Although the compressors provide 250 psig discharge, only 210 psig appears at the burner, due to pressure drop across numerous valves and small inter-connecting piping. Piping on one furnace will be enlarged to secure higher pressure and increased volume at the burner.

Tonnage raised, fuel input reduced

The records show that in a little over 18 months prior to January 1, 1956, tonnage had increased from 17.1 tons per hour to 20.5, with a drop in BTU's per ton from 4.1 million to 3.6. This was accomplished using an average of 38 pct hot metal.

During most of 1956, due to the building of a new and larger blast furnace, the shop was operated on a very low percentage of hot metal—small furnaces approximately 12 pct, large furnaces approximately 25 pct. Since September 1, we have raised the hot metal to 40 pct and have had some very good results. The highest tons per hour was 34.71 from the large furnaces and 26.40 tons per hr from the small furnaces.

At Granite City Steel, high pressure gas as an atomizing agent has been used efficiently to replace steam. The current prices of natural gas and fuel oil also make a high pressure gas for atomization economically attractive.

Empire-Reeves Steel Corp.

by V. B. Thompson

SEVEN open hearth furnaces at Empire Steel's Mansfield, Ohio plant have been converted from oil-steam to oil-natural gas firing with resultant reduction in cost, increase in production per furnace, improved product, increased fuel input, decrease in combustion products per unit of fuel, reduction in amount of fluxes needed, and a considerably hotter flame for faster melt down of cold steel. Five of these furnaces are 155 ton capacity; one, 180 ton; and one, 125 ton.

Fortunately, 200 psig gas pressure was available directly from gas company lines, otherwise compressors would have been necessary. Before the conversion, atomizing of the oil was accomplished by the injection of high pressure steam into the oil stream in the burner mixer. Replacing the endothermic steam with exothermic qualities of natural

gas has meant greater heat inputs per hour and higher flame temperatures with resultant faster melt-down of the charge.

Once in the chamber, the atomizing gas ignites instantaneously, adding a high thermal cracking effect to the mechanical atomizing. As a result of the thorough fuel dispersion, carbon particles are liberated more quickly from the oil and raised to intense incandescence, producing a much more radiant flame. This still further speeds the transfer of heat to the charge.

Up to 90 pct natural gas

The fuel mixture is richest in natural gas during the melting period when the heat input rate must be highest: 90 pct gas and 10 pct oil. During the refining period, when the firing rate is reduced by approximately 20 pct, the proportion of natural gas is reduced to 50 pct.

The substitution of natural gas for steam results in a lower volume of combustion products per unit of fuel. Because of this, a greater fuel input rate is possible with the existing draft, making additional blower capacity unnecessary. The result has been an increase in production of approximately 0.5 tons per hr per furnace.

The gas supplied is substantially sulfur-free, while the oil used for firing averages approximately 0.75 pct S. Sixty-five percent of the total heat input is now sulfur-free gas; therefore, the steel is exposed to only 35 pct as much sulfur from the fuel as when oil was atomized with smaller quantities of steam. The result is lower sulfur values for the steel.

Conversion costs recovered in one month

Empire Steel tested the new method in one furnace. The results were so satisfactory that all seven furnaces were converted as soon as material could be made available. The cost of converting is so low that it was recovered in savings on the costs of approximately the first full month's operation.

The greatest reduction in costs resulted from replacing a large percentage of a fuel of higher cost per BTU—oil—with a lower priced fuel—natural gas. This saving alone amounts to 23 pct of previous fuel costs.

The decrease in oil consumption reduced the volume of oil in storage, thereby reducing capital tied up in oil inventory by more than 5 pct.

Empire Steel is working toward supplying a higher percentage of the total heat input from natural gas. By some changes in furnace design, and method of fuel input, they have already raised this proportion to 90 pct on some of their furnaces. To do this, they are introducing raw gas into a passage in the air uptake chamber and allowing this low-pressure cracked gas to enter the furnace just under the firing end of the burner. This supplies luminous carbon particles and reduces the amount of oil required for this purpose.

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Crowe artillery burner for open hearth steel furnaces, as used at Empire-Reeves Steel Corp.