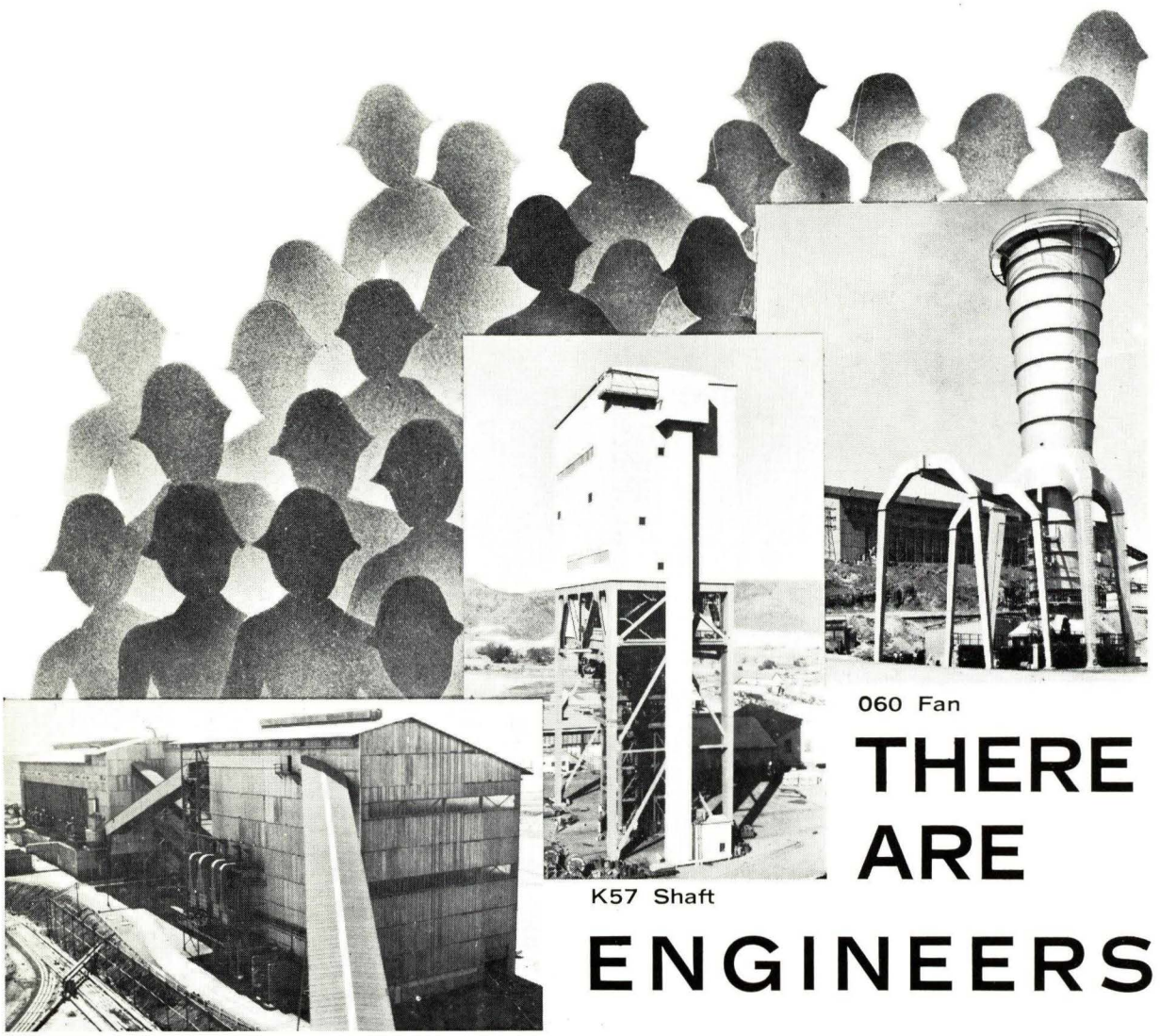
hysteresis '68

year book of the
faculty of engineering

adelaide university
engineering society

BEHIND ALL OUR BIG PROJECTS



060 Fan

K57 Shaft

No. 2 Concentrator

THERE ARE ENGINEERS

MOUNT ISA MINES LIMITED

MOUNT ISA QUEENSLAND

Never carry more Money than you can afford to lose . . .

SAVE IT!

SAVING does more for you than almost any other habit you can form.

SAVING builds your character, for it takes character to keep a promise—if only to yourself—to save regularly.

SAVING teaches you not to fritter away today what you will need later.

SAVING builds your self-confidence, for saving gives you a reserve to meet emergencies.

RESOLVE today—not tomorrow but right now—to save for some special purpose such as your holidays, Christmas presents, etc.

Open a separate account for the purpose with

THE BANK OF ADELAIDE
SAVINGS BANK
LIMITED

193 NORTH TERRACE BRANCH
(corner of Gawler Place)
Manager .... Mr. F. W. Maxwell
Telephone 23 5255

144 RUNDLE STREET BRANCH
(through from the University)
Manager .... Mr. J. O'Conner
Telephone 23 5180, 23 5337

HEAD OFFICE: 81 King William Street, ADELAIDE

HYSTERESIS

1968

Published by the Adelaide University Engineering Society.
Advertising arranged by the Adelaide University Engineering Society.

CONTENTS

PREFACE

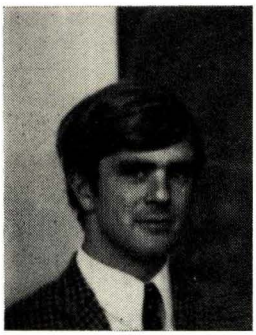
This year's book is a major breakthrough for the Adelaide University. We have lifted the tone of the Journal, changed the binding and included many new sections with a complete overhaul of presentation. New "innovations" in the publication include the individual photos of final year students, a comprehensive sports section, full Departmental reports including research, visitors, publications, prizes and final year projects. We have also included for the first time a complete list of all staff members and also a table of all degrees conferred for 1968. There are many other noticeable changes.

