ICA **8** 1974

The Eighth International Congress on Acoustics

London, July 1974

CONTRIBUTED PAPERS

VOLUME I

EIGHTH INTERNATIONAL CONGRESS ON ACOUSTICS, LONDON 1974

FOREWORD

This 8th International Congress on Acoustics is sponsored by the International Union of Pure and Applied Physics of Unesco (IUPAP) and jointly organised by the Institute of Acoustics and the Institute of Physics under the auspices of the International Commission on Acoustics of IUPAP.

The technical programme of the Congress attracted over 700 invited and contributed papers. The progress papers are in a separate volume entitled Invited Papers while the contributed papers are published in two volumes, which are page numbered consecutively as for a single volume. For this Congress a change has been made in the format of presentation of these contributions, necessitated by the rapid increase in the number of papers being submitted to the International Congresses on Acoustics. One page only was allocated to each author who was also restricted to the presentation of one paper only.

The contributed papers are published as submitted. They are grouped under the major headings corresponding to the Technical sessions.

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EIGHTH INTERNATIONAL CONGRESS ON ACOUSTICS, LONDON 1974

RECENT INVESTIGATIONS ON FACTORS AFFECTING NOISE FROM WATER SUPPLY INSTALLATIONS

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During the last few years systematical measurements concerning water installation noise have been performed for Ifö AB, Bromölla, Sweden.

The long-term puprpose is to find ways to use laboratory measurement methods such as DIN 52.218 and the Swedish disturbance force method[1] for predicting the sound level generated in an adjacent room (flat, hospital ward etc) under different building field conditions[2].

Until now field measurements have been performed with gypsum wall systems[3] and with concrete walls. All measurements are made in 1/3- or 1/1-octave bands. The results are being compared with laboratory tests on the same tap specimens with pressure and flow data identical to the field ones.

In the present measurement series also the field difference with 3 different gypsum wall types and 6 joint conditions have been studied. Fig. 1-4 show some of the results with wallmounted taps. The mean differences in noise levels (L_A) are given with the single stud wall case as reference.

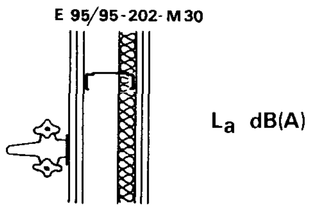

FIG. 1

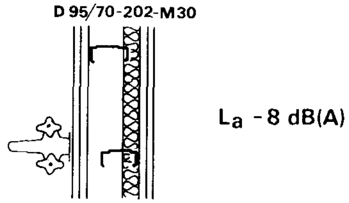

FIG. 2

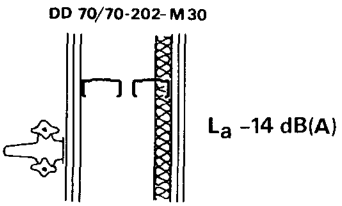

FIG. 3

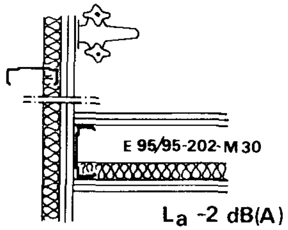

FIG. 4

(1) S. Ljunggren, ICA 7 Proc. 20N13
(2) see e.g. J. Girard, INTER-NOISE 73 Proc. C22Z12.
(3) S. Einarsson, INTER-NOISE Proc. C22Z8.

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SOUND TRANSMISSION BETWEEN ROOMS WITH INTERCONNECTING SERVICE DUCTS

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This paper describes the application of S.E.A. techniques to the problem of the reduction in sound insulation of a wall due to transmission via the ventilation duct.

A solution is given for a transmission in the case of a standard rectangular duct. The implications of changes in sectional area, shape, duct wall thickness are shown in addition to effects produced by the introduction of lining and collars.

DOMESTIC APPLIANCES AND NOISE

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INTRODUCTION

This investigation is concerned with identification and analyses of noise sources in commonly used domestic appliences. And to suggest some simple and clear methods of noise testing and rating. In a paper on noise from household appliances Roewer (1) has pointed out some aspect of this problem.

