THE BULLETIN

OF THE

AUSTRALIAN ACOUSTICAL SOCIETY

VOL. 2 NO. 3

SPRING 1973

Published by Australian Acoustical Society
P.O. Box 80, CROWS NEST NSW 2065

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C O N T E N T S

A.A.S. ACTIVITIES

1973 ANNUAL GENERAL MEETING

The Annual General Meeting of the Society was held this year on Friday, 14 September at Monash University. The meeting was followed by the 12th Technical Meeting of the Victoria Division at which Messrs. M. Dunn and R. Lam of the Noise Abatement and Aviation Security Branch of the Department of Civil Aviation presented an interesting lecture entitled 'Aircraft Noise'. The Bulletin hopes to be able to report on the subject matter of their lecture in a subsequent issue.

WESTERN AUSTRALIA

Members will be interested to learn of the active first year of the Society's youngest division. In its report to Federal Council, submitted to the 9th Council meeting held in Melbourne on 15th September 1973, the Western Australia Division recorded that its inaugural meeting was held at the University of Western Australia on 10 May 1972. Membership of the Division at 21 June 1973, the date of the 1973 Annual General Meeting, was as follows :-

Honorary Members	1
Members	15
Affiliates	2
Students	4
Subscribers	3
Applications under consideration	5

During the period of just over a year between the inaugural meeting and the 1973 general meeting the Divisional Committee met 6 times and there were 4 Technical Meetings. The subjects discussed at the technical meetings, and the speakers involved were :

The Perceptibility of Reflections ... Mr. M. Barron (of the University of Western Australia)

Acoustical Holography ... Dr. K. Taylor (of the University of Western Australia)

Aircraft Noise ... Dr. C. Mather (of the Public Works Department)

Causes of Deafness ... Dr. D. Clements (E.N.T. Specialist)

The Voice of Silence - the Aims of the W.A. Society for the Advancement of the Deaf .. Dr. H. Blackmore (of the W.A. Society for the Advancement of the Deaf).

In addition the Division undertook a survey of speed boat noise at the request of the W.A. Speed Boat Club and the W.A. Harbour and Light Department. The members involved carried out the noise survey of speed boats operating over their competition course on the Swan River.

Several members of the Division were invited to act as chairmen or speakers at local and overseas seminars and conferences. They included :-
The Otolaryngology Society Conference in New Zealand ... Dr. Clements, Chairman.

45th ANZAAS Congress in conjunction with S.A.A. Symposium, "Living in a Noisy World" ... Dr. C. Mather, Speaker.

Institution of Engineers, Australia, W.A. Division, Seminar, "Perth Polluted - Perth Pleasant", Mr. J. Giroud, Dr. C. Mather, Speakers.

Australian Seminar of the English Speaking Board. Mrs. McCudden, Speaker.

The Division has representation through its members on numerous committees and working groups including :

SAA Technical Committees on Acoustics
SAA Technical Committee Working Groups
The National Health and Medical Research Council Sub-committee on Community Noise and Occupational Health Committee,
The W.A. Noise Abatement Advisory Committee.
The Perth Airport Noise Abatement Committee.

AWARD FOR ARTICLE FOR THE BULLETIN

The NSW -Division of the Society at its 27th Meeting on 11 October 1973 resolved to make an award of $50 for the best article or essay submitted by a student for publication in the Bulletin.

The Committee's intention is that the competition for the award should be open to students in all states in Australia. The closing date for the receipt of contributions for the award, which must be on some aspect of acoustics, and which it is hoped will be able to be published in the Bulletin, is 30 June 1974. Articles submitted must be clearly marked "Student Award", and be accompanied by the requisite evidence to satisfy the judges of the contributor's status as a student.

NEWS AND NOTES

NOISE, SHOCK AND VIBRATION CONFERENCE
22ND - 25TH MAY 1974
MONASH UNIVERSITY, MELBOURNE

This conference is sponsored jointly by the Department of Mechanical Engineering, Monash University; the Australian Acoustical Society (Victoria Division); and the Institution of Engineers, Australia (National Committee on Applied Mechanics).

Registration Fee will be $60 to cover the technical programme, copy of proceedings, lunches and conference dinner.

The programme is planned to include presentations that demonstrate the role of vibration and shock in the understanding of noise generation, explore the need and yield directives for work in the environmental context, provide definitive studies of the origins of mechanical vibration in engineering systems.

Submissions received suggest that there will be technical sessions covering such topics as :-

- Sound Radiation from Vibrating Sources
- Human Response to Noise and Vibration
- Noise Sources - their Control and Use
- Aerodynamic Noise
- Noise Measurement
- Road Vehicle Noise
- Dynamics of Vehicles
- Dynamics of Rotating Machinery
- Dynamics of Beams and Strings
- Vibration of Plates and Shells
- Vibration of Mechanical Plant
- Vibration of Structures
- Damping in Mechanical Systems
- Vibration Measurement
- Calibration and Vibration Test Rigs
- Shock and Vibration Control

Keynote Addresses will include the opening address to be given by Dr. L.L. Beranek (Bolt, Beranek and Newman Inc.) who is to review the general Noise and Vibration field; Professor R.E.D. Bishop (University College London) on Hydroelasticity and Ship Dynamics; Dr. Dix Ward (Hearing Research Laboratory, Minneapolis) and Mr. C. Rice (Institute of Sound and Vibration Research, Southhampton) on the Subjective Aspects of Noise. Other invited papers will include contributions by Bruel & Kjaer on Vibration Signature Analysis; General Radio on Automatic Sound Power Measurements with a Computer, and Impulsphysik on Transient Phenomina and High Speed Photography. Other eminent speakers are to be scheduled.

A particular feature of the Conference will be a Panel Session on Instrumentation when senior engineers of leading world manufacturers of instruments and systems will confront users.

Manufacturers and suppliers of transducers, instruments and of data acquisition, processing and analysing systems will mount technical displays. These will be supplemented by displays of books and journals.

For further information contact :-

The Secretary,
Noise, Shock and Vibration Conference,
Department of Mechanical Engineering,
Monash University,
Clayton, Victoria 3168.

NEW ZEALAND ACOUSTICAL SOCIETY - SYMPOSIUM

The Inaugural Meeting of the New Zealand Acoustical Society was held in Auckland on Monday evening, 20th August. It was followed on 21, 22 and 23 August by an Acoustics Symposium, "Community Noise and Legislation". At the Inaugural Dinner of the N.Z.A.S. held on the evening of 21st August greetings from the Australian Society were conveyed by Mr. P. Knowland.