We feel that any time of effort put into this year book has been well spent. The experience gained has been invaluable and the satisfaction very real.

ACKNOWLEDGEMENTS

Our thanks to:

- Our Contributors.
- Pauline, Vera Walls and Jeane for typing.
- Last year's Editors for assistance rendered.
- Phil Keane and Alex Quan for photos.
- Prof. Davis and Prof. Woodward for friendly advice and assistance with Advertising.
- Our Advertisers.
- Staff members for help in compiling reports.



EDITORIAL

Editor—
Peter Moorfield

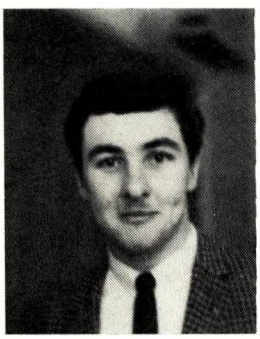
It has been said that life is a stage upon which everyone must play a part. The Professional Engineer is certainly playing a major part, but he is not commanding the respect and consideration that is his due. Of course, the situation varies from country to country, but here in Australia the Engineer is badly neglected.

To be educated but ignorant is almost a contradiction in terms, but the situation often arises. The American people for example are highly educated, but are amazingly ignorant of the Australian way of life. Many of them regard us as a "Hill-Billi" nation of "Hill-Billi" people. Tourists have expressed amazement at our standard of living and disappointment at not finding kangaroos around the main streets.

As unpardonable ignorance rears its ugly head between nations, so too it shows forth between the people of a nation, for here in Australia the society as a whole has too long taken the Engineer for granted. He has been blindly daubed the "Hill-Billi" among Professional ranks, poorly paid, often ill-treated and rarely respected.

To many people the Engineer is the man driving the little green truck with "City Engineers" boldly displayed along the side, or the man who comes to fix the teli, read the gas meter, flush out the sewer, or fix the car. True it is that these people perform very worthwhile functions, but the Professional Engineer is not to be confused.

Two or three minutes' contemplation will quickly convince anyone that this very heavily industrialized community is inordinately dependant upon the Engineer. He provides most of the services within the community. He supplies your water, gas, and electricity. Water for drinking, washing, and building; gas for power and cooking; electricity for lighting, communication, and power.



Advertising Manager—
Adrian Redden

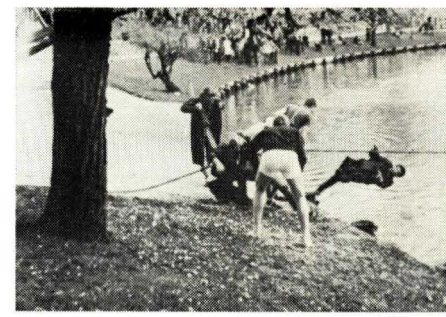
The Engineer designs and builds your roads, freeways, tunnels, bridges, dams, and multi-storey buildings. He provides you with a street drainage system and builds your harbours and associated facilities. He designs and builds your cars, trucks, trains, mono-rails, 500,000-ton tankers, 1,800 m.p.h. aeroplanes, and sends rockets around the moon. He keeps a world-wide weather watch by satellite, builds and runs computers which have become such a necessity to keep abreast with the pace of 20th century technology.

The Engineer controls your natural resources—directs your mining and builds vast irrigation projects. He runs your chemical treatment plants to provide fuel for your car and gas for industry, and so on . . . . When all is said and done, civilization today is dependant, and is becoming increasingly so, on the Professional Engineer.

What can be done to make people more aware of the important role that the Engineer plays I can only begin to suggest. We might take heed of the old adage "God only helps them who help themselves" and so we must do our best to promote the Profession. The Institution of Engineers is a platform for such activity. We in the Student Undergraduate Society feel that we are making a worthwhile contribution to the establishment of some tradition and a code of ethics in the profession.

We hope that this magazine will help to extend unity and goodwill amongst the members of the Engineering Faculty.

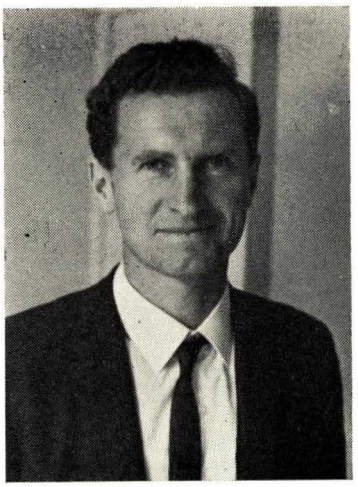
THE TUG-O-WAR



—Enough Said

THE DEAN'S PAGE

by Prof. J. L. Woodward
(Dean, Faculty of Engineering)



Professor Woodward

Deanship of the Faculty of Engineering is a rotating office, traditionally held for a two-year period. My term expires at the end of 1968, and the new Dean will be Mr. G. Sved, Reader in Civil Engineering. As a long-standing member of the Faculty, and as Acting-Head of the Civil Engineering Department for the past two years, Mr. Sved is particularly well qualified to hold this office.