EXPERIMENTAL

The experiments are conducted in a test room where the sorrounding overall noise level is 34 dBA. Hand-held shaver and hair dryer are resiliently suspended in the centre of this 5 m x 5 m x 4 m test room. Table-type blender and mixer raise a big problem as their noise spectrum depends considerably on the type, size and material of the table on which they are kept. It is proposed that these appliances should be kept on the commonly available kitchen tables, where they are generally used by the users. Noise levels are meseared at 10 and 100 cm for hand-held appliances and at 100 cm for table type appliances. Noise levels obtained are given in the following Table.

Appliance	Distance cm	Noise levels in dB 100	200	500	1000	2000	5000	10000 Hz
Shaver	10	57	61	69	68	64	67	57
Hair dryer	10	59	65	65	68	69	65	63
Mixer	100	58	55	52	55	55	55	50
Blender	100	50	55	54	56	56	55	51

NOISE RATING

Coming to the problem of noise rating it is really difficult to give a simple informative labelling.As a consumer and acoustician it is proposed that the appliances which generate peak noise levels in audiable frequency zone more than 50 dB at a distance of 100 cm may be lebelled as "Noisy", between 40 dB and 50 dB as "Normal" and below 40 dB as "Silent".

REFERENCE

(1) K. Roewer , Inter-Noise (1973) 117.

EIGHTH INTERNATIONAL CONGRESS
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TEMPERATURE DEPENDENCE OF NOISE EMISSION OF DRAW-OFF WATER TAPS

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INTRODUCTION

In the Acoustisc Laboratory of the Institute for Building Science laboratory tests on the noise emission of draw-off taps for water supply installations have been conducted.

EXPERIMENTAL

The water was circulated by a pump in a closed loop consisting of a 200 l barrel, the test pipe, and the tap to be measured from where the water returned to the barrel. The test wall was a 12 cm thick brick structure plastered on both sides, with a mass per unit area of 240 kg/m^2. The test arrangement was in conformity with the relevant ISO Recommendation.

A thermometer was built in the system by which the temperature of the water could be measured and controlled. The water in the barrel was electrically heated and measurements were performed to check the influence of the water temperature on the noise of the appliances.

RESULTS

The noise of the 1/2" and 3/4" draw-off taps was found to increase with increasing temperature, the amount of noise increase, however, was different with appliances of different design.

The majority of the taps examined showed a larger /4-8 dB/A// noise increase with a temperature change from $20^{\circ}C$ to $50^{\circ}C$ than with a change from $50^{\circ}C$ to $70^{\circ}C$ / 2 dB/A/ /. By some others no change was found till $50^{\circ}C$ and an increase of 4-8 dB/A/ was measured at $70^{\circ}C$. Finally some taps showed no noise level change in the $20^{\circ}C$ - $70^{\circ}C$ range.

The examination of the influence of water temperature on the noise of appliances was started recently and no definite conclusions can be drawn from the relatively small number of measurements. The study will be continued.

REFERENCES

/1/ A.Eisenberg,K.Gösele,C.A.Voigtsberger,P.Schneider,W. Rückward, Berichte aus der Bauforschung /1972/ Heft 75;
/2/ S.Auzou, CAHIER /1972/ 126, /1973/ 139; ISO TC43/SC2/ WG1, 1st Draft Proposal /1973/

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MESSUNGEN VON VENTILATORGERÄUSCH IM STRÖMUNGSKANAL

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EINLEITUNG

Schallmessungen an Ventilatoren, die für den Einbau in ein Kanalsystem vorgesehen sind, sollen nach einem ISO-Entwurf [1] in einem angeschlossenen Kanal durchgeführt werden. Die Vielzahl der Typen und Baugrößen verursacht dabei beim Hersteller einen hohen Aufwand an Meßzeit und Prüfstandsbauten. Es wäre daher wünschenswert, wenn man ähnlich wie bisher schon bei den Leistungs- und Wirkungsgradkennlinien der Strömungsmaschinen auch ihre Schallabstrahlung durch Modellgesetze erfassen könnte, um mit Hilfe der an einem einzigen Modell gewonnenen Meßergebnisse die Schalleistung der übrigen Baugrößen desselben Typs errechnen zu können.

