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AN IMPROVED APPARATUS FOR FAST QUENCHING

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Abstract: A new rotating-mill fast quenching device is described which represents a modified version of an earlier model. Several improvements are made thereby avoiding vibrations present in the earlier model. The accuracy of gap setting is increased and greater speed gives rise to better quenching control. A sample catching pod forms an integral part of the apparatus and serves to cool the rollers thereby improving the quenching speed.

Samples obtained show more uniform properties such as the degree of quenching, size and thickness which can be varied from 5 μm to 30 μm. Reproducibility is better than that achieved with the earlier model.

1. Introduction

The performance of the first quenching mill[1] left some room for improvement. It was prone to developing roller vibrations and its speed was somewhat lower than desired. As a result samples varied considerably in quality thickness and area. It was obvious that higher rotational speeds were called for while maintaining a constant gap.

Tracing the origin of vibrations it was realized that they came mainly from gears that interconnect the two rollers. Higher speeds were difficult to acchieve while using gears since these can be damaged unless specially constructed. The second source of vibrations was the electric driving motor.

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In determining the new machine parameters it was also necessary to introduce further improvements in the control and handling of samples. It was decided to improve the method of gap setting, to cool somewhat the rollers and to conserve better the samples immediately after their formation.

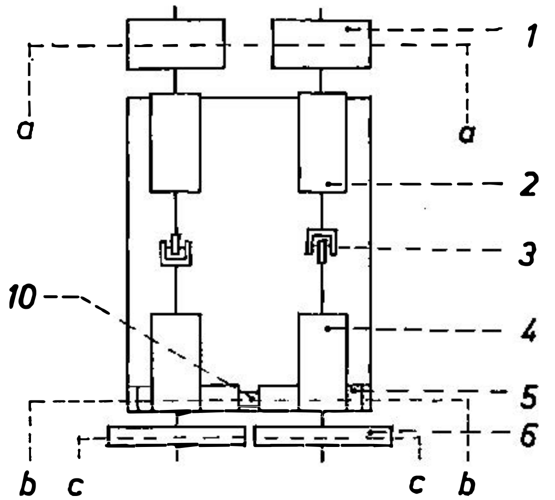

Fig. 1. Shematic drawing of the quencher layout.

No change was made in the metal injecting part of the apparatus. Its design was essentially the same as used in the previous device.

2. *Description of the apparatus*

The construction of the device is shown in Fig. 1. The power is transmitted to the rollers by a light belt driving two pulleys (1) and (1') in Fig. 1 and Fig.2. A third pulley (8) serves to give the proper sense of rotation to the quenching rollers

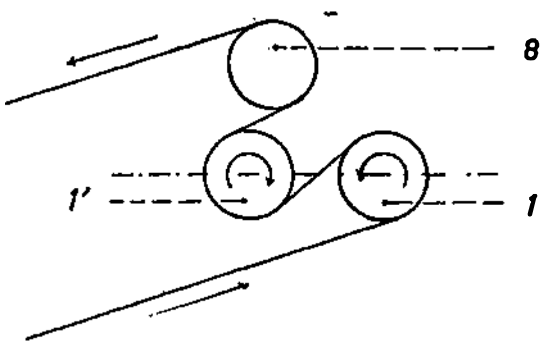

Fig. 2. Schematic drawing of the vertical section a — a from Fig. 1.

(6). Rotational speed of 15000 R. P. M., was readily achieved without any detectable vibration being transmitted from the motor to the rollers. The shafts supporting the rollers are connected to the drive shafts through universal joints (3). The role of the latter is to eliminate any remaining vibrations coming through the belt and also to allow the rollers to be adjusted for clearance. Both the drive shafts and the roller shafts are supported by sets of four special bearings (SKF 6003-2RS) placed in their housings (2) and (4). The housings that hold the drive shafts are rigidly mounted while those that hold the rollers are mounted on skids ((5) in Fig. 1 and Fig. 3)). The skids slide on a polished bed (9) and press on one side against an ac-

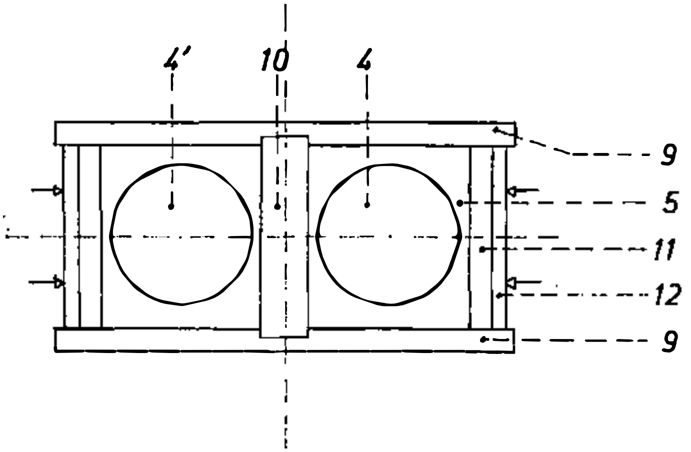

Fig. 3. Schematic drawing of the vertical section b-b from Fig. 1.

curately machined steel plate (10) while on the other side they are held by a rubber block. The thickness of plate (10) is calibrated to within one micrometer since it determines the roller clearance. When rollers are reground to repair their surface a new plate is used to bring the roller gap to the desired value. The rubber blocks allow the rollers to open in case some rigid impurity falls between them during the quenching. The absence of this feature in the earlier model often resulted in roller damage.

In order to improve the quality of the quenched samples a sample holding pod was built (Fig. 4). The pod consists of a dewar (13) fitted with a teflon neck (14) which reaches between the rollers. The dewar is fitted with a heater (15). Just before quenching is started this heater is activated causing the liquid nitrogen in the dewar to boil vigorously. Cold nitrogen fills the space between the rollers (16) cooling them and thus improving both the quenching speed and insuring a better conservation of the samples since these do not have time to warm up before falling into the liquid nitrogen.