Most readers will have only a hazy picture of the powers and responsibilties of the Dean, and I freely admit that two years ago I was not very clear myself. His most obvious function is as Chairman of the Faculty—to quote from the University Statutes:

"The Dean of each Faculty shall perform such duties as may from time to time be prescribed by the Council and (amongst others) the following:

(a) At his own discretion, or on the written request of the Chancellor or the Vice-Chancellor or of two members of the Faculty, he shall convene meetings of the Faculty.
(b) He shall preside at all meetings of the Faculty at which he shall be present.
(c) Subject to the control of the Faculty he shall exercise a general superintendence over the Faculty's administrative business."

Readers with experience of the workings of committees and societies will recognize the extent to which the health and vigour of an organisation depends upon active and efficient chairmanship. They will not be deceived by the apparent simplicity of the above prescription of duties. Nonetheless in a situation where the rights and independence of individual Departments were jealously guarded, the prestige and authority of the Dean could be strictly limited.

However, the academic administrative structure here at Adelaide is such as to reinforce the authority of the Dean. By virtue of his office he is a member of certain key University committees, notably the Staff Development, Equipment and Study Leave Committees, and the Board of Discipline. If an Engineering Department seeks additional staff or a special equipment grant, it is the Dean's job to interpret this need, objectively but expertly, to the appropriate Commitee. The Committees are legion. Mr. Sved's research students will come to learn that at certain times of the year if they want his advice they must intercept him on his way to the Committee Room at 9 a.m., or en route to the car park at 6 p.m.

It appears that one of the main tasks facing the incoming Dean is related to the current pressures for greater student participation in all the affairs of the University. Within academic and administrative circles there is strong support for student membership of the University Council, and this may well be the most important result of the projected opening of the University Act. However, there have been discussions also about student participation at a variety of levels in the academic structure, and the institution of Faculty Curriculum Committees with strong student membership is a distinct possibility.

I have complete faith in the integrity of engneering students and their ability to make a success of this sort of experiment, but it will call for tolerance and flexibility on the part of both students and staff. I am sure that the Dean will enjoy your full co-operation.

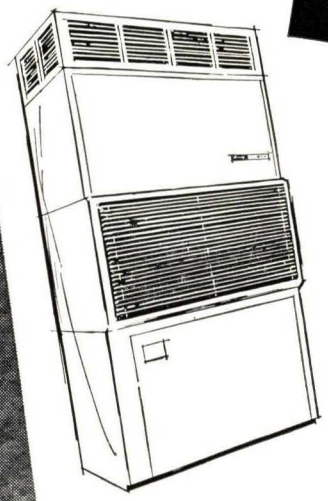
My thanks go to the officers of the Engineering Society and the Editors of "Hysteresis", for this opportunity to convey the annual message from the Dean. The Editors are to be congratulated on their enterprise and industry in elevating "Hysteresis" to the status of a Faculty Yearbook.

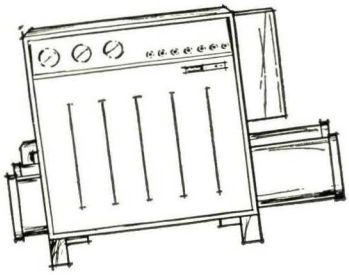
From the drawing boards of

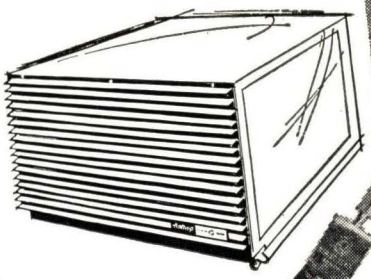
CHRYSLER..

*(Manufacturers of the famous **VALIANT** car)*

Airtemp







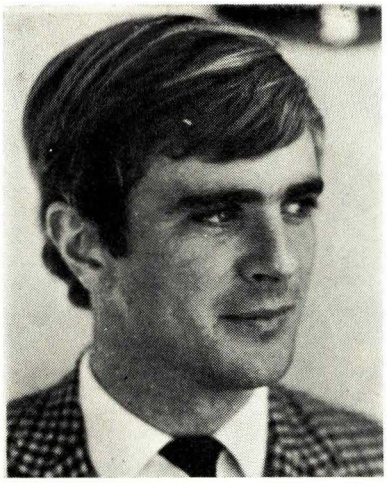
In air conditioning as in fine cars "Engineered by Chrysler" is your assurance of perfect performance. It was Chrysler who first pioneered packaged air conditioning back in 1934. Engineering leadership has kept Chrysler ahead in its fields ever since.

You can apply these skills to your air conditioning problems anytime. Just phone your State Distributor from the listing below.

CM 81

***Q'LD.**: Dunn Air Conditioning Pty. Ltd., 349 Montague Road, West End. Phone 4 2941*
***N.S.W. & A.C.T.**: Dunn Air Conditioning (NSW) Pty. Ltd., 9 Gerald Street, Marrickville. Phone 51 91100*
***VIC.**: Dunn Air Conditioning Pty. Ltd., 291 Moray Street, South Melbourne. Phone 69 7114*
***S.A.**: Airtemp Operations, Chrysler Australia Ltd., Ninth Avenue, Woodville Nth. Phone 45 8111*
***W.A.**: Noyes Bros. Pty. Ltd., 657 Murray Street, Perth. Phone 23 2214*

CLIMATE ENGINEERED BY CHRYSLER AUSTRALIA LTD.



PRESIDENT'S REPORT 1968

by Peter Moorfield

On the whole, my year as President of the student undergraduate engineering society has been a pleasurable one. I say, "on the whole", because there have been times when I have been frustrated by the attitude of certain staff members to our Society. One of our principal functions is to provide HELP to the staff where need be, and to promote staff-student relations. Unfortunately though, there have been cases where we haven't stood a chance, and I leave this University with the impression, that, it is not only the students who are often immature.

