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LATHE SIMULATED LOAD NOISE QUALIFICATION METHOD AND COMPARISON WITH THE SAMPLE PIECE METHOD

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INTRODUCTION

The knowledge of the acoustic rating of an emitting source is a most useful, even essential tool for the a priori definition of the spacial distribution of the sound pressure levels to be supported by the operators in the working room. The setting up of a reliable method thus is the fundamental starting point for those interested in a serious and finalized policy for fighting acoustic pollution.
We are sure that the efforts made by our Institute in this sense will give a profitable contribution for solving the problem.
The tests have been made with a center lathe Graziano SAG 14, rated power 5.5 HP.
The methods used, verified directly on the lathe and compared are :

1) No-load running
2) Simulated load running
3) Technological (working) load running (Photo 1).

The no-load test, made at all the speeds of the lathe, relates to the change gear kinematics, engaging also the screw-bar control for better simulating normal working steps.
The simulated load tests is made with a hydraulic disk brake (Photo 2) with servocontrol for ensuring a constant breaking torque measured with a torquemeter while taking the sound pressure levels. Also in this case has been used the screw-bar control.

This method reproduces the mechanical stresses acting on the lathe during the effective working of the piece, less the feed of the tool holder carriage, thus measuring only the noise emitted by the lathe, but not that caused by the cutting process as such.
For the cutting process have been used typical pieces and tools according to DIN 45635 (Part 16/A3), controlling the values of the braking torque with a torquemeter.
The measurements are taken in a semi-anechoic room with the lathe on a reflecting plane according to ISO/3744. The capacitive B & K microphone system on the measuring surface enveloping the lathe sends the received signals to an automatic sound pressure level measuring chain.
The test is made at the available speeds of the spindle loaded with constant torques over the whole rated lathe power range obtained with a servocontrolled hydraulic disk brake.

Table 1 compares the calculated values of the sound power levels of the lathe for the three test cases.
The diagrams of Figs.1 and 2 show the values of the sound power levels L_{WA} versus the RPM parametered as braking torque for the simulated and cutting load conditions.

CONSIDERATIONS

This test has for the moment being limited to a sole type of lathe and results to be a real and proper comparison of methods, a first step toward a more general research following up the work started by us for making available further data allowing a real statistical evaluation.
The results obtained allow us to make the following observations : a) DIN 45635 (version dated after 1976) and ISO/TC/39 for lathes provide tests at 50% of the maximum number of revs.
This subjects the lathe to torques which, at medium and low powers, produce forces on the machine tool sufficient for evidencing the dynamic structural behaviour of all the interested kinematisms.
Negative is, in our opinion, the subdivision resulting also from other proposals, see also CECIMO Oct. 82, in the field of powers forcing the operator to take a diversified choice

of the used dimensional workpiece parameters.
In fact, the diameters and lengths of a type workpiece are linked to the dynamical structural behaviour of the lathe, that is to the specific cutting pressure, the behaviour bino mial piece-tool, which is a function of the feed speed and the cutting depth, determining the chip section and thus also its morphology, almost wholly generating the produced working noise; are linked in addition to the times of taking the sound pressure levels.
b) In our opinion, the simulated load method using a torque servocontrolled disk brake, allows to use well defined and constant spindle torques by previous calibration of the sys tem, covering, by suitably dimensioning the brake, a large range of installed P_n's and preventing the splitting up into various P_n ranges.
This method can be applied to most chip-removing machine tools, thereby avoiding to have to use pieces of various forms and sizes.
It makes it also possible to completely evidence the dynamic structural behaviour of the machine tool by varying the spindle speed from the minimum to the maximum for each brake torque.
It may be true that the kinematic motions of the tool-holder slide feed have been neglected, but it is also true, as shown by our tests, that its incidence upon the total noise is rath er negligible. The screw-bar group has always been engaged both in the no-load and load determinations of L_{ps}.
The obtained data show that for each used braking torque and a varying number of rpm's, the measured values of ΔL_{ps} for simu lated and cutting loads are in the mean constant and equal to 1.84 dBA.
This use of the simulated load method is a starting point for the statistical evaluation of the data for completing the research for defining those mean parameters allowing with a sole test the acoustic qualification within the limits of the preset reliability.
It might be considered that the use of such a method calls for an equipment not always available both at constructors and users; it is hoped, therefore, that the acoustic qua lification of machine tools could be entrusted to public research bodies possessing the suitable tools.

