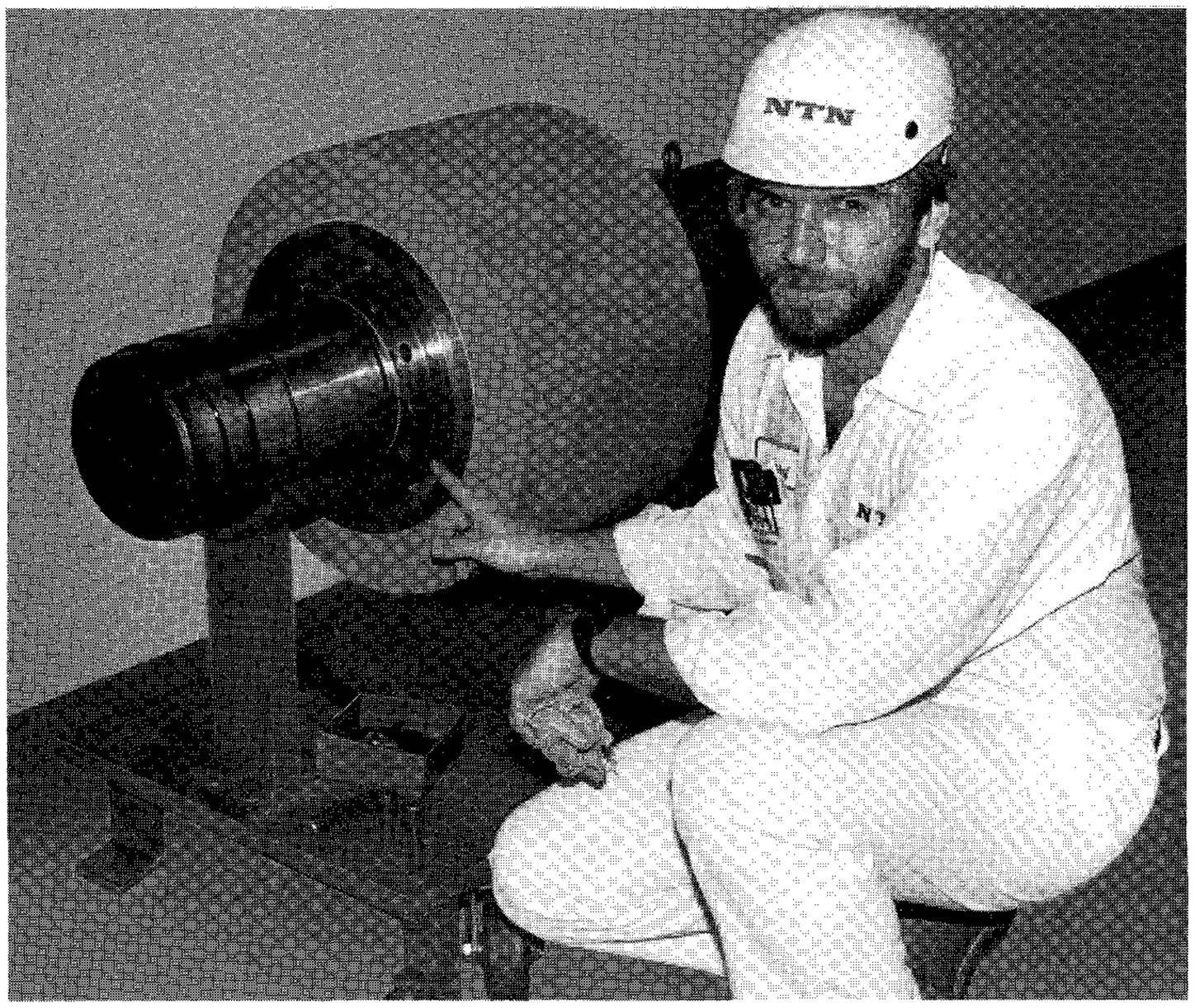
Application Notes

Quality-control of Bearings Using Vibration Monitoring

The American NTN Bearing Manufacturing Corporation at Schiller Park manufactures deep-groove ball bearings. The outer diameter of the outer races is ground on a centreless grinder. The quality of the bearings depends largely on the balance of the grinding wheel. The balance of each machine was checked at hourly intervals with a hand-held vibration meter but because the balance of the wheel could change very quickly, up to an hour's production of badly ground races could pass down the production line before they were detected.