THEORIE

Nach WEIDEMANN [2] läßt sich die spektrale Verteilung des Schalldruckes $\Delta\tilde{p}$ in Form eines Produktansatzes schreiben:

$$\Delta\tilde{p} \sim Re^{\beta} \cdot Ma^{\alpha} \cdot F(St) \cdot G(He)$$

$$\text{mit} \quad Re = \frac{U \cdot D}{\nu} \qquad Ma = \frac{U}{c} \qquad St = \frac{f \cdot D}{U}\frac{\pi}{Z} \qquad He = Ma \cdot St = \frac{D}{\lambda}$$

Darin sind U und D die Umfangsgeschwindigkeit und der Durchmesser des Laufrades, Z seine Schaufelzahl. c und λ sind die Schallgeschwindigkeit und -wellenlänge, ν ist die kinematische Zähigkeit des Fördermediums. Die Frequenz wird mit f bezeichnet. Die beiden ersten Terme beschreiben den Einfluß von Drehzahl und Baugröße, während F(St) die Frequenzverteilung berücksichtigt. Der Systemfrequenzgang G(He) erfaßt die akustischen Abstrahleigenschaften des Ventilators.

EXPERIMENT

Durch Messungen an freilaufenden Radialventilatorlaufrädern, die gegen eine Störkante arbeiten, konnte WEIDEMANN den obigen Produktansatz verifizieren. AGNON [3] führte die Untersuchungen fort, indem er das bei WEIDEMANN fehlende Ventilatorgehäuse hinzunahm. Seine Messungen beziehen sich jedoch auf den frei ansaugenden und ausblasenden Ventilator in einem reflexionsarmen Raum.

In der vorliegenden Arbeit werden die Anwendungsmöglichkeiten und die Grenzen der Ähnlichkeitsgesetze bezüglich der Schallabstrahlung an Radialventilatoren unterschiedlicher Größe und Drehzahlen experimentell untersucht. Die Bestimmung der Schalleistung erfolgt in einem angeschlossenen Strömungskanal unter Beachtung der im Normenentwurf [1] festgelegten Vorschriften.

LITERATUR

[1] ISO/TC 43/SC 1/WG 3; [2] WEIDEMANN, J., DLR-FB 71-12 (1971);
[3] AGNON, R., Proceedings DAGA 1973;

EIGHTH INTERNATIONAL CONGRESS ON ACOUSTICS, LONDON 1974

DOMESTIC APPLIANCE NOISE

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INTRODUCTION

Octave band sound pressure levels in domestic rooms, directivity patterns, acoustic power outputs and frequency spectra of several household appliances have been investigated.

MEASUREMENT ENVIRONMENTS

Appliance noise levels were measured in the appropriate average domestic environment (1 - 3) at characteristic user positions; typical octave band spectra are given in Fig. 1. The other acoustic characteristics of the appliances were measured in an anechoic room (4).

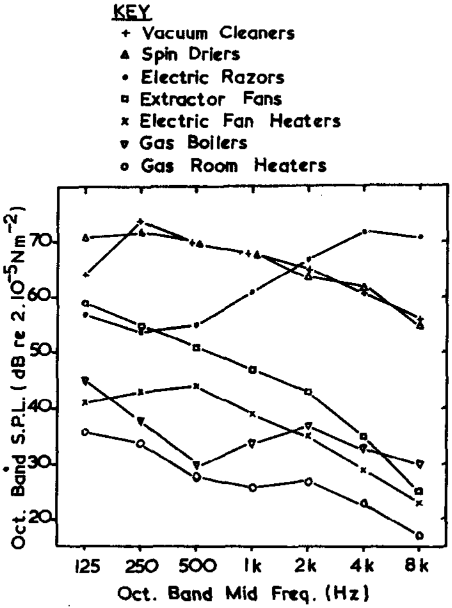

Fig. 1 Domestic room noise levels

RESULTS

Vacuum cleaners and spin driers were the noisiest appliances tested. Most sound was emitted from the top of the spinner and the rear of the cylinder vacuum cleaners. Extractor fans generally had symmetrical directivity patterns and some discrete frequencies. Electric fan heaters usually produced more noise as the heat setting was increased. Directivity patterns depended upon the heater design.

