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1. Tselikov and V. Anisiforov: New Technology of Rolling Periodic Shapes and the Conservation of Metals. pp 24-30.

   a. Two types of parts seem particularly suitable for production by means of rolled periodic shapes: axles and similar parts with a round section, which need only machining after rolling; crankshafts and other parts that do not have a round section, where the rolled shape must be subsequently forged.

      (1) The main advantage of this process is the decrease in production costs and consumption of steel resulting from the fact that rolled parts can be furnished closer to final dimensions than is feasible with forgings. The amount of steel saved varies from 10 to 25% of that necessary with previous processing methods (generally forging or pressing).

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(a) For example, 3.8 kg of steel were required for a drop-forged half axle but only 2.9 kg for the same axle as rolled by the new process. On this basis, a single stand producing 12,000 tons a year would save 2850 tons of steel a year.

(b) In the case of railroad axles, the weight for a hammer forging is 560-590 kg, for a drop forging 510/520 kg, and for parts rolled by the new process 460-470 kg. Therefore, 7000/9000 tons would be saved in the production of 100,000 parts.

(2) The properties (apparently in the as-rolled condition) of the finished part are also superior to those obtained with previous methods of processing.

(3) Additional advantages of the new process are ease of changing from one size to another; possibility of complete mechanization; lower operating costs; less wear and maintenance.

b. Several models of stands for rolling periodic shapes were made commercially. Despite the technological and economic advantages of this process, its adoption by industry has been very slow.

(1) One stand was installed in 1951 in a factory making textile machinery. Although approximately 40% less steel was needed for each spindle, other factories in this field have made no attempt to use the new process.

(2) In September 1952 a larger unit for automobile parts was completed for a Moscow plant, which has not even started to install the equipment. Several thousand axles have, however, been made by the new process for Moskvich and Zis automobiles. These axles processed satisfactorily and are now in service.

(3) A still larger stand was designed for one of the metallurgical plants. Work on this model was discontinued, however, since the Ministry for Ferrous Metallurgy showed no interest.

c. This method sounds like a type of roll forging. In general, this process has not been used widely here because of the high cost of rolls and the few advantages over modern forging or hot extrusion methods. Ford, for example, makes similar parts to some of those described in the present paper by hot extrusion and claims various advantages over forgings.

C L Stevens and G Vennerholm: The Application of Hot Extrusion Methods for Automotive Production. SAE Preprint 269 (1949); an abstract was published in SAE J 57 (1949) no. 7, p 43.

d. This method appears to be a further development of the method described by Aleksandrov and Yudovich in 1946 as being satisfactory for certain tank shafts. In this case the rolled shape was used to eliminate the first of two drop-forging operations.

E A Aleksandrov and S M Yudovich: Intermittent Shapes for Drop Forging Stabilizer Shafts. Stal 6 (1946) pp 559-565.

e. There could be various good excuses for the delay from September to December in installing the one unit. On the other hand, if the advantages mentioned by Aleksandrov and Yudovich were legitimate, it is surprising that this method has apparently received so little recognition by industry in the period from 1946 to 1952. Perhaps some of the disadvantages mentioned under C above were a factor.

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f. The difference in viewpoint among the various ministries and bureaus is rather interesting. Apparently the departments dealing with the design and construction of new equipment have considerable initiative in developing new processes even when the departments and ministries that must use the resultant equipment are neither enthusiastic nor interested.

2. V. Golum: Rational Choice of Materials for Machine Construction. pp 31-39.

a. The old idea that safety depended mainly on mass has been shown to be incorrect. The fifth five-year plan calls for a decrease in weight of machines and an increase in performance in addition to a doubling of production. The availability of a wide variety of materials and the possibility of using each where it is most suitable facilitate the proper choice of materials and opens the way for new designs with higher performance and lower weight and cost. A careful analysis of each part is needed for best results. National economy as well as technology and production must be considered. In many cases the use of relatively expensive materials will give better performance, lower weight and lower over-all costs than could be obtained with a cheaper material.