A Type 2505 Multipurpose Monitor was installed on each grinder to detect sudden changes in balance. Since the installation of the Type 2505, the scrap rate at the plant has been halved.



Bearing quality greatly depends upon the quality of the grinding wheel. By permanently monitoring vibrations from the grinding wheel, a tight check can be kept on its condition

The American NTN Bearing Manufacturing Corporation, Schiller Park, Illonois

The American NTN Bearing Manufacturing Corporation is a subsidiary of the NTN Toyo Bearing Company of Japan. The plant at Schiller Park manufactures 40 mm, 52 mm and 62 mm Deep-Groove Ball Bearings. The bearings are standard items in the NTN catalogue and most will be used by the automobile manufacturing industry for car alternators, etc. The plant has 4 production lines, two of which produce 40 mm bearings. Each line consists of several grinding operations followed by assembly and testing.

The outer diameter of the outer races is ground on a centreless grinder at the beginning of each line. This op-

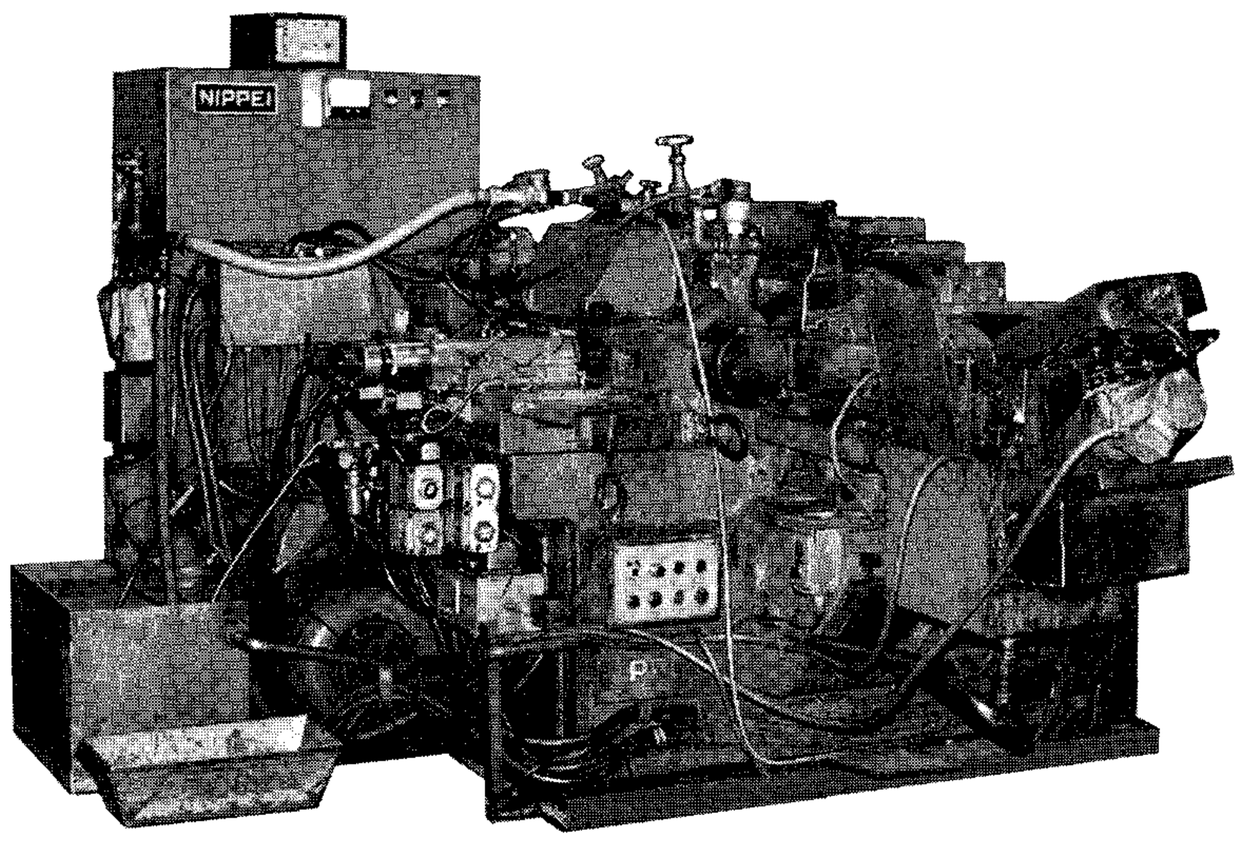


Fig. 1. One of four centreless grinders used to grind the outside diameter of the outer races at Schiller Park

eration is largely automatic. The quality of the bearings depends largely on the balance of the grinding wheel. Normally the grinding wheel would go out of balance gradually over a period of 18 hours. Sometimes, however, the change would be more sudden. Such sudden changes would be due to a chip coming off the wheel or a change in the density of the coolant.

Balancing the Grinding Wheels

The balance of each machine was checked at hourly intervals with a hand-held vibration meter. The balance of the grinder was unacceptable if the vibration displacement exceeded 3,5 μm for the 40 mm bearings or 4 μm for the 62 mm bearings. The wheel was then balanced so that the vibration did not exceed 1 μm. Initially, the rebalancing operation could take 5 or 6 hours. The balancing was done by trial and error and it took some 5 minutes for the wheel to stop before each adjustment. Larry Hackett, the Electrical Engineer at Schiller Park, reduced the balancing time to 20 minutes by installing a dc brake on each machine.

The hand-held vibration meter adequately covered the routine case of the grinding wheels going out of balance over a period of time, and the dc brakes had speeded up the balancing operation. The problem of the wheels suddenly going out of balance still remained. The problem was made worse by the fact that the grinding time dictated the overall rate of production. The average grinding time was 8 seconds whereas the average assembly time was 3 seconds per bearing. The mismatch between the grinding time and the assembly time meant that the newly ground races would often pass down the production line immediately. Because the machines were only checked periodically, up to an hour's production of badly ground races could pass down the production line before they were detected.