Gas appliances were the quietest tested, although the boilers and fan convector heaters were comparable to electric fan heaters. Their spectra were governed by combustion noise and mixing tube resonances. The radiant-type fires had forward pointing directivity lobes.

By comparison, two types of electric razor were studied - rotary and shuttle, noise levels being measured 3 inches from the cutting heads. Hetrodyne analysis of the shuttle type showed discrete frequencies up to about 16 kHz.

REFERENCES

(1) G. M. Jackson, Univ. London (1972) Ph.D. Thesis; (2 & 3) G. M. Jackson et al. App. Acoust. (1972) 5 265; (1973) 6 277; (4) K. E. Jeatt, Univ. London (1972) M.Sc. Thesis.

EIGHTH INTERNATIONAL CONGRESS ON ACOUSTICS, LONDON 1974

THE EFFECTS OF UPSTREAM DUCT GEOMETRY ON DIFFUSER NOISE GENERATION

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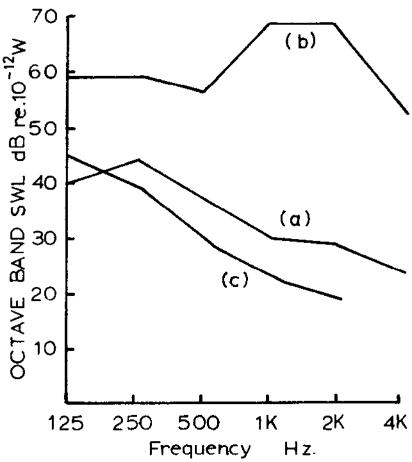
In the last few years a lot of attention has been focussed on the noise generated by duct components in high velocity ventilation systems. However, it is the authors' experience that diffusers in low velocity systems, or in the so-called low velocity sections of high velocity systems represent a more serious problem, and one which is receiving rather less attention.

For more commercially available grilles and diffusers, noise data are available from manufacturers. Unfortunately this is normally based on ideal installations where the diffuser is the only noise source. In practice, diffusers are rarely installed in an ideal manner. They are usually closely preceded by square branch connections or bends, or alternatively by various forms of so-called plenum chambers. The presence of these upstream components considerably modifies the airflow through the diffuser, upsetting the air distribution pattern and causing a very great increase in noise level. The resulting noise generation is a function of the combination of upstream components and diffuser rather than a function of the individual items. In extreme cases the increase in noise level may be as much as 40dB (see Figure 1).



The Effect of Plenum Shape on Diffuser Noise Generation
(a) Manufacturers' data
(b) Diffuser + original plenum
(c) Diffuser + modified plenum

The work outlined in this paper covers measurements of the effects of some common upstream duct geometries on diffuser noise generation. Methods of minimising the increase in noise generation are also examined. The relatively low noise generation of diffusers operating under ideal conditions and their sensitivity to disturbed airflow makes accurate airflow measurement a difficult and tedious business. To overcome this problem, proprietary viscous flow damper elements have been used to provide a quiet, accurate and convenient means of measuring the comparatively low airflows through the diffusers.

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NOISE OF FANS AND ITS DEPENDENCE ON DIMENSIONS AND OPERATIONAL CONDITIONS

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INTRODUCTION

The sound power of the continuous spectra of noise has been investigated for various types of fans. It was assumed that more general rules can be verified.