At the Symposium Dr. Karl Kryter, Director, Sensory Science Research Centre, Stanford Research Institute, California and President of the American Acoustical Society delivered the theme paper, "Criteria and Standards for the Evaluation of Noise Pollution". Nineteen other papers were presented, with subjects covering such topics as legal aspects, town planning, hearing conservation, construction noise, equipment noise, community and traffic noise surveys, ratings for noise, and noise measurement techniques.

Some 80 delegates attended including 15 members of the A.A.S. who enjoyed the friendly hospitality of their New Zealand hosts.

Those presenting papers, in addition to Dr. Kryter mentioned above, were :

C.G. Balachandran
N. Carter
R.S. Carter
L.A. Challis
J.R. Dart
W.A. Davern
H.R. Dawker
J.I. Dunlop
W.J. Glass
P.R. Knowland
A.B. Lawrence
A.H. Marshall
G. Moss
A.D. Paterson
M.F. Rodgers
C.W. Salmon
R. Satory
D.C. Stevenson
R.J. Wakelin

The New Zealanders who registered to attend the Symposium were as follows :

P.J. Brewer	M.L. Heron
A.S. Brewis	D.W. Holmes
R.W. Bridgman	D. Jenkins
L.G. Burt	G.E. Lind Walker
D. Carter	M.P. McKenzie
V.A.L. Chasteau	J. McMichael
R.J. Clark	B.J. Main
H. Elder	R.W. Meadows
D.J. Ferguson	G.K. O'Brien
A. Fitzgerald	G.D. O'Sullivan
J. Fogelberg	D.R. Pattenden
J. Hamlyn	R.C. Pemberton
S. Hampton	M.P. Riley
S.F. Havill	J.S. Rushton
L.W. Hayes	G.W. Ryrie
D.A. Sowry	W.A. Sluce
J.O. Stewart	M.K. Grainger
M.P. Stubbing	W. Keith
F. Tredgett	B.H. Robinson
H.A. Trethowen	H. Rive
R. Van Meeuwen	J.R. Twinn
E.M. Wainscott	F. Bergman
G.W.F. Warren	B.L. Burton
J.A. Waters	J.E. Fitzgerald
J.B. Diack	R.J. Irwin

POST GRADUATE STUDIES -- M.SC. (ACOUSTICS) FACULTY OF ARCHITECTURE, THE UNIVERSITY OF NEW SOUTH WALES

There is a growing need in the community for graduates with a special knowledge of acoustics. This course provides for post-graduate study in several important topics in acoustics, such as noise control in buildings, community noise control, auditorium design, machine, ventilation and air conditioning noise control and acoustical systems and structures. It is designed for graduates in architecture, engineering or science who wish to specialise in these topics and it is suitable for those who wish to practice as consultants or to find employment in industry, research establishments or in larger architectural and engineering offices.

PROFESSIONAL RECOGNITION:

It is confidently expected that after obtaining two years' professional experience graduates will be admitted to the corporate grade of Member of the Australian Acoustical Society. Students of Acoustics are admitted to Student membership of the Society.

ADMISSION REQUIREMENTS:

It is intended that each candidate for admission be considered individually, but in general certain Qualifying Subjects should be completed before entry into the Course.

Candidates holding the degree of B.Sc.(Arch.) of The University of New South Wales (or equivalent qualification) will be required to complete a part-time Qualifying Year. Candidates holding the degree of B.Arch., B.Building, B.Sc., or B.E., of The University of New South Wales (or equivalent qualification) may be required to complete certain qualifying subjects before entry to the Course.

COURSE STRUCTURE :

The course has a duration of Four Sessions, part-time study taken over two years. The first two session cover basic acoustic theory including sound generation , propagation, and in addition a detailed study is made o sound perception and hearing conservation. Instrumenta tion for sound analysis is described and laboratory and field exercises are an important part of the work. Community noise assessment and control is also studied the second session.

Electives in the final two sessions allow students to specialise in particular aspects of acoustics such as engineering noise control, noise control in buildings, auditorium design and acoustical systems and structures. In addition a Graduate Project, on a specific topic, is undertaken by each student.

The course is conducted by Senior Members of the Faculty of Architecture and the School of Physics, with the assistance of visiting acoustic specialists.

S Y M P O S I U M

NOISE AND THE TEXTILE INDUSTRY

Tuesday, 19th February 1974 - 2.00 pm - 8.00 pm
The University of New South Wales

The textile industry may be classified as a noisy industry. Noise levels in excess of 100 dBA are quite common in many processing rooms. This noisiness was seen traditionally as either an occupational hazard or as occupational therapy, but these attitudes are being revised by the recent interest shown by unions and health authorities in hearing conservation.

The aim of the Symposium is to acquaint those involved in the textile industry with recent developments in noise measurement and control, and hearing conservation and legislation. The Conference is aimed at managerial, engineering, personnel and scientific staff

in the textile industry and also at acousticians who may be interested in the problems of this industrial sector.

The Symposium will be divided into two sessions - one in the afternoon dealing mainly with background acoustic theory, and the other session in the evening which deals with the textile industry and its noise problems. Society members are invited to attend the evening session.

ACOUSTICAL EVENTS OVERSEAS, 1974/1975

Czechoslovakia 1-5 October 1974, High Tatra

Topic: "XII. Acoustical Conference on Electroacoustics"

Held by: Acoustical Commission of the Czechosl. Academy of Sciences jointly with the Research Institute of Sound and Picture (VUZORT), TESLA and House of Technique Bratislava

Secretariat: House of Technique
-Acoustical Conference-
Kocelova 17
80000 Bratislava

Great Britain a) 15 January 1974, The University Loughborough

Topic: "Liners and Duct Acoustics"

Held by: the British Acoustical Society, Aerodynamic Noise Group

Secretary: R.P. Itter
1 Birdcage Walk, London SWIH 9JJ

Great Britain b) 2 April 1974

Topic: "Boundary Layer Noise"

Held by: the British Acoustical Society, Aerodynamic Noise Group

Secretary: R.P. Itter
1 Birdcage Walk
London SWIH 9JJ

c) 23-31 July 1974, London
Imperial College of Science and Technology

Topics: "8 ICA 1974 - International Congress on Acoustics

Held by: British Acoustical Society and the Institute of Physics

Secretariat: 8 ICA 1974
47 Belgrave Square
London SWIX 8QX

Satellite Symposia:

d) 22-23 July 1974, the University of Southampton

Topics: "Transportation Noise"