But there is a man in our Faculty who has more than made up for the apathy of other staff members. Without the Dean, Prof. Woodward, we would have been a very sorry lot. He has been an inspiration to us all and a tremendous boost to the Society. He has attended most of our staff events, and on all occasions has shown a genuine concern for staff-student affairs. We are indebted to him and his wife for entertaining the Society at his home twice in the last year.

I would also like to thank Mr. Crawley, Mr. B. Smith and Mr. Tyler for the interest they have shown in our Golf Day and Mr. Robinson for his generosity to the Society. Many thanks must also go to Mr. Fowler in the Mech. Dept. for his years of faithful service in the auditing of the Society accounts. Thanks must also go to Prof. Davis for friendly advice about "Hysteresis" and Mr. Culver for his comments on the Editorial. And last, but by no means least, I would like to pay special tribute to Vera Walls and Pauline Prisk, departmental typists, for their support to the Society.

The Orientation Week welcome was well attended by staff and students. About 100 of the 135 freshers turned up to be introduced to staff members, to be offered some words of advice, to hear something of the Society's activities and to partake of light refreshments. We were pleased to note the presence of two members of the fairer sex in the group. The Society collected nearly $200 in membership and sale of ties and badges.

Our second official function for the year was the Car Trial, admirably organized by Jeff Pitts, Graham Burton and Ian Clutterham. However, the weather wasn't really with us and we actually had trouble getting rid of the 18 gallon keg at Cherry Gardens after the trial.

This year the Barbecue was held at Memorial Drive and Phil Rinder must be commended for the time and effort he put into this show. However, we were stricken with bad luck from the word go and although we insured against rain, and it rained all night, it didn't rain hard enough, so we dipped out badly. I suggest that next year, the Society try to confine the Barbecue to Engineering students only, and that they have it on private property—say on a tennis court. In the last few years it has gotten a little out of hand. Once again we had trouble with the police.

The Dinner was again held at the Adelaide Country Club and all seem to agree that it was a "knockout". The guest speaker, Mr. Johinke, proved to be the right chap at the right time. Our thanks must also go to Mr. Luckhurst-Smith for his organisation of the dinner. About 100 people turned up, which is by far the largest number we have ever had. The brewery tour, which we arranged in the afternoon must have had something to do with it.

The Ball was described by many people as "the best Ball in living memory", not

only by the student body, but also by those few members of staff who attended. This year, we hired the new "Redlegs" football clubrooms and congratulations must go to Bryan Jenkins and John Gillet for their good work.

Before going on I must say a few words about Bryan Jenkins. Bryan deserves a real pat on the back for his support to the Engineering Society. Next year will be his fifth year on the Committee. Having been President in 1967, he is now going back as Treasurer in 1969. Bryan has been an S.R.C. rep. for the last two years and this year was Sports Editor for "On Dit". He is also active in many other extra-curricular activities on campus.

The Golf Day was once again held at Ashbourne and those who attended are already looking forward to next year's. This is a day that neither staff nor students should miss. You don't have to be a golfer—it's just a day of fun. See you there next year.

The Tug-O-War against the Meds. we lost 1-2, when our 21-stone anchor man turned out to be a weakling—you can't win them all.

The Football Carnival was held at Kangarilla oval and each Department "fielded" a team. A barbecue lunch, a few quiet lemonades and a healthy game of football —what more could you want on a Sunday afternoon.

The Society has also been able to arrange tours of various farms throughout the year and has shown films of a technical and non-technical nature. We have also arranged talks during lunch hour periods (last one being by the Institution of Engineers). The Society might have more of these one-hour forums in the future. The publishing of "Hysteresis" is no mean task and only comes out at much personal sacrifice to the Editor and Advertising Manager. Looking back over the year I think we can say in all sincerity that we have applied ourselves well to the task of fulfilling the Engineering Society's functions, viz:

(a) To promote the welfare and to further the interests of the members of the faculty.

(b) To establish a means of communication between the members of the Society and the faculty.

(c) To further the social life and intellectual culture of the members.

HYMN OF BREAKING STRAIN

The careful text-books measure
(Let all who build beware!)
The load, the shock, the pressure
Material can bear.
So, when the faulty girder
Lets down the grinding span,
The blame of loss, or murder,
Is laid upon the man,
Not on the Stuff—the Man!

But, in our daily dealing
With stone and steel we find
The Gods have no such feeling
Of justice toward mankind.
To no set gauge they make us,—
For no laid course prepare—
And presently o'ertake us
With loads we cannot bear;
Too merciless to bear!

The prudent text-books give it
In tables at the end—
The stress that shears a rivet
Or makes a tie-bar bend—
What traffic wrecks macadam—
What concrete should endure—
But we, poor Sons of Adam,
Have no such literature,
To warn us or make sure!

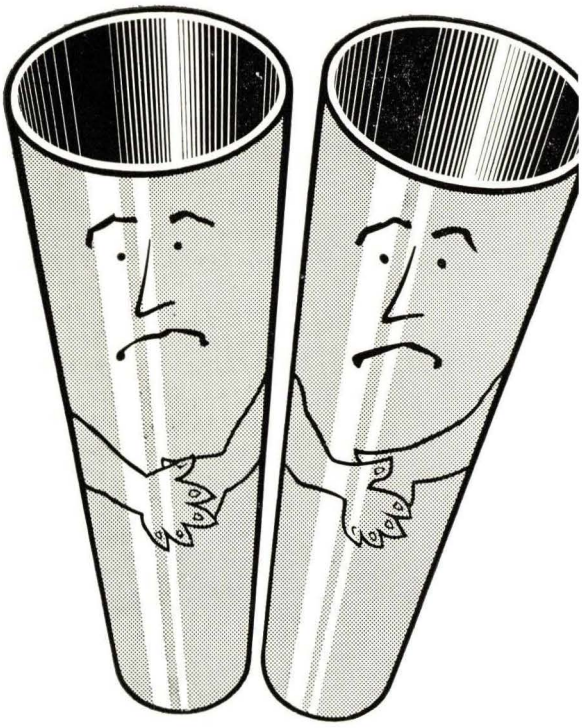
We hold all earth to plunder—
All time and space as well—
Too wonder-stale to wonder
At each new miracle;
Till, in the mid-illusion
Of Godhead 'neath our hand,
Falls multiplied confusion
On all we did and planned—
The mighty works we planned.