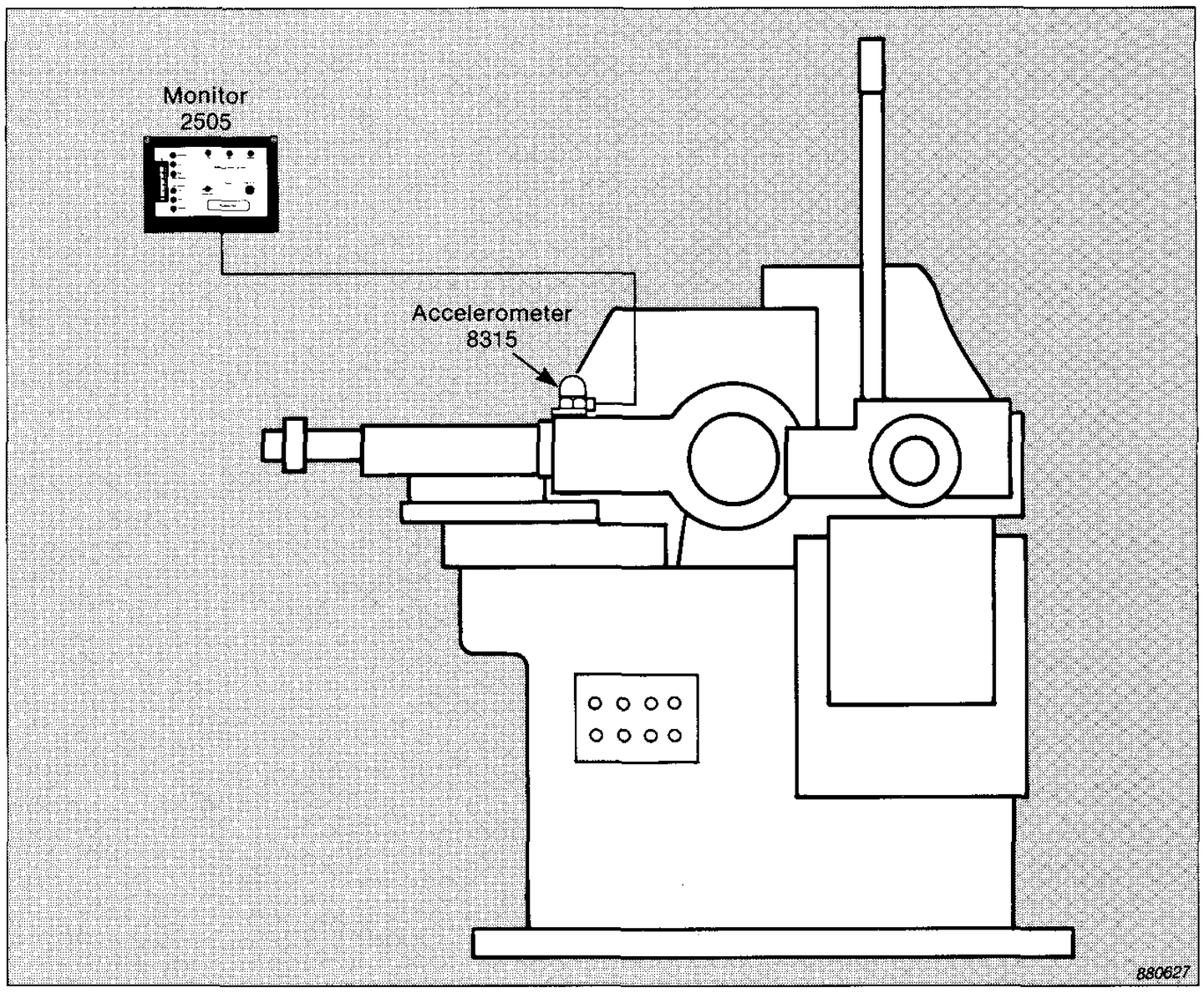


Fig. 2. Diagram of the Type 2505 setup on a centreless grinder

Permanently Monitoring the Grinding Wheels

A permanent monitoring system was needed. The plant already used Brüel and Kjær sound level meters and vibration analyzers and so Brüel and Kjær were asked to provide a solution. Larry Hackett chose the Type 2505 Multipurpose Monitor as the most suitable for the application. The fact that the Type 2505 closes to a sealed unit was an important consideration because of the coolant suspended in the air around the grinders. A permanently-installed "rugged" Industrial Accelerometer Type 8315 was used for the vibration pick-up. Larry