THEORETICAL ANALYSIS

Using a general formula given by Sharland(1) there could be written the equation (1) for the specific sound power spectral density depending on the diameter D_2 of the machine, on speed $N(s^{-1})$ and length of the blade l_2, see(2)

$$W_f = \rho \cdot c^{-3} \cdot \pi^7 \cdot D_2^6 \cdot N^6 \cdot l_2^2 \cdot (k_4 \cdot k_5)^6 \cdot \phi(\text{fluctuations}, Sh, Q, N, \text{etc.}) \quad (1)$$

and equation (2) for the Strouhal parameter Sh following from frequency f and the chord of a blade l_1.

$$Sh = \frac{f}{\pi \cdot N} \cdot \frac{l_1}{D_2} \cdot \frac{1}{k_4 \cdot k_5} \quad (2)$$

Modification using total pressure and flow capacity Q of a fan can be used according Yudin(3). The coefficients $k_4 \cdot k_5$ express the dependence on the angle of the blades or vanes and on the flow capacity Q of the fan. For the parameter ϕ it is supposed that it is depending strongly on the Strouhal parameter Sh and on the intensity of flow fluctuations. It may be compared for various kinds of fans.

EXPERIMENTAL

From the measurements of continuous sound power spectra of fans the parameter ϕ has been evaluated. After using an empirical correction depending on the efficiency the values of ϕ show to be very close together for various types of fans and flow capacities. Tab. 1 shows typical values of $10.\log_{10}\phi$ in decibels.

Tab.1

Sh	,0315	,063	,125	,25	,5	1	2	4
10.logϕ	-51	-52	-57	-61	-66	-71	-77	-83
	±12	±10	±7	±4	±3	±3	±3	±3

REFERENCES

(1)I.J.Sharland,J.Sound Vib.(1964) 1 302;(2)J.Němec,Proc. 7 ICA Congr.,19 N 10; (3)J.Yudin,Proc.6 ICA Congr.,P-O-9.

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NOISE GENERATED BY PUNCH PRESS FRAME VIBRATIONS

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INTRODUCTION

The impulsive type of noise which is being radiated by the surfaces of a punch press has been investigated experimentally.
A simple mathematical model has been used to investigate theoretically the influence of certain press parameters on the sound pressure level.

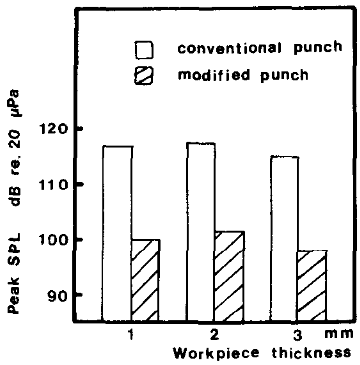
EXPERIMENTAL RESULTS

The sound pressure signal from the press was found to consist of two transients. The first one being generated when the punch hit the work piece. The second and major one, was generated due to the sudden force release when the punch broke through the workpiece. Modifications of the punch shape which eliminated the sudden force release lead to major noise reductions, fig. 1.

Further investigations using a forcing function approximately described by

$$F(t) = F_0 \quad t<0$$
$$= 0 \quad t>0$$

revealed that the major noise radiating surfaces were the presstable and the horisontal surface on the lower part of the ram.



Fig·1

MATHEMATICAL MODEL

A mathematical model consisting of an elastically supported mass represents the sound radiating vibrating system, the major sound radiating surfaces being essentially plane. The impulse response functions for pistons in infinite planar baffles, developed in 1, may then be used to calculate the influence of natural frequency, surface area and the shape of the forcing function on the radiated peak sound pressure level.

REFERENCES

(1) P.R. Stepanishen J.A.S.A. (1971) 49 1629.

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NOISE AND VIBRATION IN AN ELECTRIC ARC MELTING SHOP

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INTRODUCTION

At certain stages in the electric arc melting process there appeared the possibility of infrasound being generated, additional to the prevailing existence of audio and other poor environmental conditions. The operative furnace power could be as high as 40 MW, and model experiments have indicated that as much as 0.05 could be converted into acoustic power. On this basis the acoustic energy would be 0.02 MW; in practice sound pressure levels of 130 dB have been measured near the furnace tap holes.