Secretariat: 8 ICA 1974

e) 1-2 August 1974, the University of Birmingham

Topics: "Underwater Acoustics"

Secretariat: 8 ICA 1974

f) 1-2 August 1974, the University of Lancaster

Topics: "Microwave Acoustics"
International Symposium (detection, propagation and interactions in any medium of acoustic waves at microwave frequencies)

Held by: the Institute of Physics

Secretary:
Dr. J.K. Wigmore, Dept. of Physics
University of Lancaster
Lancaster LA1 4YB

Latin America May 1974, Buenos Aires University

Topic: "IV. Jornadas Latino Americanos de Acustica" - all branches of acoustics -

Held by: Grupo de Acusticos Latino-Americanos (GALA) jointly with Universidad National de Buenos Aires

Information: Prof. F.G. Malvarez
Catedra de Acustica
Facultad de Ingegneria
Paseo Colon 850
Buenos Aires

or Prof. G.L. Fuchs
GALA
Ciudad Universitaria
Estafeta 32
Cordoba

Netherlands a) March 1974, Rotterdam

Topic: "New developments in building acoustics" (airborne, impact, flanking sound transmission)

Held by: Nederlands Akoestisch Genootschap

Secretary: Dr. A. de Bruijn
Postbus 162
Delft

b) November 1974, Utrecht

Topic: "Open Meeting"
- all branches of acoustics -

Held by: Nederlands Akoestisch Genootschap
Secretary: Dr. A. de Bruijn
Postbus 162
Delft

Poland Autumn 1974
Topic: "Open Seminary on Acoustics"
Held by: Polish Acoustical Society and Acoustical Committee of the Polish Academy of Sciences
- Details to be announced -

U.S.A. a) 23-26 April 1974, New York
Topic: "Meeting of the Acoustical Society of America"
- all branches of acoustics -
Held by: The Acoustical Society of America
Chairman: Paul B. Ostergaard
Ostergaard Associates
10 Glenwood Way
West Caldwell
New Jersey 07006

b) 5-8 November 1974, St. Louis, Missouri
Topic: "Meeting of the Acoustical Society of America"
- all branches of acoustics -
Held by: The Acoustical Society of America
Chairman: Ira J. Hirsh
Washington University
Box 1094
St. Louis
Missouri 63130

Yougoslavia 3-6 June 1974, Ulcinj
Topic: XVIII ETAN Conference
(electronics, telecommunication-acoustics, bio-medicine technique)
Held by: Yougoslavian Committee ETAN Beograd with Electrotechnical Faculty Titograd
Secretariat: Yougoslavian Committee ETAN
XVUII Conference
P.O.B. 356
11 001 Beograd

Czechoslovakia Autumn 1975
Topic: XIII. Acoustical Conference
- details to be announced -
Held by: the Acoustical Commission of the Czechosl. Academy of Sciences jointly with the House of Technique
Secretariat to be announced.

France September 1975, Paris
Topic: "1st Congress of the FASE on Acoustics"
- acoustics in telecommunication, analysis and synthesis of speech, noise, theoretical acoustics -
Held by: the Groupement des Acousticiens Francaise (GALF)
President: C.N.E.T.
Issy-les-Moulineaux 92

Great Britain:
a) 8-12 July 1975, The University Nottingham
Topic: "2nd International Conference on Phonon Scattering in Solids"
Held by: The Institute of Physics
47 Belgrave Square
London SW1X 8QX

b) 17-23 August 1975, The University Leeds
Topic: "8th International Congress of Phonetic Sciences"
Secretariat: Department of Phonetics
The University
Leeds LS2 9JT

ECHOES

Under this heading it is hoped to publish articles of historical interest to Australian acousticians. The editorial Committee invites contributions from members to place on record something of the history of acoustics in Australia. The AAS is itself very youthful, having not yet spanned 10 years from its origin. Nevertheless among its members are those who grew up and had their early training when the classical publications of Lord Rayleigh and W.C. Sabine were still appearing. In this issue a brief item is published based on information forwarded by Mr. John F. Heine, a member of the formative committee of the Victoria Division from 1964 to 1968.

Mr. Heine retired from a managerial position in 1973 after more than twenty years association with the Australian Gypsum Limited group of companies. Quite a number of active members of the Society had their early experience in applied acoustics in companies allied with A.G.L., and will recall early association with John Heine. The Society wishes him well in his declared intent to become at last a 'professional' amateur radio man - an activity he had pursued merely as a hobby for 46 years before his retirement.

Sound Absorption in Earlier Times - Manufacture and Measurement

Mr. John Heine began his association with AGL in 1951. During the fifties he was concerned with the technical development of modern sound absorbing

products manufactured by Insulwool Products Pty. Ltd. The latter company commenced production of mineral wool in the early forties with a new plant at Nunawading. Although this was the first large-scale production plant operated in Australia, it had been preceded by at least one other small Australian Plant - for example one owned by the firm Victor Leggo & Farmers which produced small quantities of loose and granulated mineral wool at Footscray-Yarraville during the 1930's and possibly earlier.

James Bell Mineral Products commenced the manufacture of sound absorbing products in the early thirties first with 'Sorbsound' (sprayed pumice) and later with "Perfotile" utilising a moulded perforated plaster face with a backing of loose mineral wool absorbent.

The use of a perforated plate facing an absorbent was by arrangement with the Burgess-Manning Co. of the U.S.A. under patents by Dr. Burgess of Chicago.

The firm James Bell Mineral Products later joined the Australian Gypsum Group. Mr. Cyril Coffey, the Manager, was instrumental in the foundation of Insulwool Products and the commencement of manufacture of mineral wool in loose, granulated and Batt form.

Company files contain correspondence on laboratory testing of materials of American origin, the tests at that time being carried out in the U.S.A. for the General Insulation Manufacturing Co. of Indiana (GIMCO).

Insulwool Products for many years had a technical arrangement with Mr. Richardson a consultant associated with that Company.

The following copy of a test report of the late 1920's, from the laboratory of Dr. Vern O. Knudsen, Physicist and Consultant on Acoustics, 907 N. Mariposa Avenue, Los Angeles, is reproduced here in full. It is the earliest example from a number supplied concerning materials in which James Bell Mineral Products were interested, following personal contact between Dr. Knudsen and Mr. Cyril Coffey, Manager of that company.

