SAVINGS OF ROLLED STOCK WITH THE USE
OF STEELS WITH GOOD MACHINABILITY

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The use of easily machinable steels in engineering yields a substantial effect: it helps increase productivity of labor, reduce consumption of cutting tools, broaden the application of automatic machines and production lines, and improve the quality of the output. Thereby considerable savings of material as well as of labor resources are attained. Moreover, the use of steels with improved machinability helps attain savings of rolled metal on account of the following factors.

The use of strengthening heat treatment ensures longer life of parts. When in this case easily machinable steels are used, machinability is not impaired, on the contrary, it somewhat improves.

For instance, for connecting rods of the tractor T-130M (Production Association "Chebokary Tractor Plant) calcium steel with increased machinability ATs40Kh in the tempered hardened state was used instead of steel 45 in the normalized state. As a result the output of connecting rods for the tractor T-130M corresponded fully to the requirements of the standard, the reliability of this heavy-duty component was increased,* and this made it possible to reduce by one third the requirements of spare parts and to save 600 tons of rolled metal per year.

If steel 45 were replaced by ordinary steel 40Kh, the expenditure of cutting tools (made of steel in short supply) would increase by a factor of 1.5-2, and the number of machine tools would double.

Reduction of actual expenditure of cutting tools when steel is replaced by the same marque but in easily machinable modification.

At the Kharkov Tractor Plant in the production of the main shafts of tractors steel 45Kh was replaced by the easily machinable calcium steel ATs45Kh, and in the production of friction drums and hubs steel ATs40Kh was used instead of steel 40Kh. These parts were made from forged blanks subjected to temper hardening. Machining of the blanks involves slot milling, deep drilling, turning, keyway broaching, milling, counterboring, and gear cutting. As a result of the replacement the durability of hard-alloy and high speed steel tools increased in the production of transmission main shafts, friction drums, and hubs by a factor of 1.35-2.2, 2.2, and 1.1-1.7, respectively. This provided for savings of tens of tons of high speed steel and hard cermet alloys.

At the Minsk Tractor Plant the use of easily machinable steels ATs25KhGT and ATs45 ensured savings of tools of 30-40%, a 15-20% increase of productivity of labor in the production of tractor parts, and also reduced costs of the steels that were used.

Without improved machinability it would be impossible to introduce into engineering structural steels whose strength is increased by controlled rolling and forging, which provides for substantial savings of rolled stock.

The introduction of easily machinable steels in the planning and organization of production of new products is most effective. For instance at the Production Association VAZ lead and sulfur-lead steels were used for the first time in the USSR: a broad range of parts (more than 120 different items) for passenger cars were made from them. Calculations showed that the annual savings attained by the introduction of lead-containing steels at the Production

*Obviously on account of the replacement of normalization by temper hardening (Editorial note).

Classification of steels with good machinability
produced in the USSR.

According to economists' data, the introduction of 1 ton of rolled easily machinable steels in engineering leads to an overall saving of 1 ton of rolled metal.

The problem of improving the machinability of steel may be regarded as a problem of controlling the processes occurring in the cutting zone (in the zone in which swarf forms), by introducing certain components into this zone in the form of inclusions that form in the steel.

To improve the machinability of steel as a result of its programmed "pollution," the following inclusions are most often used:

a) Sulfides, selenides, tellurides forming in the steel in consequence of the excess content of sulfur, selenium, or tellurium (or a complex of these elements) specially added to the steel.

b) Oxides among which there are complex inclusions of the systems CaO–Al₂O₃; CaO–Al₂O₃–SiO₂ or Mn–CaO–Al₂O₃–SiO₂. These inclusions are a characteristic feature of calcium steels which, as a rule, contain 0.03–0.07% S.

c) Special metallic inclusions forming in steel when it is alloyed with lead or bismuth.

Thus, free-cutting and easily machinable steels are classified: according to chemical composition into steels with additions of S, Pb, Bi, Se, Te, Ca, and other elements, and also with a complex of these additives, into carbon steels and alloy steels; according to the degree of deformability into cast steels, with ordinary and great deformability; according to the form in which they are supplied, into hot-rolled and cold-rolled, heat-treated, and untreated; according to the purpose, into structural, carbon and alloy steels including stainless, tool and special steels. The classification of steels with good machinability is