We only, of Creation
(Ah. luckier bridge and rail!)
Abide the twin-damnation—
To fail and know we fail,
Yet we—by which sole token
We know we once were Gods
Take shame in being broken
However great the odds—
The burden or the odds.
Oh veiled and secret Power

Whose paths we search in vain,
Be with us in our hour
Of overthrow and pain;
That we—by which sure token
We know Thy ways are true—
In spite of being broken—
Because of being broken—
May rise and build anew,
Stand up and build anew!

RUDYARD KIPLING.

There are steel tubes..



..and steel tubes with a "plus"

B.T.M. makes the difference

Backed by generations of U.K. 'know-how' B.T.M. has specialised in steel tube production for 25 years. B.T.M. precision steel tubing, made on equipment equal to the latest overseas, cannot be bettered anywhere in the world. B.T.M. and their distributors have the capacity to meet promptly, efficiently and economically, every demand for stainless or carbon steel tube. As standard production, B.T.M. produces the widest range of sizes and specifications. They are specialists in non-circular sections and their technical staff can solve your manipulation problems. These are but some of the factors which put B.T.M. far ahead in steel tube production. Branches and Distributors are in all States for expert on-the-spot attention to your needs.

First name in Precision Steel Tubes
Last word in "know-how" and facilities

BRITISH TUBE MILLS (AUST.) PTY. LTD.

CHURCHILL ROAD, KILBURN, SOUTH AUSTRALIA —— **BRANCHES IN ALL STATES**

FACULTY OF ENGINEERING

CHEMICAL ENGINEERING

Professor and Head of the Department:

ROBERT WILLIAM FRANCIS TAIT, B.Sc. (Edin.), Ph.D. (Birm.).
Appointed Senior Lecturer, 1950; Reader, 1955; Professor, 1963.

Professor:

DAVID ROSS MILLER, Ph.D. (Melb. and Camb.), Material Science.
Appointed 1966.

Senior Lecturer:

TERENCE NORMAN SMITH, B.E. (Syd.), Ph.D.
Appointed Lecturer, 1959; Senior Lecturer, 1964.

Lecturers:

CARL PATRICK JEFFERSON, B.E. (Syd.), M.Tech. (N.S.W.).
Appointed 1965.

DAVID REGINALD GLYNDWR WILLIAMS, Ph.D.
Appointed 1965.

MALCOLM JAMES MESSENGER, Ph.D.
Appointed 1966.

MICHAEL JOHN STORY, Ph.D. (Camb.), B.E.
(Temporary).

Part-time Lecturer:

ROBIN GUION ELIX, B.E.
Appointed 1964.

CIVIL ENGINEERING

Professor:

FRANK BERTRAM BULL, M.A. (Camb.), B.Sc. (Lond.).
Appointed 1952.

Readers:

GEORGE SVED, Dip.Mech.Eng. (Bud.).
Appointed Senior Lecturer, 1950; Reader, 1958.

ROBERT CULVER, B.Sc., B.E.
Appointed Lecturer, 1949; Senior Lecturer, 1954; Reader, 1966.

Senior Lecturers:

ARTHUR JAMES ROBINSON, B.C.E. (Melb.).
Appointed Testing Officer, 1937; Assistant Lecturer, 1940; Lecturer, 1946; Senior Lecturer, 1950.

DONALD HENRY TYLER, B.E.
Appointed Lecturer, 1953; Senior Lecturer, 1960.

MAURICE ARNOLD, B.Sc. (Eng.) (Natal).
Appointed 1960.

DAVID BEAVINGTON CRAWLEY, M.A. (Camb.).
Appointed 1963.

DAVID STIRLING BROOKS, M.E.
Appointed Lecturer, 1958; Senior Lecturer, 1967.

DENIS ARTHUR CUMMING, M.A. (Oxford).
Appointed 1967.

Lecturers:

JOHN ROBERT EWERS, B.E. (W. Aust.).
Appointed 1965.

DAVID JOHN MALE, M.A. (Camb.).
Appointed 1967.

ELECTRICAL ENGINEERING

Professor and Head of the Department:

JACK LIONEL WOODWARD, B.E. (Cant.), M.A.Sc. (Tor.).
Appointed 1966.

Professor:

ERIC OSBORNE WILLOUGHBY, M.A., B.E.E., B.C.E. (Melb.).
Appointed 1946.

Senior Lecturers:

DAVID CHRISTIAN PAWSEY, B.E.E. (Melb.).
Appointed Lecturer, 1952; Senior Lecturer, 1960.

BRIAN HARTLEY SMITH, B.E.
Appointed Lecturer, 1961; Senior Lecturer, 1965.

DONALD WARD GRIFFIN, B.A., Ph.D.
Appointed 1965.

DOUGLAS ALBERT PUCKNELL, B.Sc. (H.-W.).
Appointed 1967.

PETER HAROLD COLE, B.Sc., Ph.D. (Syd.).
Appointed 1967.

