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HIGH-SPEED MACHINING METHODS

EXPLAINS HIGH SPEED DRILLING -- Moscow, Vestnik Mashinostroyenia, Mar 52

V. Zhirov, a Stalin Prize winner, operates a radial drilling machine at the Kuybyshev Srednevolzhskiy Machine Tool Building Plant. The power of the motor is 20 kilowatts; maximum spindle speed is 1,200 revolutions per minute. He machines a hole according to the second and third classes of accuracy in two swivel attachments. He mastered these operations in 1947. In 1948 he started to use a drill with hard-alloy tips which made it possible for him to convert to high-speed drilling.

Using a drill 16 to 41.5 millimeters in diameter and tipped with VK8 hard alloy, he applies cutting conditions $1\frac{1}{2}$ times as strenuous as those recommended by norm-setters. For example, he drills a hole 16 millimeters in diameter at a speed of 1,200 revolutions per minute and a feed of 0.43 millimeters and a 28-millimeter-diameter hole at a speed of 368 revolutions per minute and a feed of 1.44 millimeters.

Increasing the cutting speed does not affect the durability of the tools because the machining time of any drill does not exceed 0.5 minute for one part, and by the time the next part is to be machined, the drill has cooled off. A drill made of high-speed steel is cooled by emulsion.

To increase durability, Zhirov uses a drill with a double point angle (s dvoynoy zatochkoy). This prevents crumbling of hard-alloy tips in operation at high cutting speeds and feeds, especially as the drill emerges from the hole. Such drills last 1.5-2 hours.

Instead of twist drills, he uses drills with straight flutes which require less labor consumption manufacture. Experience has shown that a drill with straight flutes is not inferior to twist drills.

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Thick webs which increase thrust are found in both high-speed steel and hard-alloy-tipped drills. To reduce thrust, Zhirov thinned the web. However, with excessive thinning of a web, especially of a large-diameter drill, the tool either breaks or "burns." Properly thinned webs permit an increase in labor productivity.

Drills with inserted hard-alloy tips, which require a double point angle, are more effective than high-speed-steel drills. In his article, "Let Us Furnish Stakhanovites and High-Speed Workers With First-Class Hard-Alloy Tools," I. I. Semenchenko describes one drill design where the inventor tried to eliminate the influence of a transverse edge. This was achieved by replacing one hard-alloy tip with two, located in such a way that they resemble a fork. Zhirov tested drills of this design and was convinced of the expediency of their application. Working with a drill 6.5 millimeters in diameter at a feed of 0.55 millimeter, he noted that the transverse edge was frequently crushed in and formed similar forks. Drills with a crushed-in web require less physical strength in drilling holes with hand feed. This fact inspired him to cut through the transverse edge. A groove /see appended sketch/ decreased friction on the surface, increased the durability of the drill, and permitted an increase in feed. As a result, labor productivity increased rapidly.

On his request, associates of the Kuybyshev Industrial Institute measured the thrust and torque of a high-speed drill 16 millimeters in diameters at different feeds and speeds. As can be seen from Table 1, the thrust decreased about three times on drills with a grooved web as compared with and ordinary web. This makes it possible to increase the drilling speed to machine cast iron of increased hardness, and to conduct drilling operations on less powerful machines.

Table 1. Testing Results

Feed (mm/rev)	Speed (rpm)	Drill With Ordinary Web		Drill With Grooved Web	
		Thrust(kg)	Torque(kg/m)	Thrust(kg)	Torque(kg/m)
0.23	185	130	1.15	30	0.8
0.3	185	175	1.4	45	0.95
0.38	185	235	1.7	65	1.0
0.23	305	130	1.15	45	0.6
0.3	305	175	1.4	65	0.85
0.38	305	235	1.7	120	1.2
0.23	475	80	1.4	45	0.7
0.3	475	100	1.15	65	0.8
0.38	475	130	1.4	75	1.07

In addition to drills, Zhirov also uses counterbores with hard-alloy tips. The introduction of high-speed drilling has shortened machining time rapidly. The output of gearbox housings has increased from 12 to 14 housings per shift.

Table 2 shows the cutting conditions used by Zhirov:

Table 2

Tool	Tips Material	Tool Diameter (mm)	Length of Hole (mm)	Speed (rpm)	Feed (mm/rev)	Cutting Speed (m/min)	Feed per Minute (mm)	Machining Time (min)
Drill	VK8	16	35	1,200	0.43	61	520	0.07
	VK8	28	27	368	1.44	33	530	0.05
	VK8	41.5	30	545	0.55	71	300	0.1
	High-speed steel	10	36	1,200	0.43	38	520	0.07
Counterbore	VK8	17	120	545	1.5	29	820	0.16
Drill	High-speed steel	16	120	850	0.43	43	365	0.33
	High-speed steel	6.5	13	1,200	0.43	25	520	0.05

ASK FOR LONG HARD-ALLOY DRILLS -- Moscow, Moskovskaya Pravda, 9 Aug 52

High-speed methods of metalworking are used extensively at the Moscow Krasnyy Proletariy Plant imeni A. I. Yefremov.