EXPERIMENTAL

Fig. 1. shows a narrow band analysis of a typical furnace noise output. Generally the dBA noise levels are in excess of recommended exposure levels but those for infra sound (below 20 Hz) are within the safe limits as recently recommended (1). The importance of resonance in the melting shop at low frequencies is illustrated by the presence of standing wave systems, which was evident in particular control cabins. Subjectively there appears to be an appreciable level of ground vibrations in the shop and these are being further investigated.

REFERENCE

(1) Colloquium on Infrasound, Paris, September 1973.

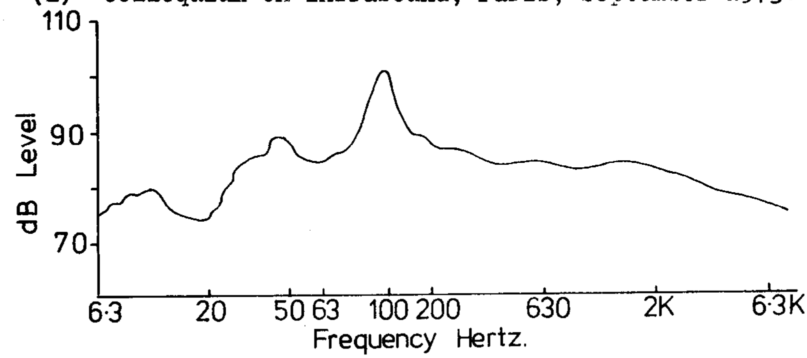

Fig. 1. TYPICAL FREQUENCY SPECTRUM OF ARC FURNACE NOISE.

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IDENTIFYING AND SILENCING THE NOISE SOURCES IN GAS TURBINE POWER STATIONS

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When using gas turbines for electric peak power generation it is desirable to locate the stations close to residential areas. To fulfill noise limits - NR 40 or 45 dB(A) outside dwellings at 200 m distance - for a Swedish-made 60-70 MW installation, it was necessary to consider many widely spaced individual sources:
Compressor air intake, exhaust duct and chimney, building constructions (incl. doors, ventilation louvres etc.) and power transformers. Noise data were scaled from measurements on earlier versions of the components included, e.g. the air intake (compressor) PWL peaked at 2000 Hz with 156 dB re 10^{-12} W.

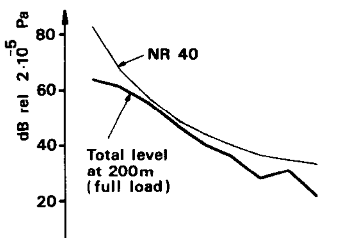
The size of the building (in lightweight steel construction) is about 30 x 35 x 10 m, height of stack is about 30 m. The contributions in different directions from the sources had to be calculated for mufflers and building parts of several designs.

Great efforts were taken to obtain silencers with good aerodynamic properties, i.e. low pressure drop and low turbulence generation. Due to the large quantities of air and hot gases as well as limitations for flow velocities (to ensure sufficient baffle lifetime), parallell type baffles with large spacing have been chosen:

	Gas flow m^3/s	Baffle thickness mm	spacing mm
Intake	300	100	100
Exhaust	595	150	450

The exhaust duct baffles are placed very close to the power turbine, thus they are also serving as splitters of the gas stream giving improved "laminar" flow behind the silencer section.

No considerable low frequency turbulence has been observed from the stack, and - as can be seen from the figure - no very-low-frequency noise problems have occurred. Such "pumping" fluctuations have been reported from other gas turbine stations rather frequently. The levels in the 125 and 250 Hz bands, however, are caused by flow instabilities in the section between horisontal duct and vertical chimney. This will be cured by the introduction of vanes.



Right: Figure showing OB sound pressure levels measured at 200 m for a STAL-LAVAL gas turbine installation.

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SOME PROBLEMS IN THE CALCULATION AND MEASUREMENT OF MAGNETIC NOISE ON CAGE-TYPE INDUCTION MOTORS

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The magnetic noise of an electrical machine is caused by higher harmonics of magnetic induction. The distance between the single tone frequencies of iron core oscillations caused by such forces is at least 50 c/s. /L 1,2/.

