

Continuous cast steels of bloom and billet size, of most constructional alloy steels are now being made in the U.S., (and Canada) successfully, but with metallurgical difficulties requiring development of new techniques. These include:

Changes in liquid steelmaking practices (this is equally true of electric furnace, open hearth and basic oxygen steelmaking all of which are being used for continuous cast steels).

Changes in pit practices on ladles for continuous casting.

Use of argon stirring of steel in large ladles.

Modified deoxidation practices. Some of the factors affecting this are: Aluminum killed steels are preferred for many applications but there are problems in casting such steels in small billets and blooms. Aluminum oxide plugging of nozzles is one of the serious problems in small nozzle bores. Substitution of columbium or vanadium for deoxidation is acceptable but these alloy residuals affect established heat treating cycles in mass production shops.

Mechanical modifications to the continuous casting machines as originally designed.

The probability of using direct strand reduction as an integral part of the casting process.

Extensive inspection practices at the same levels used for traditional ingot-rolling practices.

#### *Slab casting—U.S. steelmen just getting under the tent*

For stainless (of the 300 series) and silicon transformer steels, Atlas Steels' historic (1953) Welland casting machine and more recent (1966) Tracy machine, along with Armco's Butler Plant experiences demonstrate conclusively that slabs of these alloys can be and are being cast on a production basis. While there are quality control metallurgical problems, these are solvable within the limits of normal shop operating practices.

Two more stainless slab casters are under way. Republic's Canton Plant slab caster will go into production this year, making stainless slabs from electric furnace heats. At 200 tons these will be among the largest stainless heats ever made. Crucible's Midland Works will also start stainless slab casting, probably sometime in 1969. With stainless being made in an oxygen converter, in addition to Crucible's arc furnaces, this too will be a unique set up.

For plates, returns to date are based only on European practices and there the evidence is overwhelming (33, January '68, page 94) that most grades of plate steels can be successfully cast. The industry consensus is that no unsolvable metallurgical difficulties will arise when Phoenix Steel starts up its plate caster. Making plate slabs by continuous casting will, in all probability, become the norm for the industry. It should be noted that there will be some formidable scheduling problems involved for plate makers as well as the question of reduction ratios for plates over 2 in. thick.

#### *For sheets and strip*

McLouth Steel is spending \$105 million for a large tonnage sheet slab caster system starting up in 1968. McLouth's decision is based on substantial quantities, probably in the 100,000's, of sheet tonnage shipped to automotive and other users and made from slabs cast in their developmental continuous caster. This has demonstrated the metallurgical feasibility of making automotive sheet grades by continuous casting. McLouth gave 33 its policy in regard to continuous cast steel this way, "McLouth announced that it will make 'rimmed' steel which will meet automotive or appliance, or any use to which sheet steels are normally applied." As to precise details of their continuous casting practices, McLouth will not talk for the record until after their new equipment is in production.

It should be noted that McLouth is making a substantial extrapolation of its development work. The new McLouth casting machines are of Concast curved mold design vs the earlier Concast straight mold in their development unit and have capacity of possibly 3 million tons/year vs less than a quarter of that in their original unit.