"REPORT ON SOUND-ABSORPTIVE TEST OF GIMCO ROCK WOOL :

This will report the results of tests conducted by the writer for the purpose of determining the coefficients of sound-absorption of Gimco Rock Wool. Tests were made on the standard 1" thickness, 1½" thickness, and a combination of these two thicknesses separated by a 1½" air-space. The Gimco Rock Wool was covered with cheesecloth. In addition, the exposed side was covered with 1" mesh chicken wire and the rear side was covered with wire lath. The test area in each case was 64 sq. ft. The Gimco Rock Wool was placed directly upon the floor of the sound chamber. In the case of the double layer test the two layers were separated by wood strips spaced 16" on centres. The 1½" layer was against the floor and the 1" layer was exposed directly to the sound in the room. The method of conducting the tests was essentially the reverberation method as described by the writer in the Journal of the Optical Society and Review of Scientific Instruments, November 1926. Tests were made for tones of the following frequencies: 128 d.v., 256 d.v., 512 d.v., 1024 d.v., and 2048 d.v. This embraces the more important range of frequencies employed in speech and music.

The results obtained in these tests are given in the following table:

Specimen	128 dv	256 dv	512 dv	1024 dv	2048 dv
1" layer	.27	.40	.56	.65	.68
1½" layer	.40	.49	.61	.67	.69
Double layer -- one 1" and one 1½" separated by 1" air-space	.51	.60	.65	.71	.73

These tests indicated that Gimco Rock Wool has very high acoustic merit as a sound absorbent. The double layer combination possesses uniformly high absorption throughout the useful range of frequencies employed in speech and music. This combination should be particularly meritorious for the acoustic treatment of rooms used for the recording of speech and music.

Respectfully submitted,
Vern O. Knudsen

March 6, 1929"

Reference to the article by Knudsen in the J.O.S.R.S.I. November 1926 reveals that its title was "Measurement of Reverberation Using the Thermionic Tube Oscillator as a Source". Its main point was that in the preceding 3 years the introduction of thermionic tubes has revolutionized Knudsen's measurement of reverberation time in the laboratory, and particularly so in the field. The impact in the latter case will be appreciated when it is realized that the source equipment (supplanted by the valve oscillator, galvanometer, attenuator, loudspeaker, etc.) he described, had hitherto consisted of four similar organ pipes for each frequency, complete with air supply.

It is interesting to note however that in 1926 the microphone and electrical timing device had not yet replaced the ear and stopwatch, which were still used at

the receiving end of the experiment as Sabine had done 30 years before. Furthermore, because pure tone excitation was used, it was still necessary to repeat the measurement of reverberation time at 25 to 50 positions in the room; and up to 50 sound decays were measured at each position!

The test report reproduced above covered the frequency range 128 d.v. to 2048 d.v. but another of the same year had already extended the frequency range to 4096 d.v. because "many of the motion picture technicians have expressed a desire to know the absorption coefficient for frequencies as high as this".

Unfortunately, none of these early laboratory reports, nor the 1926 article by Knudsen, give a clue to the meaning of the abbreviation "d.v." for the contemporary unit of frequency. Can any reader throw light on this question?

LETTERS TO THE EDITOR

Dear Sir,

Further to Mr. R.C. Donnan's article in Vol. 2 No. 2 of AAS Bulletin I would like to mention the following:-

It is well-known that the relationship between room volume and specimen area affects the sound absorption coefficient as determined by the reverberation room method. This has been reported by:-

1. V.L. Chester, Journal of Research of National Bureau of Standards, Vol 13, August, 1934
2. C.W. Kosten, Acustica, Vol. 10 (1960), p.400
3. E.D. Daniel, J.A.S.A., Vol. 35, No. 4, p 571 (April, 1963).

The relationship is such that for the same sample area a higher sound absorption coefficient is obtained in a room with larger volume. Conversely, for a fixed room volume a higher result is obtained by reducing the sample area.

The sample size and room volume used in Australian testing meets the requirements of Australian Standard 1045-1971 which in turn is in conformity with the International Standards Organisation recommendation R354. Basically, the room volume required is larger than 180 m^3 and as close to 200 m^3 as practicable. The sample area should be between 10 m^2 and 12 m^2.

The U.S. tests referred to by Mr. R.C. Donnan have been carried out using a sample area of 6.7 m^2 as recommended by A.S.T.M. method C423-66. The room volume used was about 291 m^3.

Hence the sound absorption coefficients obtained by the U.S. testing authority would be expected to be higher than those obtained by the Australian laboratory.

Because of these differences it would be quite meaningless to compare materials on the basis of tests carried out in different laboratories working to differ specifications in respect of room volume and sample are The only valid comparison of test results is when they have been carried out in the same facility using the sa method.

As there is an Australian Standard and there exis facilities in Australia for the determination of sound sorption coefficients of sound-absorbing materials, it only reasonable for specifiers to require the presentat of absorption data obtained using this Standard as a gu

A.A. PARTS
SECTION LEADER, ACOUSTIC
CSR BUILDING MATERIALS
RESEARCH LABORATORIES, S

Dear Sir,

Re "Measuring Sound Absorption", Bulletin Vol 2 No. 2.

We have visited and studied the Riverbank Acoustical Laboratories in U.S.A., where most American sound absorption tests are carried out, presumably including the series described in the article by Mr. R.C. Donnan.

In addition to the significant differences introduced by the larger room volume and the smaller specimer size compared with the Australian Standard procedure, a feature which appears worth mentioning is the arrangemer at Riverbank, for holding the specimen under test. This device is an aluminium framework, resting on and sealed to the floor, with the tiles or panels mounted face upwards. An air space of 16 in. is provided below the specimen, and the sides of the frame are covered with panels to create a sound-tight chamber. This whole mounting system is removed from the chamber when the 'empty' reverberation time is being measured. This means that any sound absorption offered by the mounting rig (though probably small at mid and high frequencies, is ascribed to the test specimen.

In the Australian laboratory, presumably that at the Commonwealth Experimental Building Station, the specimen is installed in a ceiling rig which is a permanent part of the test chamber. The tiles or panels are supported in the conventional face-down attitude, using regular commercial metal suspension systems. Any absorption offered by this mounting rig is included in the 'empty' room test, and thus excluded from the absorption ascribed to the specimen.

ROGER WILKINSON
CARR & WILKINSON, SYDNE

NOISE LEGISLATION IN AUSTRALIA

C. E. MATHER, Ph.D

Investigating Architect

Public Works Department, W.A.