Extensive noise examinations were done in an anechoic 320 m^3 chamber with a low limit frequency of 90 c/s on a 2p = 8 motor. The noise was measured in the acoustically far field. On Fig.1 a part of a spectrum recorded by a 6% bandwidth analyzer is shown. Fig.2 shows the same frequency band analysed on a 3,15 c/s bandwidth analyzer. On Fig.3 the time oscillation of tone level for 560 c/s is shown. Thus, a considerably higher number of tones has been found by means of narrow band analyses than it was by calculation. Some of these levels have time oscillations of different periods. This phenomenon was observed both with no load and under load. It was also recorded when vibrations were measured on the housing. Appearance of new tones was also recorded at higher frequencies.

The results of performed examinations show that in the air gap there also exist frequencies other than those which can be calculated according to the actual theory, and by which a considerable noise is caused.

In accurate analyses of the acoustical characteristics of a motor and comparison of calculation and measurement results, great attention should be given to the measurement technique and selectivity of the measuring analyzer.

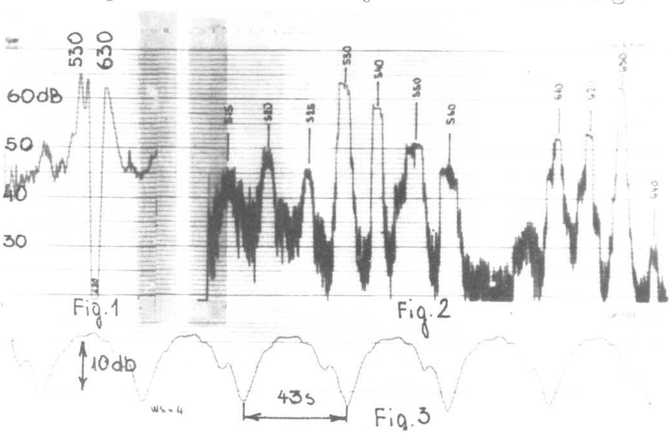

Fig.1 Fig.2 Fig.3

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/2/ Taegen: Ar. Für El. 1964, XLVIII Band, Heft 6

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ON ACOUSTICS, LONDON 1974

NOISE REDUCTION OF TRACTORS TYPE D4K

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INTRODUCTION:

The decreasing of the very high noise-level existing in the tractor-cabs became one of the most urging and important task of developing the up-to-date tractor manufacture.

In course of tests and trials carried out in our Institute before having started with the work we could measure an average level of 95 dB/A in the tractor cab whilst after having finished the tests - as a result of the same - the noise level could be decreased in an average by abt, lo dB-s according to which level of 85 dB/A could have been measured within the noise - reduced cab.

EXPERIMENTAL:

The noise reduction could be reached by accoustical methods namely by reduction of the vibration, isolation of the vibration, noise hindrance and absorption of the noise. To reach these effects there were used up i.e. employed antivibration materials vibration reducing mass polyurethane foam and perforeated artificial leather as well as a Helmholtz-rezonator placed at the top of the cab.

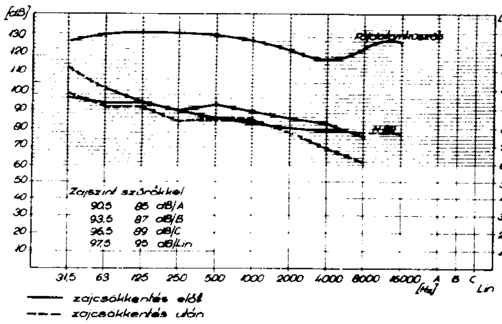

Fig.1 The noise levels before and after the noise reduction

THEORETICAL ANALYSIS

The Halmholtz-resonator has been desingned to that frequency where the noise level exceeded most substentially the N 80 curve prescribed as a limit value in our country. Sizes and characteristic data of the rezonator are indicated by the formulas below.