Lecturers:

GEORGE KAROLYI, B.E.
Appointed 1961.

BRUCE RAYMOND DAVIS, B.E., B.Sc.
Appointed 1964.

Part-time Lecturer:

ROMAN MARIA ANTHONY OLESNICKI, Dip.Eng. (Lvov.).
Appointed 1955.

Honorary Consultant in Computer Engineering:

GEORGE EDGERTON BARLOW, M.Sc., (Melb.).
Appointed 1965.

Honorary Consultant in Communication Engineering:

ALBERT J. SEYLER, Dipl.Ing. (Munich), D.App.Sc. (Melb.).
Appointed 1966.

MECHANICAL ENGINEERING:

Professor:

HENRY HARGAN DAVIS, B.Sc., B.E. (Syd.), Ph.D. (Camb.).
Appointed 1946.

Reader:

JOHN MANNAM, Ph.D. (Birm.).
Appointed Senior Lecturer, 1969; Reader, 1963.

Senior Lecturers:

WILLIAM DEVON NOBLE, B.E. (Syd.).
Appointed 1955.

ANTHONY GEORGE THOMPSON, B.E. (N.Z.), Ph.D.
Appointed Lecturer, 1958; Senior Lecturer, 1962,

ALLAN SHAW, B.A. (Brooklyn), B.M.E. (N.Y.), M.E.
Appointed 1962.

ROBERT BRUCE KING, B.Sc. (Syd.).
Appointed Lecturer, 1959; Senior Lecturer, 1963.

MAXWELL KENNETH BULL, B.Sc., B.Mech.E. (Melb.), Ph.D. (S'ton.).
Appointed 1964.

JAMES HENRY FOWLER, B.E.
Appointed Lecturer, 1956; Senior Lecturer, 1965.

JAMES ROSS DYER, B.E., B.Ec.
Appointed Lecturer, 1961; Senior Lecturer, 1965.

Lecturer:

JOHN MARTIN PICKLES, B.Sc. (Brist.), Ph.D. (Camb.).
Appointed 1967.

Research Fellow:

PETER LEWIS GOODALE, B.E. (Simpson Pope Limited Grant).
Appointed 1965.

ENGINEERS IN PUBLIC AFFAIRS

Lord Casey

The Hon. the Right Reverend Lord Casey in an address to the Tenth Commonwealth Universities Congress, in the Great Hall of the University of Sydney, made the following remarks:

"You, Sir, (to the Chairman) are an engineer by profession. I had training that, if I had pursued it in practice, might have resulted in my being able to say the same thing—but I diverted myself at an early stage, into public life, which is a rare field in Australia or elsewhere for someone with your and my training. I once had the figures taken out in an effort to discover how many of those many individuals who had been through Australian Federal and State Parliaments since Federation in 1901, had been Engineers. There had been something like 7,000 members in all our many Parliaments, and only twelve of them could be said, by any stretch of the imagination, to have been Engineers. I don't know the reason for this or if there is any lesson to be learned from it, but in any event I regret it."

In correspondence to the Editor, Lord Casey says, and I quote. "I've asked if the same lack of Engineers in Public life (i.e. in the Parliaments and the like) exists in other countries. I'm told that in the United Kingdom and in the United States of America they are rare birds, as indeed they are here. The exception is in the Soviet Union where I'm told that the **majority** of the top hierarchy are either engineers or have done one of the sciences."

And there you have some very interesting comments from one of the most distinguished men in Australian Public Life. He is a man with an Engineering education, having done a course at the Melbourne University and then the Mechanical Science Tripos at Cambridge University.

There are many other educated and influential people who believe that the time has come to involve men of Science in Public Affairs. With the vast technological and Scientific advances occurring in the world today it is no longer sufficient to have a knowledge of **just** politics and economics. A scientific background is essential to appreciate, anticipate and prepare for, the changes that are bound to come. The Russians have made their move—isn't it about time we made ours?

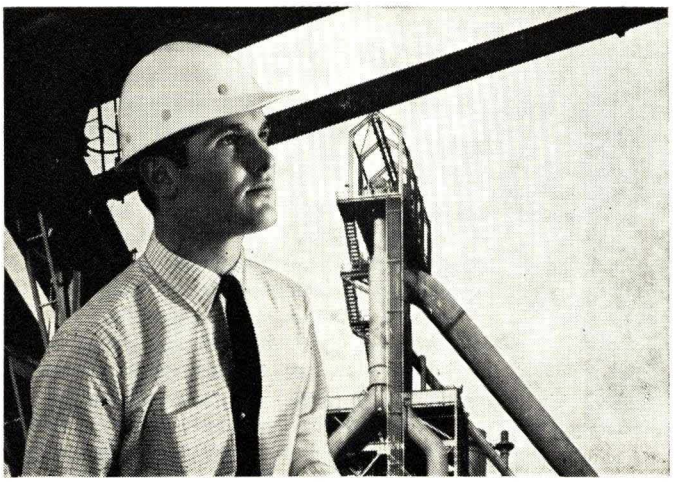
PROBLEMS FACING A GRADUATE ENGINEER

by A. J. Jenner (Elec. V.)

A serious and important task facing engineers in Australia, particularly younger ones, is that of keeping abreast of changing and advanced engineering techniques. The rapid advancement of applied scientific and engineering principles and practice, coupled with keen competition, demands that all industrially developing nations must keep climbing technically, if their industry is to survive economically.