Drilling-machine operators utilize their machine tools at full power and at maximum speeds, up to 2,000 revolutions per minute. The greatest effect is obtained not only as a result of high speeds, but by proper organization of the working area, and by decreasing the time required for auxiliary operations with the use of different quick-acting chucks and high-duty attachments, etc. Drills, counterbores, and reamers with hard-alloy tips are used throughout the plant.

However, the plant's reserves for increasing labor productivity by utilizing high speeds and hard-alloy tools is far from exhausted. High-speed tools have to be used in some operations because the hard-alloy combine [Moscow Hard-Alloy Combine] has not yet set up production for a wide variety of tips for drills, counterbores, and reamers.

For the most part, tool makers at the plant manufacture special tools. Normal drills with hard-alloy tips must be obtained from tool enterprises, in particular, from the Moscow Frezer Plant. However, the Frezer Plant manufactures only short drills which are unsuitable for work with jigs and bushings.

In March 1952, plant leaders turned to Rybkin, chief of technical control of the Ministry of Machine Tool Building, with the request that long hard-alloy drills be manufactured at the Frezer Plant. Incidentally, this problem interests dozens of different enterprises.

Rybkin promptly sent a letter to Nadeinskiy, director of the All-Union Scientific Research Tool Institute, in which he asked questions on how to solve the problem of designing and manufacturing long drills with hard-alloy tips. As yet, no reply has been received from Nadeinskiy.

Hard-alloy drills have not yet been used for drilling steel. Only cast iron has been drilled at high speeds. Scientific research institutes and laboratories should help to solve this problem.

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ORGANIZE SHOP FOR HIGH-SPEED WORK -- Moscow, Morskoy Flot, Mar 52
(from Vestnik Mashinostroyeniya, Sep 51)

A shop for high-speed machining has been organized at the Leningrad Machine Tool Building Plant imeni Sverdlov. An interesting fact is that the basic contingent of workers at the shop consists of youths 16-19 years old who have completed trade schools.

The problems of organizing the shop were solved by reducing not only machining time but auxiliary time, which comprised up to 25-30 percent of the whole work day.

Special attention was given to modernizing the equipment by increasing the spindle speed, the power of the machine, and the rigidity of its units. The control and equipment of the machine were changed to shorten the auxiliary time. A modernization work plan was worked out for each machine tool.

In replacing pulleys, provisions were made for the installation of V-belts, which would assure a higher coefficient of efficiency. In addition to increasing the power of electric motors in milling machines, the worm pairs for table travel were reinforced.

To simplify and regulate tool economy, the number of types of cutters was decreased. The total number of type-sizes of cutters was reduced from 340 to 45. Through and undercutting cutters with mechanical fastening of blades were designed and manufactured.

These cutters assure chip breakage under any cutting conditions used at the shop. The hard-alloy blades are cut identically on four sides. When one edge becomes dull it is only necessary to change the position of the blade. Such changing can be done three times.

Protective screens were installed on the lathes. Tool sharpening was centralized.

The following measures were taken to decrease auxiliary time:

1. Dials for longitudinal movement were manufactured and installed on the feed shaft. Using the dial in machining a group of graduated parts cuts in half the auxiliary time for installing and checking them.

2. On the top slide on the side opposite the basic tool holder, additional tool holders were installed which held cutoff (or grooving) cutters;

3. Instead of ordinary tool heads, swivel heads which can be fixed in 12 different positions were installed. This permitted the turning of tapered surfaces.

Simultaneously with the introduction of high-speed operating conditions, the technology for machining a number of parts was reviewed. For example, milling plane surfaces instead of planing saved a great deal of time.

A new system for organizing and planning production was developed and introduced. This includes: (1) a routine system for passing parts; (2) a simplified system of calculating work and workers' wages; and (3) a 24-hour schedule for delivering parts for assembly, etc.

The measures taken have shortened machining time 55 percent; time required for auxiliary operations, 36 percent; and preparations and finishing time, 56 percent.

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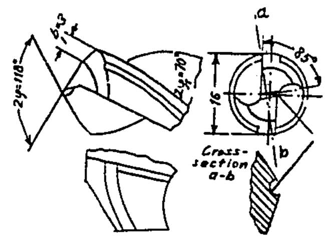

High-Speed-Steel Drill 16 mm in Diameter
for Machining Cast Iron
a,b-Groove up to 3 mm wide and 2 mm deep

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