$$f_o = 5400 \sqrt{\frac{p}{d\,[\,1 + R\,\pi/2\,]}} \quad /\mathrm{Hz}/$$

$$p = \frac{\pi \sum_i R_i^2}{S} \quad \text{perforation quotients}$$

EIGHTH INTERNATIONAL CONGRESS ON ACOUSTICS, LONDON 1974

ÉTUDE COMPARATIVE DU BRUIT ÉMIS PAR LES TUBES GUIDE-BARRES UTILISÉS DANS L'INDUSTRIE DU DÉCOLLETAGE. (ETUDE CT DEC - CNRS AVEC CONCOURS MDIS)

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INTRODUCTION

Sur tour automatique, la barre en cours de décolletage tourne et vient frotter contre les parois du tube guide-barre, leur contact donne lieu à un bruit qui dépend des caractéristiques de la barre (métal, longueur, section) et de sa vitesse de rotation. Il existe quelques tubes "silencieux" mettant en jeu des principes divers (double enveloppe, guidage par ressorts etc...).

La première phase de l'étude d'ensemble du bruit du décolletage a consisté à caractériser acoustiquement les tubes existants dans leurs conditions d'emploi réelles.

MESURES

On a examiné deux tubes ordinaires et sept tubes silencieux, guidant des barres de sections carrée, hexagonale et circulaire, en acier, duralumin et laiton de 5 à 40 mm. Les petites barres (5 à 10 mm) tournant vite (1900 à 9000 tr/mn), ont été essayées sur un tour à poupée mobile et les grosses (14 à 40 mm) tournant lentement (480 à 2900 tr/mn) sur un tour à poupée fixe.

Pour chaque barre, on dispose de cinq à six spectres par tiers d'octave et du niveau pondéré A correspondant à diverses longueurs ; on a calculé des critères caractéristiques du bruit, pour des regroupements par métal, par forme et par dimensions. L'efficacité des tubes silencieux est obtenue en comparant chaque critère à celui qui lui correspond pour le tube ordinaire.

RESULTATS

L'allure moyenne des spectres de bruit est différente pour les petites barres et pour les grosses : la première est en V renversé, la seconde est uniformément croissante. On donne les caractéristiques suivantes : le taux de croissance p et de décroissance q (dB/octave), la fréquence f_m (Hz) ou se situe le niveau maximal L_m (dB), les dispersions a et b (dB) à gauche et à droite, le niveau moyen maximal pondéré A $(L_A)_m$ (dB) et l'écart type σ_A correspondant.

Les tubes silencieux sont caractérisés par l'efficacité maximale Δl (dB) dans le spectre et par l'efficacité globale ΔL_A (dB (A)) et la fréquence au-dessus de laquelle ΔL dépasse 10 dB.

CONCLUSIONS

Le niveau de bruit émis varie dans le même sens que la vitesse de rotation de la barre, il est indépendant du métal qui la compose.

Les spectres relatifs à chaque tube se groupent par familles, qui présentent toutes une même allure moyenne caractéristique du tube, et constituent en quelque sorte sa "signature acoustique". L'atténuation apportée par les tubes guide-barres silencieux est assez faible.

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EXPERIMENTAL INVESTIGATION OF THE NOISE EMISSION OF AIR VALVES

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INTRODUCTION

The knowledge of the noise generating and the noise radiating mechanisms of gasflow regulating valves is of great interest for two reasons. At first a good noise prediction method provides a better projecting of industrial facilities under all operational conditions. Secondly a thorough knowledge of the noise mechanism is necessary to define low noise design criteria for the control valves themselves and for construction of mufflers. The usual prediction methods for noise emitted by control valves are derived from Lighthill's theory on the generation of areodynamic noise and from the acoustic efficiency factor for supercritical flow conditions as defined by Powell. Baumann has developed a widely accepted prediction method using these theories and taking into account the transmission loss of the pipewalls.

EXPERIMENTAL

A wide variety of valve types were measured varying the pressure ratio and the mass flow. It could be concluded that the experimental data fitted fairly well Bauman's predicted values, especially in the supercritical region. The vibrations of the cylindrical pipes were recorded as they are responsible for the radiated noise. The narrow bandwidth frequency analysis shows that the pipe is being excited by the internally generated jet and shock noise and that it radiates the noise in very discrete frequency conponents.