This paper discusses firstly some of the principles and difficulties involved in legislating to abate noise nuisance. It examines next the extent and nature of legislative developments in the various States and Territories, including the similarities and differences between them. Lastly it describes some of the practical problems associated with noise abatement legislation, and discusses several possible strategies to increase its effectiveness.

1. INTRODUCTION

In general, legislation to abate noise nuisance has two distinct objectives - the minimisation of noise induced annoyance in communities, and the reduction of the incidence of noise induced hearing loss in communities.

Noise abatement by legislation involves balancing the rights and remedies of society (8). In doing this, two factors should be taken into account:
(a) that on some occasions people will, in all probability, have to accept a certain amount of noise induced annoyance and hearing loss, and
(b) that the permitted extent of such noise induced annoyance and hearing loss should be determined for each case on its own particular set of circumstances so that the costs to the noise annoyed or impaired person can be evaluated against the utility to the community from the noise-maker's activity (8).

"Nuisance" is neither new nor unique to noise. For example, for hundreds of years courts have been attempting to reconcile the conflicting interests of property owners who believe that ownership entitles them to unrestrained use of their property regardless of the extent of neighbourhood nuisance, and of those who believe that ownership entitles them to nuisance - free use of their property through the appropriate restraint of their neighbours (1).

It is important to realise that it is more difficult to legislate for the abatement of noise nuisance than it is for the abatement of many other nuisances due to the substantial variations in individual responses to noise.

With regard to noise induced annoyance, there is, at this point in time, no single, generally applicable method for assessing it accurately in terms of the classic stimulus/response relationship, and consequently legislative criteria cannot be established easily.

With regard to noise induced hearing loss, this could, in theory, be eliminated if exposures were to be:
(a) held to sufficiently low levels,
(b) held to sufficiently short durations, or
(c) allowed to occur only rarely (10).
In practice, however, the elimination of noise induced hearing loss is difficult as its extent depends in part on a person's accumulated exposure to all the noise sources he encounters, and whilst it is generally possible to control sufficiently his occupational noise exposure, this is not possible with his non-occupational exposure.

On the other hand, legislating for the reduction of the incidence of noise induced hearing loss is easier than legislating for the minimisation of noise induced annoyance as the methods for its assessment in terms of stimulus/response relationships are comparatively well defined.

2. AUSTRALIAN LEGISLATION

2.1. General

Noise abatement legislation is only now being introduced in Australia many years subsequent to several other countries, such as England, whose first laws relating solely to noise were promulgated in 1960. So far, legislation has not been effected at the national level and is currently being handled by the States and Territories individually. This decentralisation could lead to idiosyncratic legislation in each of them which, in turn, could contribute to economic disunity nationally. Recently, however, the National Health and Medical Research Council set up two ad-hoc sub-committees to advise it on legislative principles, suitable for adoption throughout Australia, for abating noise induced annoyance and hearing loss. Recommendations are currently being formulated, and if the States can be encouraged to adopt, or take cognizance of

these in their own legislation, this should contribute significantly towards legislative consistency between the States and within the Territories (see also Section 2.2.7 below).

2.2. Developments to Date - State and Federal

2.2.1. Western Australia (3). In Western Australia, enabling legislation dealing solely with noise, known as the Noise Abatement Act, was assented to on December 6, 1972. This legislation, by defining noise or vibration nuisance as that which affects adversely a person's rightful physical, mental or social well-being, provides for the abatement of both noise induced annoyance and hearing loss. The Act also provides for:

(a) the establishment of a Noise and Vibration Council which will, subject to the Minister for Health, and with the technical advice of a Noise Abatement Advisory Committee, be responsible for its administration;

(b) local authorities to restrain noise induced annoyance;

(c) the appointment of inspectors to examine property or its equipment; and

(d) the imposing of specified penalties for contravention of, or failure to comply with the Act.

Complaints regarding noise induced annoyance must generally be made by three or more affected owners/occupiers of land or premises, but will be considered when made by fewer persons if less than three were affected or were willing to complain.

Regulations defining criteria for assessing and abating noise nuisance, and which will put the principles of the Act into effect, are currently being drafted and will be in two main parts:

(a) those relating to the abatement of noise induced annoyance within the community generally, with emphasis on residential activities particularly; these will probably be the first regulations enacted; and

(b) those relating to the abatement of noise induced hearing loss generally, with emphasis on occupational activities particularly.

These Regulations will, wherever possible, incorporate the concepts contained in relevant codes produced by the Standards Association of Australia, particularly AS 1055 Noise Assessment in Residential Areas and DR 72084 Hearing Conservation (shortly due to be issued as a code). In addition, cognizance will be taken of the recommendations to be produced by the National Health and Medical Research Council.

2.2.2. South Australia (15)

Enabling legislation for noise abatement, apparently to be very similar to that produced in Western Australia, is currently being formulated, the final draft of which is presently with the Parliamentary Draftsman.

One possible difference between this and the Western Australian Act may be that provision for only one administrative body, either a Council or a Committee, will be made. However, it is anticipated that regulations to be made under the Act will, as in Western Australia, follow closely concepts contained in relevant codes produced by the Standards Association of Australia and the recommendations to be made by the National Health and Medical Research Council.

2.2.3. New South Wales (7,16)

Noise abatement legislation in New South Wales has been foreshadowed by this State's politicians since 1971 and recent press releases have reported that a Noise Control Bill will be put before State Parliament during its current session. This legislation has been drafted largely by the Division of Occupational Health and Pollution Control of the Health Commission, and was recently submitted to Parliamentary Counsel.

The Noise Control Bill will be, in part, enabling legislation which provides for the administrative processes to abate noise induced annoyance and hearing loss. However, it will also define criteria for their assessment and abatement. These will probably include provisions for:

(a) noise rating tests on certain types of equipment;

(b) limiting noise emissions from industry, motor vehicles, and construction and demolition;

(c) limiting noise emissions within occupational situations; and

(d) the zoning of low-noise areas.

2.2.4. Victoria (2,14)

In Victoria, enabling legislation is at present limited to the abatement of noise induced annoyance and is contained in the Environment Protection Act 1970, Part VIII - Control of Noise. This Part provides for:

(a) the establishment of guidelines to limit noise emissions;

(b) the licensing of certain noise emissions to exceed the noise limits prescribed;

(c) the making of regulations defining "objectionable noise"; and

(d) the imposing of specified penalties for failure to comply with the provisions prescribed.