A comparison of the performance and weight characteristics of present machines with those produced a number of years ago shows what has already been done along this line. Attention is called to the merits of various materials and processes:

(1) Alloy and inoculated cast iron, which is often more economical than wrought steel. Examples given include crankshafts of internal combustion engines, cylinder blocks and machine tools. Particular emphasis is placed on the suitability of inoculated cast iron for mass production (ease of mechanizing foundry, excellent machinability, high yield of sound parts). The use of cast iron for cylinder blocks in the automotive and tractor industry, for example, means the saving of hundreds of thousands of tons of wrought steel.

(2) Steel castings, especially those produced in small Bessemers.

(3) Cold pressed steel sheet. As shown by several parts of the ZIS-150 automobile, the substitution of cold pressing for hot forming permits the use of thinner sections with a resultant weight saving.

(4) Aluminum and magnesium. Parts made of these metals and alloys are lighter in weight and easier to machine than equivalent parts of wrought steel.

(5) Bimetals or composite metals, which frequently permit marked savings of nonferrous alloys such as bronze.

(6) Powder metallurgy, the application of which is unfortunately limited by the relatively high cost of metal powders, the impossibility of making heavy parts and the fact that powder metallurgy is not economic for small-scale production.

(7) Plastics

(8) Ceramics.

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b. A casual reader would be inclined to question why there was any use of wrought steel or weldments. Although there is a casual statement that such materials may be suitable in some cases, the entire emphasis is on "new" materials. This may be intentional in an effort to induce designers, engineers and economists to think about unconventional materials and processing. (It is perhaps noteworthy that this paper is presented "for discussion".) From an unbiased view~~point, it would appear that wrought steel in general had been greatly underrated.~~ Although the high properties that can be obtained with alloy and heat-treated steels are mentioned at the start, they are ignored for the rest of the paper.

While the author feels, and some engineers here would agree, that cast iron is superior to wrought-steel weldments for many applications such as machine tools, other authories [authorities] could cite cases to prove the reverse. Gokun does not emphasize the close connection between design and choice of materials. Actually a comparison of the suitability of cast iron and welded wrought steel is completely valid only if the design in each case has been such as to take advantage of the particular properties of the type of material to be used.

c. The discussion of the various materials is more or less in line with usage in this country, although the space and praise given to cast iron appear somewhat disproportionate. The persistent mention of inoculation is rather odd, since inoculation is now accepted here as a matter of course in the production of high-strength cast iron. Gokun may, however, have wanted to emphasize the superiority of modern cast iron to the older product. No mention is made of nodular iron, which has received much publicity here and in Europe in the past few years, although the maximum tensile strength of 114,000 psi mentioned as being obtainable with cast iron seems to be too high even for alloy or heat treated gray cast iron.

3. V Rakovskiy: Powder Metallurgy as a Factor in Conserving Metals and Lowering the Cost of Producing Parts. pp 40-45.

a. A general discussion of the economics of powder metallurgy and its present status in the USSR. Only passing mention is made of special products, such as sintered carbides, that can be made only by powder metallurgy.

(1) The basic economic advantages of powder metallurgy for mass production are the use of cheap waste products instead of highly processed materials, and the lowered consumption of materials resulting from the practical elimination of machining and the lighter weight of the finished parts. Even when specially processed metal powders are used, the cost of production is lower than with wrought products. In many cases labor costs are cheaper with powder metallurgy because less skilled workers can be used. An extensive development of powder metallurgy would make possible the conservation of a large amount of metal each year and would add substantially to the material resources of the USSR.

(2) The main materials that come into question for mass-produced parts are iron, some types of alloy steels and copper, all of which can be obtained from waste products, such as mill scale, dust, turnings and chips. The recovery of such waste products as powder is far more efficient than their utilization for remelting. It is often possible to substitute cheaper materials (for example, bronze instead of tin) when powder-metallurgy parts are substituted for wrought products.

(3) A table is given to illustrate the amount of material and man-hours required and the cost per piece for six types of parts, as produced by machining and by powder metallurgy. In general, each ton of parts produced by powder metallurgy saves up to two tons of processed metal and up to 10,000 hours of machining.

(4) Powder metallurgy is already used for sintered carbides, high-melting-point metals, copper-base antifriction parts and magnets. On the other

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hand, the commercial mass production of iron-base parts by powder metallurgy is practically nonexistent because of the underestimation of the benefits of this method by the various ministries.

(a) The Ministry of Ferrous Metallurgy has been studying the problem for a number of years but has still done nothing about the extensive production of iron powder.