installed a Type 2505 and 8315 on each grinder. The alarm level was set between 2,5 and 3 μm displacement depending on the diameter of the race to be ground. The trip level was set 1 μm higher. The best position for measuring vibration had been found with the hand-held vibration meter. The 8315 was put in the same position.

The wheels still go out of balance in 18 hours but no longer are there production losses due to sudden changes of balance. Since the installation of the Type 2505, the scrap rate at the plant has been halved.

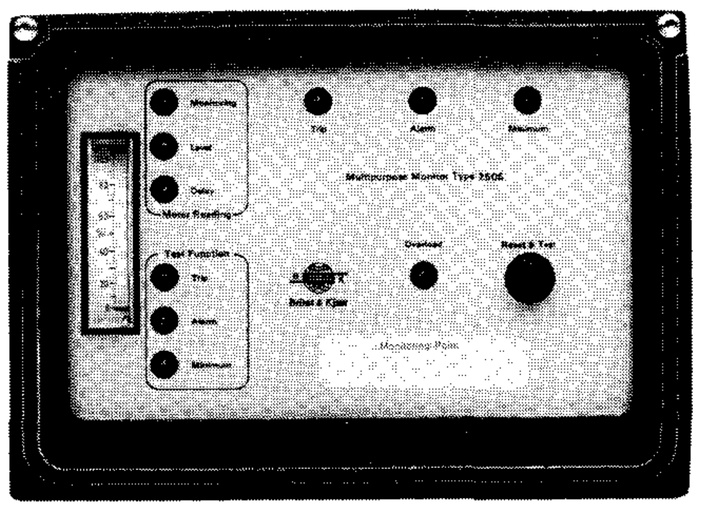


Fig. 3. The Type 2505 Multipurpose Monitor

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