An ad-hoc Committee on Noise Control Policy, established to draw up the guidelines and regulations, has just completed the first set of regulations which provide for the control of noise from industrial, trade and business premises, and from motor vehicles with faulty or amplifying exhaust systems. These Regulations, which are presently awaiting approval by the Environment Protection Authority before being passed to Parliamentary Counsel, do not prescribe any limiting noise levels as it was felt that the problems involved in their enforcement would be too great.

The Committee has also drafted guidelines to define acceptable noise conditions in terms of emission limits from stationary sources, for adoption as an environment protection policy. This policy will initially be confined to one municipality (Richmond); however, with appropriate adjustments, it will eventually be applicable throughout Victoria. Mobile noise sources, such as motor vehicles, will be dealt with under a separate policy or policies.

2.2.5. Queensland (11)

No noise abatement legislation has been drafted as yet in Queensland. However, in December 1979 a Bill, passed as an amendment to the State Development and Public Works Organisation Acts, provided for the establishment of an Environmental Control Council, under which three technical advisory committees were set up. One of these, the Noise Control Committee, deals specifically with noise pollution and has recently recommended to the Council that legislation to abate occupation noise induced deafness is needed. However, this will probably take the form of amendments to appropriate, existing Acts. The Committee has also undertaken a study on aircraft noise near Brisbane Airport, and is currently undertaking studies on motor vehicle noise and noise induced annoyance in metropolitan areas.

In addition to the above developments, the Environmental Control Council has decided lately to set up a further committee to prepare enabling legislation for the abatement of noise induced annoyance. This committee's membership will consist of representatives from the Department of Local Government, the Police Department, the Department of Health, the Department of Transport and the Co-ordinator-General's Department.

2.2.6. Tasmania (13)

In Tasmania, enabling noise abatement legislation is incorporated in the Environment Protection Bill, which was assented to in July 1973. The pertinent clause of this Bill provides for :

(a) the making of regulations specifying noise standards; and

(b) the imposing of specified penalties on those persons responsible for emitting noise that is "harmful" or "offensive" to human beings.

In addition, noise is defined to include infra- and ultra-sound as well as the audible frequency range.

2.2.7. The Federal Ministration and the Territories

No noise abatement legislation has been enacted in the Territories. However, legislative prototypes, suitable for adoption throughout Australia, are currently being drafted by ad-hoc sub-committees of the National Health and Medical Research Council. The two sub-committees undertaking this work are :

(a) the ad-hoc Sub-committee on Community Noise which is advising the Environmental Health Committee on legislative principles for the abatement of noise induced annoyance; and

(b) the ad-hoc Sub-committee on Hearing Conservation which is advising the Occupational Health Committee on model legislation, including criteria, for the abatement of noise induced hearing loss.

The work of the former Sub-committee is progressing through a number of working parties set up to examine various categories of noise sources which induce annoyance within communities.

The work of the latter Sub-committee is well advanced, and it is intended to present draft model legislation to the Council for its approval later this year.

3. SOME PRACTICAL PROBLEMS CONCOMITANT WITH NOISE ABATEMENT LEGISLATION

3.1. Public Support

As in most areas of environmental control, legislation and its enforcement seem to be necessary to abate noise. However, they tend to connote a coercive rather than persuasive approach to the matter (12), and this can provoke a certain amount of public apathy and resistance.

In addition, the community generally is prone to be unaware of the physiological and psychological effects of noise, and of the fact that measures can be taken to eliminate or abate many noises. These factors can also contribute to a certain amount of apathy and resistance.

3.2. Type of Legislation

3.2.1. "Unnecessary Noise" Legislation

The major problem with legislation that defines

"unnecessary" or "deemed to cause annoyance" noise sources is the extent of subjective judgement which must sometimes be used by the enforcing officer and it is possible that, because of this, it could be attacked as unconstitutional on the grounds of arbitrariness and vagueness (9).

3.2.2. "Decibel Limit" Legislation

There are several problems regarding standard setting, enforcement and constitutionality with legislation that defines limiting noise levels. Some of these are as follows :

(a) enforcement tends to be expensive as it required special equipment and personnel;
(b) the noise being investigated cannot be isolated from its environment and measurement of it may therefore be affected significantly by other sounds; in addition, the meter is affected by the physical nature of the surroundings and by atmospheric conditions;
(c) if the noise under investigation exceeds the permissible limit but is compounded of noise emitted from several sources, none of which individually exceed the limit, it could be very difficult to apportion liability (9).

4. SOME STRATEGIES TO INCREASE THE EFFECTIVENESS OF NOISE LEGISLATION

4.1. General

For noise legislation to be maximally effective, it is usually necessary for it :
(a) to provide for efficacious enforcement;
(b) to have the acceptance and support of the public; and
(c) to be regarded as provisional, so that it may be updated in accordance with changing needs and the latest research findings (4).

4.2. Public Acceptance and Support

In order to gain the public's acceptance of, and support for noise abatement legislation, it is necessary to provide suitable propaganda programmes directed towards making people sufficiently aware of noise and its detrimental effects. Aspects of such programmes could include:
(a) the establishment of an organisation, or branch within an existing organisation, to instigate, administer and co-ordinate the propaganda programmes; such an organisation could be similar to the now disbanded American National Noise Abatement Council (5), which was supported by the noise-control products industry and by some firms seeking means of abating noise;
(b) the encouragement of existing organisations, e.g. local citizen groups, professional organisations and service clubs, to support and endorse citizen action against noise;
(c) an increase in the number of comprehensive courses at tertiary level; such courses should be appropriate for all those occupations which, or may in the future, include noise abatement and control, or related aspects, in their activities;
(d) an icnrease in the number of scholarships available to further research into noise;
(e) the establishment of continuing education programmes in industry on noise and its effects (5);
(f) the establishment of an educational "clearing-house" to assist relevant graduate and under-graduate education (5);
(g) a substantial increase in the availability of attractively presented information in schools, libraries, museum and other suitable insttituions (5);
(h) a substantial increase in the quantity and quality of information disseminated through the mass media; and
(i) an increase in the number of regular public symposia and seminars on noise; these should be on the international as well as the national and state levels (6).

4.3. Taxes and Loans

Whilst it would probably be difficult to tax noise-makers directly, Federal and State Governments could possibly offer tax inducements to encourage the use of treatments or procedures to achieve the abatement of noise For example, a company could be allowed to treat expenditure incurred in noise abatement as a business expense for immediate tax write-off rather than having to depreciate it over several years (6).

In addition to tax reliefs, the Federal and State Governments could provide low interest loans to companies unable to secure equivalent funds from other accepted sources.