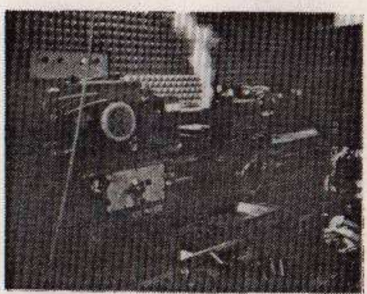

photo 1

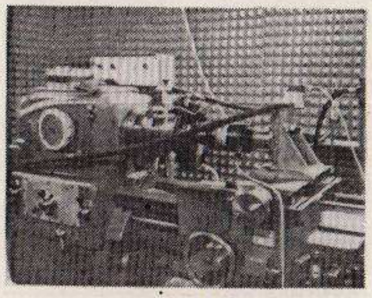

photo 2

POWER SOUND LEVELS (dBA)

n rpm \ Torque Kgm	0	1		2		4		6		8	10
		s.s.	s.t.	s.s.	s.t.	s.s.	s.t.	s.s.	s.t.	s.s.	s.s.
40	77.5	79	79.6	79.7	81.3	80.4	83.7	80.8	84.9	81.2	81.5
55	78.2	80.6	80.6	81.1	81.4	82.2	83.5	82.5	84.3	82.8	83
80	78.0	80.5	82.2	80.7	82.9	80.7	85.4	80.8	86.2	81.3	82.2
115	79.6	82	84	82.6	85.1	83.8	86.7	84.6	87.7	85.2	85.5
160	78.4	79.3	81.7	83.2	82.5	81.2	84.7	82.2	84.5	82.5	83
200	79.1	80.3	82.9	81.5	84.2	82.4	85.1	83.2	86	84.6	84.5
280	80.9	82.4	82.5	83.3	83.3	86.4	85.8	87.3	88.1	89.7	89.3
400	82.9	84.6	85.9	85.8	85.9	87.9	89	88.5	90.4	91.3	91.7
550	82.4	[illegible]	[illegible]	83.9	84.5	90.1	89.4	90.3	92.1	90.9	93.1
800	85.1	87.5	85.4	89	87.2	88.5	91.8	89	91.3	91.5	93.2
1100	87.1	87.7	85.2	87.9	89.3	90.4	92.2	91.2	93.4		
1500	89.8	89.1	92.1	90.1	91						

s.s. simulated load
s.t. technological load

TABLE 1

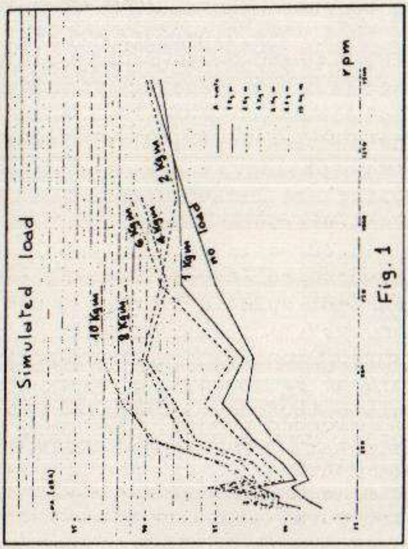

Fig. 1

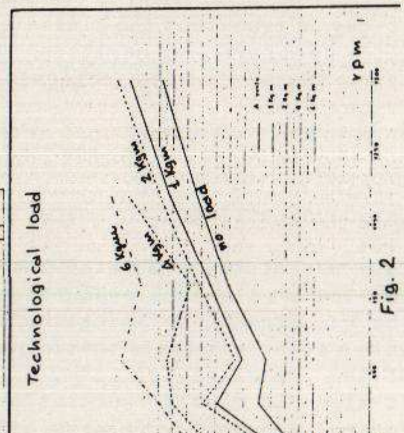

Fig. 2