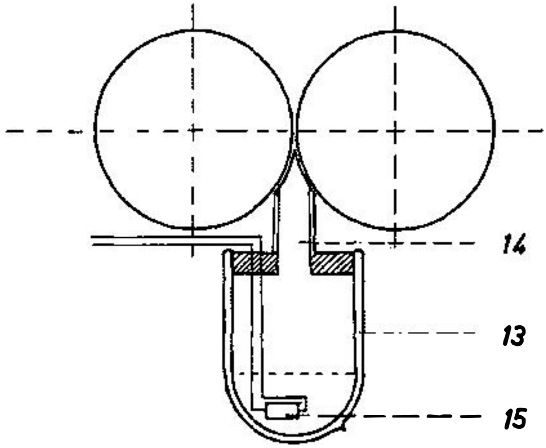

Fig. 4. Schematic drawing of the vertical section c-c from Fig. 1.

3. *Results*

The device was tested using pure (99.997%) aluminium. For each gap setting (5 μm, 10 μm, 15 μm, 20 μm and 30 μm) ten consecutive runs were made. Samples were classified according to their thickness and their length. The sample thickness

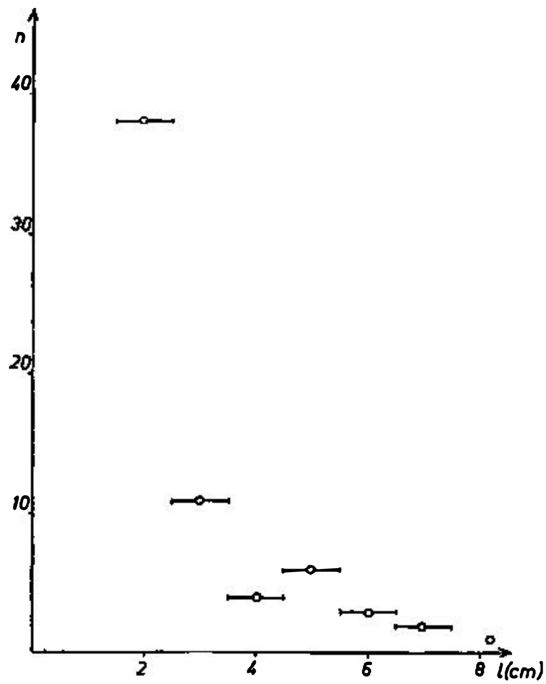

Fig. 5. Graphic representation of the testing: The number of samples v. their length.

offers a good measure of the quenching speed in this method of quenching. The sample length gives an indication of its usefulness for the purpose of electric measurements. From the 50 runs a total of 64 samples were selected with length greater than 1.5 cm. Shorter samples were discarded. All samples were made using the same injection furnace. The results of classification are shown in Fig. 5.

The sample thickness affords a measure of quenching speed since the latter is inversely proportional to the square of the thickness. Samples made with gaps of 5 μm and 10 μm were selected and their thickness carefully measured to within a micron. The 5 μm setting yielded 12 samples while the 10 μm setting yielded 19 samples. The results of measurements are shown in Fig. 6. The samples obtained with the 5 μm setting are marked with crosses. As with other settings the values of sample thickness are centered around the value of the gap with deviations of about 2 μm.

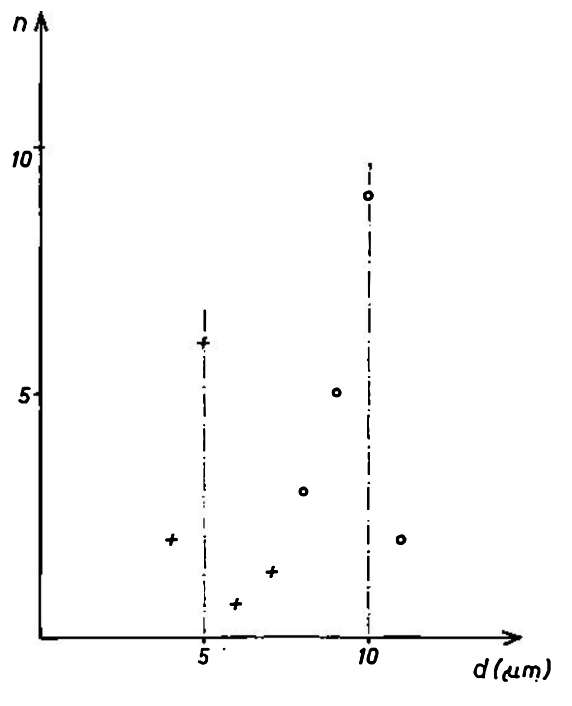

Fig. 6. Graphic representation of the testing: The number of samples of given thickness as a function of gap setting.

These results show that the new device represents a significant improvement in the »rotating-mill technique since it affords a much greater reproducibility and ease of sample manufacture.

Acknowledgements

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Reference

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POBOLJŠANJE UREĐAJA ZA BRZO KALENJE

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Sadržaj

U radu je opisan novi uređaj za brzo kalenje, koji se osniva na proturotirajućim valjcima i predstavlja znatno poboljšanje u odnosu prema ranijim tipovima istog. Procjep među valjcima može se regulirati veoma precizno a veća brzina daje bolju kontrolu kalenja.

Dobiveni uzorci pokazuju jednoličnije osobine nego što je to kod ranijih modela (kvaliteta kalenja te veličina i debljina, koja se može mijenjati od 5 μm do 30 μm) tako da je indentičnost uzoraka znatno bolja.