4.4. Overview

Whilst voluntarily adopted noise abatement measures are probably the most acceptable to the community generally, their effectiveness cannot be relied on solely at this time and some legislative measures are required also. Such measures should be judicious, gradual and uniform whenever possible, and an increase in the Federal Government's active involvement in noise abatement could assist in achieving this.

In addition, those involved in noise abatement should consider the possibility, suggested in America (12), of motivating communities generally to actively desire and seek quiet conditions.

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NOISE CONTROL IN SECONDARY INDUSTRY

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The aims of noise control in secondary industry as in all industry is to ensure that the industry or factory is in harmony with the community living and working both within and without the factory.

From the acoustician's point of view the measures required to control a noise vary according to the nature of the noise and the aim of the noise control measures. The common aims of noise control in secondary industry are listed below :-

1) to ensure freedom from community disturbance.
2) To conserve the hearing of workers in the plant.
3) To permit free speech communication in the plant.
4) To provide amenable working conditions.

The legal and moral incentives for proper noise control to achieve the aims listed above are increasing daily; and the aim of this discourse is to discuss ways of achieving these aims rather than either the motivating forces behind the aims or the degree to which the aims should be pursued.

Considering now noise control to avoid community disturbance, the important control procedures are :-

1) Control by Town Planning.
2) Control by Factory Layout and Planning.
3) Control by Silencers to blowers, vacuum pumps, compressors and the like.
4) Control by blow-down type silencers to air, steam and gas blow-offs.
5) Control by enclosures around pumps, compressors, gear boxes, plastic grinders and similar.
6) Control by sound absorption within the factory.
7) Control by Factory shell sound absorption.

If you have a factory with a community noise problem, it is a bit late to start organising some town planning. It is notable that many factories we have seen are not very noisy and would not have a problem had they been properly separated from residential areas. Whilst it is agreed that most people working in noise control see the badly planned (or more correctly the unplanned areas) it is also agreed that no municipality has been known to properly separate industrial and residential areas. A main road or a train line are commonly used separators, but form inadequate acoustical barriers. An extensive Light Industrial (See footnote 1.) area is sometimes used as a buffer by Municipalities who fail to realize that there is virtually no such thing as light industry. An ideal barrier would be formed by a grassed or wooded hill surrounding the industrial area

Factory planning is very useful for the large number of factories which are relatively quiet except for one or two devices such as an air compressor or cooling tower. Simply locating these noisy devices away from the residential areas or within that part of the factory building which is most so isolating, may be all the noise control required for commun acceptance.

The intakes or discharge from blowers, fans, compresso vacuum pumps, internal combustion engines and the like form a potent source of community annoyance which are easily treated by rpoprietary silencers, or silencers custom-desig for the application.

In the same way blow-offs from boilers, process lines and the like form a concentrated high-intensity noise source which can be readily treated by blow-off silencers.

Where factories with compressors and similar equipment are so close to residential areas that intake silencers alor are not sufficient, then it is necessary to provide complete enclosures around the noisy machines. This is not as simple as it sounds and the subject of enclosures is dealt with later on in this paper.

So far we have been considering factories or plants which are acceptably quiet from the community noise point of view, excepting only for one or two easily treated noisy items of plant. Now if all of the production plant is noisy as for example in a repetition engineering shop then the question is often asked as to whether the application of sou absorbing baffles or materials suspended or otherwise fixed inside the factory would provide adequate reduction. All theory would suggest that the noise reduction from internal sound absorption is very limited. However, on the occasions we have seen this technique used, it has been surprisingly effective.

When all of the above treatments are inapplicable, the sure and certain method of noise control is to provide a sou

isolating shell (that is walls, doors, windows, vents and roof) to the factory.

This treatment or, more correctly, form of building design can confidently be expected to give the desired noise reduction but is not widely used because of the cost of a sound isolating structure. For an existing factory there are the added difficulties and inconveniences of pulling down the present structure so that a new one can be built. Even if a new structure is not required the difficulties of upgrading the existing structure are formidable.

Thus far, the discussion has been concerned with reducing the noise intensity from industrial plants as heard outside the plant in the neighbouring community.

Now we are to consider hearing conservation, free speech communication and amenable working conditions. For each of these we must aim at reducing the noise level inside the factory as distinct from outside the factory although almost any measure which reduces the noise inside a factory will also reduce the noise outside the factory.

Many of the noise control measures mentioned above in the control of noise outside the factory are equally applicable for the control of noise inside the factory; such measures include the provision of various sorts of silencers and enclosures and the provision of sound absorbing materials to the interior of the factory.

Not previously mentioned are the noise reductions possible by changes in manufacturing techniques such as the change from impact rivetting to squeeze rivetting; another example is the use of welded duct seams instead of "Pittsburgh" seams.

Apart from reducing the noise within the factory there are other ways of reducing the risk of damage to hearing, such as the use of ear plugs or ear muffs or by using quiet rooms. Quiet rooms are sound isolating rooms widely used in which could be called process type industry; in paper mills, power stations, chemical and other plants where the noise is generated by the whole of the plant to form an extended and almost untreatable source.

For those not familiar with them, quiet rooms customarily are glazed on four sides, air-conditioned, contain a working desk and telephone, and have enough room for the occupant to put his feet up. The rooms are intended to be a haven to which the operators can retire to make out reports, have their morning tea, or perform any duty not requiring them to be on the plant floor. Whilst not reducing the factory noise these rooms materially reduce or eliminate the risk of damage to ears because of the characteristics of the human ear whereby a noise which would be deafening over a lifetime of continuous exposure is not deafening when there are intervals between periods of exposure.

To provide a better working idea of how noise control is effective in practice an example of a compressor enclosure is discussed in detail. Fig. 1 shows the elements of such an enclosure.

Elements (1) and (2). Isolating springs and isolating piping would practically never be required in an industrial situation but isolation may be required for example if the enclosure were around a drop hammer.

Element (3). The receiver should be within the enclosure, as the pulsating airflow into the receiver causes it to ring and so act as a secondary source of sound. Alternatively a line silencer can be fitted between the compressor and receiver.

Element (4). The compressor intake should deliver cool air to the compressor, otherwise the compressor air delivery will be reduced.

Elements (5) and (6). The need for providing cooling air is not always properly realised. Because sound isolating enclosures are universally thermally insulating, even a small heat input to the enclosure will cause a large temperature rise. For design purposes the total electrical input to the motor can be regarded as being converted to heat, and cooling air at the rate of about 100 to 200 cubic feet per minute per kilowatt is commonly required. The acoustical performance of the silencers should of course be in keeping with the performance of the enclosure.