PROBLEMS FACING A GRADUATE ENGINEER

Keeping up to date in engineering trends necessitates a certain amount of study, but even the best of intentions can fall far short of their goal, especially when the pressure of compulsory study and examinations are lifted. But it is not just laziness that hinders engineers from studying after graduation. It is often that he just does not have the time. Commitments of home and family, community activities, cultural pursuits, sport and other pastimes render it almost impossible for him to devote more time than his normal working hours to the profession. And one might reasonably ask, why should he?



If you want to work with a small company-

try BHP for size

It's a great idea working in a small outfit—that's where a man gets responsibility, opportunities to lead, room for initiative and development—a show of his own to run.

What's that got to do with BHP? BHP is the greatest collection of small (and large) opportunities in the country. Young men right through the structure of BHP run quarries, blast furnaces, research projects, mines, commercial undertakings.

What's more, no-one gets 'lost'; BHP takes good care of this with its advanced staff planning and development procedures.

So if you are a manager, a marketer, a researcher, a science wizard, come and talk to us. We would like particularly to see you if you are graduating in Engineering, Commerce or Economics, Science or Metallurgy.

THE BROKEN HILL PROPRIETARY COMPANY LIMITED

MINING/STEEL/OIL & GAS

BHP531/86

It is interesting to compare the lack of time problem mentioned in the last paragraph, with the fall-off in attendance at meetings of the Engineering Institutions. Does this indicate a decline in interest, or does it suggest unwillingness on the part of engineers to devote their free time to learning things related to their regular occupation?

The real devotee, however, who may make the time to meet the constant barrage of technical literature, will often be discouraged by the lack of appreciation given to his sacrificial effort. Should he try to introduce new methods, improve designs or use a different approach, he may meet resistance and mistrust of older people who could be out of touch with modern developments. He is likely to find that his more senior superiors are reluctant to introduce new techniques where old ones are well established. Both the fear of failure and being outperformed often causes the supervising engineer to insist on "playing it safe with the way we know".

Having recognised that the problem of keeping abreast exists, and that it will be more critical in the future, it is interesting to consider what the employer of engineers are doing about this. Unfortunately, in many cases, it is little more than being vaguely aware that "we must move with the times". In all but a few cases in Australia (these few cases are mainly overseas controlled, manufacturing firms), the problem is not tackled at all. It is unfortunate that many managements in Australia seem to regard technical people as "necessary evils". Engineers are often "fitted" to narrow, specialised fields and are discouraged from trying to obtain a broad knowledge or experience, as this "distracts them from their line". However, when a rival manufacturer releases a new product which poses a threat, the rivalled manager expects his "necessary evils" to know immediately how to match the challenge.

Turning hopefully towards government and semi-government establishments is not very encouraging either. Most engineering public servants could easily conjure up a vision of grey-haired, baggy-trousered members of the public service Boards throwing up their hands in horror at the suggestion that their engineers should be given four hours a week for study of technical literature. In all this it appears that our employers, whether private or State, have not yet realised the investment value of using a little time unproductively, that their "necessary evils" may be in better shape to tackle the production problem.

The reason for this lack of understanding of managements for the needs of engineering personnel, is probably due to the fact that high management positions are increasingly falling into the hands of non-technical people. This is not necessarily a bad thing, but it can be. The accountant oriented manager is likely to measure success and profit entirely by the yardstick of dollars and cents. But no generalisation can really be made on the question of whether engineers make good managers, or whether non-technical managers can direct engineering activities.

POSSIBLE REMEDIES

The first step toward improving the present position, is to recognize the problem, and the difficult position engineers are in. Engineers (unlike lawyers, physicians, dentists, who are usually self-employed and give their services in the form of consultation and direct practice) depend on being employed. This poses special problems.

William S. Evans sums up the situation thus:

> "As a staff engineer, he lacks the authority of the manager, and he tends to be treated in some organisational contexts, in the same manner that an engineering technician or production worker is."

Kornhauser puts it this way:

> "As a salaried employee, the engineer experiences organisational constraints that he finds difficult to reconcile with his expectations as a professional."

The problem of keeping up to date can only be satisfactorily treated when employers, both private and State, accept the notion that continual education must be part of an engineer's normal duties, and he must be given the time necessary for this. But having recognised this, it is futile to leave it at that. An organised regular programme of education would be essential.

As an example, consider how this problem has been experimentally tackled in the Soviet Union. Within an engineering establishment, regular lectures are given to practising engineers by the engineers themselves. Each engineer is responsible, periodicaly, to deliver lectures to his colleagues. This seems to be an excellent system, but it must be recognised that it would be much easier to institute where

the State was the employer of all such engineering concerns, as uniformity of organisation could be ensured. It would pose problems in our situation.

King, writing of an experiment in France states: " . . . the conception of professional education as a lifelong activity is not confined to the years of formal training in engineering schools. Whether and how to inculcate these and other professional values are still frontier problems in professionalizing engineering. For example, the novel and presumably controversial practice, at a French institution of higher learning at Saclay, of awarding a degree in reactor engineering for a limited period —subject to revalidation after five years by means of attendance at refresher courses and success at future examinations—is based on a conception of engineering education as a lifelong process."

It is quite obvious that this problem will not be solved while present attitudes of employers and engineers prevail. It is time engineers, particularly younger ones, started thinking about and discussing this problem seriously. It is time that frank discussions took place between employers and engineers, on how the responsibility for this should be shared, in fairness to all parties. Finally, the initiative will probably have to come from engineers, since most of our employers have little awareness of our needs.

References:

"International Encyclopedia of the Social Sciences" (1968)—article by William M. Evan.

