Using Molybdenum as an Alloying Agent in the Oil Fields

By GEORGE McCONEGHY, Agr. E II

(While George McConeghy, the author of this article about molybdenum, is not in school the Winter Quarter, the article was written last Fall, while he was enrolled in the Department of Agricultural Engineering.—Ed.)

THE discovery and development of the world's largest molybdenum mine at Climax, Colorado, largely eliminated the factors of high cost and uncertain production in molybdenum. After the first World War the market for molybdenum suddenly slumped from its 1918 high. This decrease, however, was only temporary. Since 1924 production has never stopped growing, ultimately reaching an alltime high of 60,000,000 pounds in 1943.

The reasons for the phenomenal rise in the production and consumption of molybdenum can be easily demonstrated by showing the versatility and usefulness of molybdenum steel in all industry. A typcial example of this usefulness may be found in the oil industry.

Our nation's transportation system and our whole war machine are dependent upon oil as a fuel and lubricant. No one knows better than the men who are producing our oil what alloy steels mean to production. Although alloy steels did not make our present day drilling possible, they made it practical.

There are many types of molybdenum steels, both cast and wrought, used in the oil drilling and pumping equipment. In the rotary drilling rig which is used most extensively in the United States, many parts where molybdenum is used can be found. These parts are made of a type of molybdenum steel which may contain other alloying elements. Since there is a large variety of alloying elements from which to choose, an effective basis for selection must be set up. Cost plays some part in the selection, but the major point considered is the ability of the steel to meet the physical requirements.

There are many ways of determining the ability of the steel to meet the physical requirements. It may be done by service tests or by laboratory tests. The former method gives the best results but is not always the most practical, because drilling rig breakdowns may be very expensive. The knowledge gained from these methods of testing is used to establish a relationship between requirements and properties.

The beneficial effects of molybdenum in steel usually arise from the influence of the element on transformations which occur in ferrous alloys, rather than from any cleaning or deoxidizing action. The improved physical properties obtainable through the addition of molybdenum to steel are a result of its alloying effects rather than any role this element plays in the steel making process.

The addition of molybdenum provides more uniform hardness and greater depth hardening without the brittleness that usually accompanies such an operation. Molybdenum also offers high hardness and impact strength, intensifies the action of certain corrosion-resistant alloys, and is somewhat corrosion resistant itself.

Molybdenum steels are easily machined, which reduces the wear on cutting edges of tools, and they do not adversely affect or interfere with welding.

Chromium-molybdenum steels are probably the most used and therefore the most familiar of all the molybdenum steels used in the oil fields. One reason for this wide use is that they may be treated to meet widely varying physical requirements. They have a high impact strength at any given tensile strength, and can be treated to relatively high hardness without a sacrifice in ductility. This particular is suitable to all sorts of applications subject to heavy fatigue, torsion, or impact loads, or to abrasion and erosion. They are also free from temper brittleness.

Nickle-molybdenum steels are among the highest grade steels which are used in oil production equipment. They are used where strict physical requirements are necessary. An example of such a case are the hard rock bit cutters. Nickle-chromium-molybdenum steels are used for such parts as drill collars and heavy shafting. In these places, advantage can be taken of their outstanding properties in heavy sections.

The outstanding properties of silicon-molybdenum steels in connection with the production of oil are their response to rough heat treatment. their high impact strength, and their excellent torsional strength. They are easily worked in

(Please turn to page 22)

MOLYBDENUM

(Continued from page 15)

the field and are consequently used extensively for fishtail bits, rock bit bearings, chisels, and reamer bodies.

Molybdenum cast steels are found for almost every type of molybdenum wrought steel and the properties are quite similar. These cast parts are used in scores of parts familiar to all oil men.

Molybdenum's future in all fields of engineering and science may be foretold by mentioning the fact that molybdenum consumption the world over has risen 30,000 per cent in 30 years. It can be said that molybdenum has a wide future.