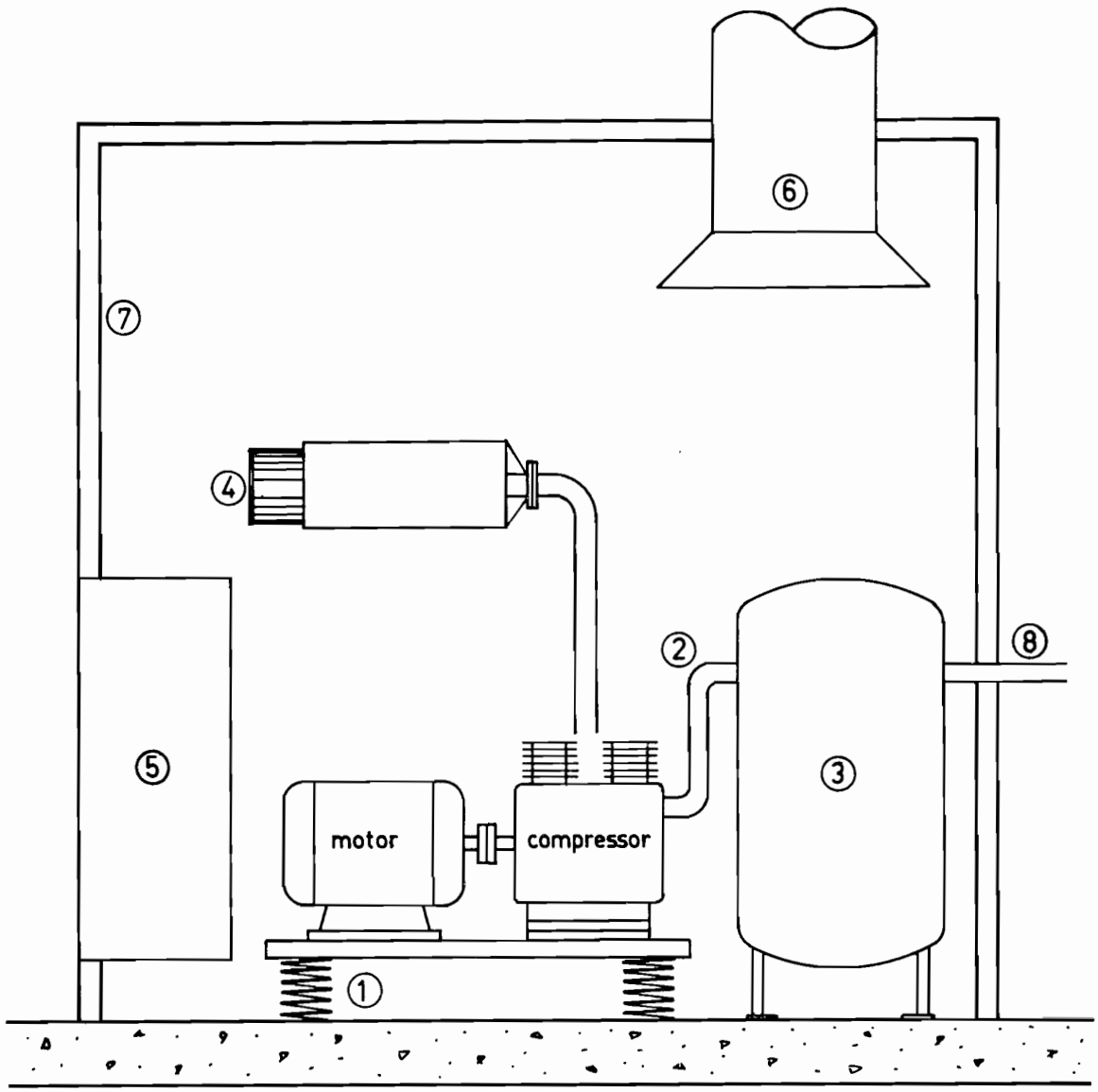
Element (7). The enclosure walls need to be sound absorptive and sound isolating to the degree required.

Element (8). All penetrations for pipes, conduits, or personnel access should be sealed so that the performance of the enclosure is not degraded.

Finally, this discussion would not be complete without a brief discussion of what cannot be done.

Mentioned earlier was the "process" type industry, which is characterised by large plants forming extended sound sources. In general it can be said that process type plants, unless unusually located, are easily treated by controlling the noise of the dominant sources, by the use of quiet rooms, and by sound absorptive treatment.

Production line type plants are in general more difficult to control. These plants include those of the automotive and appliance manufacturers, repetition engineers, and the like, are usually less remote from the residential community, and often have many impact noise sources from small presses, rivetters, etc. It



① Spring mounting.
② Compliant piping between compressor & receiver.
③ Receiver within the enclosure.
④ Compressor intake near cooling air intake.
⑤ Enclosure cooling air intake silencer.
⑥ Enclosure cooling air fan and discharge silencer.
⑦ Enclosure walls, sound absorptive & sound isolating.
⑧ Sealed penetrations.

FIGURE 1

IDEALISED ENCLOSURE SHOWING THE IMPORTANT ELEMENTS OF A SOUND ISOLATING ENCLOSURE

is probably true to say, however, that none cannot be adequately quietened, given sufficient time and money.

Tradesman-type industries as the classification implies involve tradesmen who move from machine to machine or use one hand tool or another according to the job on hand. Such industries include cabinet makers, steel fabricators, sheetmetal workers, as well as builders, building demolishers and ship builders. It is here that the impossible noise control task is found; if you want to remove a weld in a hurry you use a high speed grinder which makes a deafening sound; if you want to dress over a rivet you use a large hammer to "belt" it. These and many other processes cannot be quietened and ca-not at present be abandoned without an economic penalty which the community is not prepared to pay.

Footnote No. 1. Light industry has a legal meaning in Victoria and is defined as follows:-

"Light Industry" means any industry whether or not particularly described or defined -

(a) in which the processes carried on, the materials and machinery used and the transportation of materials, goods and commodities to and from the premises will not cause injury to or prejudicially affect the amenity of the locality by reason of the emission of noise, vibration, smell, fumes, smoke, vapour, steam. soot, ash , dust, waste water, waste products, grit, oil or otherwise and

(b) the establishment of which will not or the conduct of which does not impose an undue load on any existing or projected service for the supply or provision of water, gas, electricity, sewerage facilities, or any other like service.

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