(b) Despite the promising work by Orgavtoprom on certain types of parts, there is no commercial production of powder-metallurgy parts for the automotive and tractor industry.

(c) The Ministry of Heavy Industry has made no provision for the manufacture of iron-graphite bearings in spite of their successful production on a laboratory scale. Substantially the same lack of progress is found in the Ministry for the Construction of Machinery and Equipment.

(d) Moreover, the production of the necessary automatic pressing equipment and electric sintering furnaces is either nonexistent or insufficient. The one exception to this dismal picture is the Ministry for Coal Production, which has organized the production of iron-base bearings and other parts in a relatively short time.

(5) The steps that should be taken for commercial exploitation of powder metallurgy for mass-produced parts are outlined.

(a) The suitable industrial basis for the production of various types of iron powder should be created. Automization (?) should be considered here as it would have the added merit of lowering the cost, electric energy consumption and manufacturing space requirements of powders for other purposes, such as ferroalloys for welding-electrode coatings, which are now produced by ball milling.

(b) The ministries concerned should begin to make suitable equipment for powder-metallurgy production (automatic presses, sintering furnaces).

(c) There should be a satisfactory allocation of the types of parts to be produced by each ministry.

b. The figures in the table, which is given for illustrative purposes only, mean very little without other details, such as the number of parts produced.

c. In the USA, many of the parts made from iron powder have densities approaching that of the wrought product. The mention of the lighter weight of finished products would indicate Rakovskiy is more concerned with porous parts than with "high-density" iron-powder parts.

d. Rakovskiy is obviously a convinced advocate of powder metallurgy for mass-produced iron-base parts. From the lack of interest displayed by most of the ministries, it is clear that he has not gotten far with his arguments. This may explain the emphasis placed on the use of "waste products" as a source of powder. There is considerable doubt that such powder would be suitable for all, or even a majority, of the applications where iron powder could be used.

In the USA, iron powder is made by various processes, including reduction of mill scale. (As far as is known, chips and turnings are not being used here.) Du Pont and Fulton of the Plastic Metals Div of The National Radiator Co., a major producer of iron powder, have written:

> "So no single type of powder will fill the bill. To provide iron powder on a tailor-made basis for each application, the products of the five fundamentally different production methods described in this article are frequently mixed...
>
> "Numerous companies have been unsuccessful in the production of iron powder. This is due to their failure to recognize one or more of the following facts: (1) No matter how cheap an iron powder may be developed, if it does not have the required properties it cannot be sold profitably in large amounts; (2) conversely, no matter how well a grade of iron powder might meet all quality specifications for a given application, if it cannot be produced to be sold profitably at a marketable price, the demand will disappear; (3) notwithstanding the substantial increases in the demand for many types of iron powder, the iron powder industry is still a relatively small one."
>
> B T DuPont and R Fulton: Five ways to make iron powder. Iron Age 169 (1952) no. 17, pp 135-139.

Despite the stress Rakovskiy places on the presumed cheapness and economy of powder made from waste products, he tacitly indicates the fact that such powder cannot be used for all purposes when he refers to the need for producing various types of powder. Therefore, there does not appear to be much difference in concept between the USSR and here, although Rakovskiy's paper would indicate that the scale of production of iron-base parts by powder metallurgy is far smaller in the USSR than it is in the USA.

4. I Yakimchuk: Repeated Reconditioning of Worn Tools. pp 72-74

a. Brief discussion of reconditioning tools at Vladimir Il'ich Plant; organization; routine paper work; disposal of tools that cannot be reclaimed; methods of reconditioning; inspection of reconditioned tools; plans for future improvements in department. During 1951, 22 tons of tool steel and about 126,000 rubles were saved by reconditioning. In addition the man-hours needed per tool were decreased by 20-25% in comparison with new tools. The importance of such reconditioning is also shown by the fact that tool consumption amounts to about 10% or more of the net cost in the construction of machinery.

