2 mm (0.08 inch), and as wide as 865 mm (35 inches). Heats have been up to 92 metric tons. The casting speed for 304 stainless has been 36 meters per minute, but other grades have been produced at up to 90 meters per minute, Simon said.

"We also have low-carbon grades for tin plate and other applications under development," Simon said. "But the as-cast product in the range of 2-3 mm thick is similar to hot-rolled band used for cold-rolling. For tin plate we would cast strip at the lower end of the thickness, maybe 1.8 mm."

The developers forecast that they soon will be able to increase strip width to 1,300 mm (52 inches), Simon said. The length of coils currently is limited only by the 92-ton size of the Isbergues casting ladle, which is completely emptied for each coil. Casting durations of 100-110 minutes were recorded late last year with the 92-ton heats.

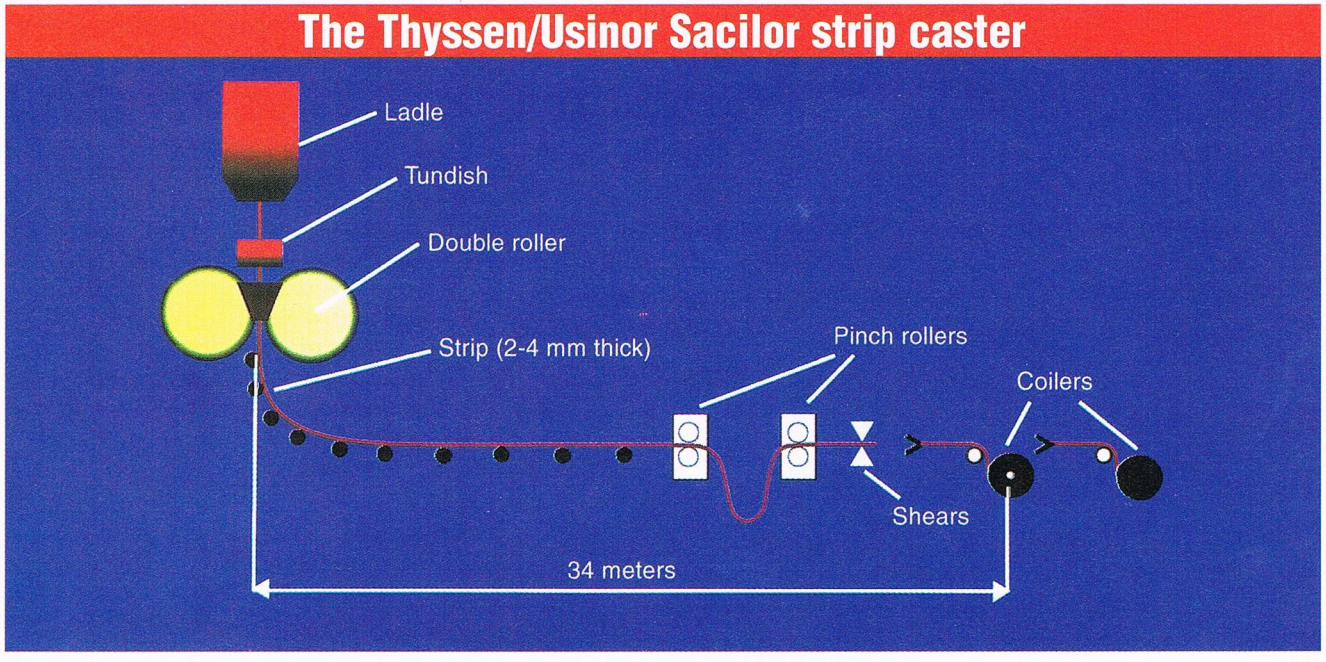
The idea of thin-strip casting began more than 100 years ago, when Sir Henry Bessemer took out a patent for a simple machine to cast strip directly from the liquid phase, Simon told the Stainless Steel '96 conference of Verein Deutscher Eisenhuettenleute, Germany's iron and steel institute. Over the past 10 years, several research teams have taken up Bessemer's idea and built prototype plants for casting steel by a double-roller process.

Thyssen and Usinor Sacilor conducted the first tests at the Isbergues pilot facility in 1991; by May 1992, the caster was producing up to 10 tons of strip with thicknesses of 3 mm. The addition of a second coiler and a shearing unit helped push the coil size up to 92 tons last October.

Steel grades cast so far include austenitic- and ferritic-stainless, low- and medium-carbon, high-silicon for electric sheet products, and iron-nickel alloys. Some coils, including 304 stainless and smaller quantities of other grades of carbon and magnetic steels, have been cold-rolled and processed further into such products as tubes and deep-drawing parts, Simon said.

Strip casting with a double roller differs from continuous slab or thin-slab casting because there is no relative movement between the strip and the mold, and the strip solidifies completely as it contacts the casting roll-

The Thyssen/Usinor Sacilor strip caster



ers, Simon said. The double-roller method represents "a remarkable leap forward in the technology of steel casting," he said.

The strip produced is about 20 times thinner than a thin slab, and no hot rolling is needed to reach the strip's final characteristics, he said. Complete solidification takes about 0.6 second with casting speeds of 30-90 meters per minute. Secondary cooling is not needed, and the total length of the pilot caster is less than 40 meters, including the coiling machines (see schematic).

The tundish at Myosotis has a capacity of 12 tons. A special submerged nozzle distributes the molten steel, which is protected from the air, between the rollers. The two water-cooled, nickel-plated, copper casting rollers, which are 1,500 mm in diameter and 865 mm in width, were designed to deal with the heat flux during solidification. Simon declined to discuss additional technical details of the casting rollers. The nickel coating must have better durability, strength, and adhesion in heat than conventional nickel coatings, and the rollers' surface condition must be optimized continually to avoid defects, he said.

The side containments of the pool of steel between the rollers also are subjected to high demands in terms of thermomechanical characteristics and chemical and friction behavior, Simon said. The steelmakers developed special side-plate material that prevents steel from freezing on the side dams, he said. This helps provide satisfactory edges on the cast strip.

The pilot plant's exit line has roller tables, two pinch rollers, a shearing unit, and two coilers. The pilot line's automation and instrumentation is a "very sophisticated control system," Simon said. The system includes a fully automated approach, regulation of the steel level in the pool, monitoring and control of thickness and roll-separation force, and control of thermal roller expansion and strip shape.

"This process represents a technological leap forward which enables the greatest possible degree of simplification in the manufacture of flat products," Simon said. ❑

Philip Burgert is the Düsseldorf, Germany, correspondent for American Metal Market, New Steel*'s sister publication. He served as a reporter for the* Iron Age/Scrap Price Bulletin *from 1990 to 1993.*