b. The methods used for reconditioning appear normal except in one case. A "hard alloy" is electrolytically deposited on new as well as reconditioned tools to improve performance. At present, the thickness of this coating is 0.002 in., but new equipment will permit an increase to 0.008-0.012 in. The nature of this coating is not indicated. Also, it is not clear whether this coating supplements or replaces cyaniding, which is said to be used on all high speed steel cutting tools. Cyaniding is commonly used in the USA on high speed steel cutting tools but without an electrolytic coating. Chromium plating is used to a lesser extent, with thicknesses about the same as those mentioned by Yakimchuk but in that case it is not clear why he refers to the coating as "hard alloy" and not as chromium. One proprietary process that has found a certain popularity in the USA for tools ("Electrolizing") is based on the deposition of "an extremely hard, dense alloy", but the thicknesses are considerably less than those given by Yakimchuk. The nature of Electrolizing has not been disclosed but it is being used by various well-known companies such as Morse Twist Drill and Machine Co, Lapointe Machine Tool Co; Taft-Peirce Manufacturing Co.

5. V Glevzer and A Mattskov: Conservation of Metals in Repair Work. pp 74-77

a. Among the methods used by the Moscow Brake Factory to conserve the amount of material needed for maintenance and repair of lathes and other machine tools are:

1. Chromium plating
2. superficial induction hardening
3. modernization, as by replacing bronze bearings with needle bearings.
4. use of "compensation" bushings on parts such as gears
5. improvements in design, as by increasing fillets
6. standardization of replacement parts, including a decrease in the number of sizes needed.
7. decrease in machining allowances
8. rebuilding worn parts by hard surfacing, chromium plating or welding.
9. shot peening or burnishing of gears.

Most of these measures are designed to increase the wear resistance and durability of individual parts. During the past four years, these measures have made it possible to decrease the amount of material needed for maintenance and repair by the following amounts

1. engineering carbon steels by 27%
2. low alloy steels by 21%
3. cast iron by 18%
4. nonferrous castings by 60%

b. The authors state that maintenance of a lathe during its life requires several times as much metal as would be required to build a new one. This statement sounds most peculiar and would tend to indicate either an unusually large amount of repair work necessary or an extremely long life involving several rebuildings. It would be a reflection on the construction of the lathes if these methods - or at least some of them - were not used in the original construction. Since the authors insinuate they were not, it is possible that the lathes under consideration were either poorly made or very old.

c. The measures taken to prevent or minimize wear would be considered normal here, although they probably would not be described as methods of conserving metal but rather as means of prolonging service life and improving performance.

d. On the whole, this is very much the type of paper that might be written here by the chief mechanic (Glevzer) and the head of the preventative maintenance department (Mattskov) and appear in a magazine such as American Machinist.

6. V. Maslennikov. Utilization Coefficient of Wrought Ferrous Materials. pp 82-84

a. The utilization coefficient is one of the basic indices for determining the efficiency of utilization of metals in machines and engineering construction. It is obtained by dividing the weight of the finished part by the weight of rolled stock necessary to make that part. Two of the factors that markedly affect this index are complexity of part and type of rolled product involved. Therefore these coefficients can be used only to compare more or less analogous machines or parts. They are, however, very useful in considering the efficiency of specific operations. For example, in one automotive plant, improvements in lay outs for sheet increased the utilization coefficients by an average of 5%. In the case of forgings there ought to be two coefficients: one to show efficiency in the forge shop; the second, efficiency in the machine shop. An analysis of the various types of losses will indicate possible ways to increase efficiency.

b. The utilization coefficients mentioned in this paper appear fairly reasonable.

automobiles	0.66-0.85
tractors	0.62-0.70
compressors	0.49-0.60
machine tools	0.44-0.50
freight cars	0.92-0.96
sheet and plate construction, as for railroad cars and ships	0.90-0.97
parts made from bars and forging	0.50-0.70
barges with load capacity of 2000 tons, where bars or forgings represent less than 3 to 4% of steel and about 96% is sheet or plate	0.97
ZIS-150 truck	
forgings	0.3-0.7, aver 0.52
over-all for rolled products*	0.72
gears made from bars	0.15-0.50

* not clear whether this applies to ZIS-150 truck or ZIS-150 automobile

c. These utilization coefficients represent the maximum possible output and do not take rejections into consideration. Therefore, they would be useful as an indication of the highest production that could be obtained from a given tonnage of steel. Although the possibility is not mentioned, such coefficients would undoubtedly be useful to central planners in setting up production goals and [illegible] check on illegal diversion of steel.

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