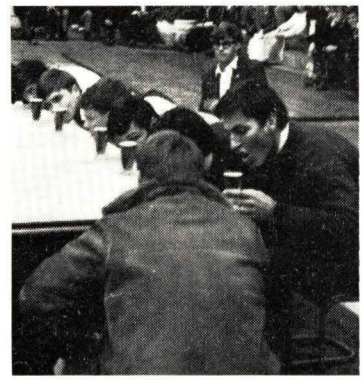
"Scientists in Industry: Conflict and Accommodation" — William Kornhauser (1962).

"Education and Change"—Alexander King (1965).

DRINKING HORN -- 1968

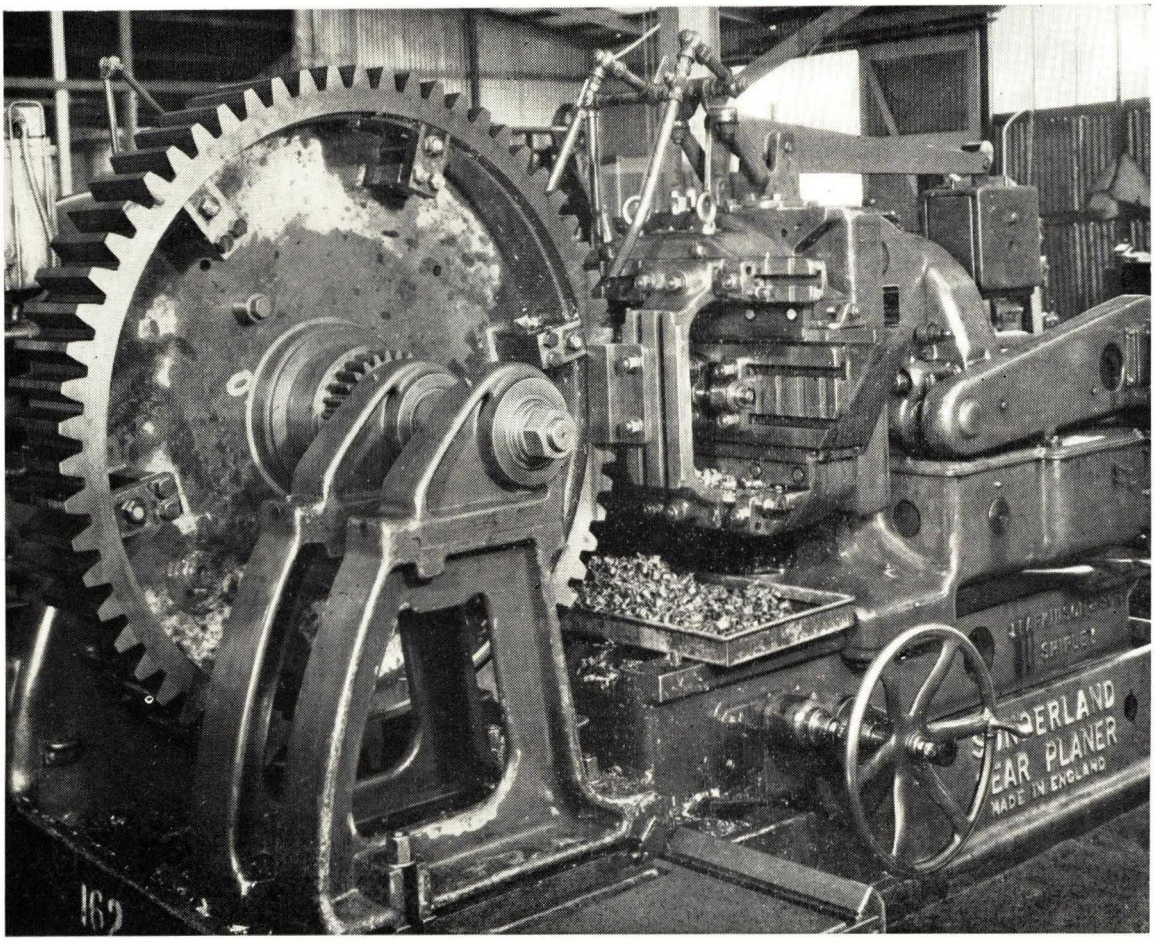
The Drinking Horn received more publicity this year than it ever has before. As those of you who have spent some years in this establishment will know the S.R.C. and others who are trying to preserve the respectability of the student image have made sure that neither sight nor sound of the Drinking Horn reached the outside world. This year, however, ABC TV featured a sculling race on "Today Tonight" early in Prosh Week. Two teams of six, consisting mostly of rather slow "swallowers" lined up at the table. The winning team made a time of thirteen seconds, about which Prosh Director, Grant Elliot made the following immortal comment; "They would have lost very badly".

Having finished with this digression I will now return to the Drinking Horn proper. Recruits for the team had an opportunity to demonstrate their skills at the Southwark Brewery on the Wednesday of Prosh Week. Somebody picked a team which was to compete in the competition. Friday came and hopes were high for the team. However, at the start of the contest several members of the team could not be found. Presumably they had found it necessary to take a few drinks to calm their nerves which were shaken by the tremendous pre-match tension. Finally a team was found and they set out for the contest.



Getting "Educated"

The final was eventually fought between the Technology and Flinders teams. Technology won with a new record time of 6.05 secs., although it remains a mystery to me how the judges arrived at this extremely precise figure with a 1/10th sec. stop-watch. Congratulations to the Technology are in order and may I urge hopefuls for the 1969 team to start practising early in the year.



F. W. HERCUS PTY. LTD.

Specialists in All Types of Gearing

Spur, spiral and double helical gears, internal gears, bevel gears, precision instrument gears, racks, sprockets, spline shafts

ANDERSON STREET, THEBARTON, S.A. — 57 6273

A.U.E.S. COMMITTEE

1968

President: PETER MOORFIELD.

Vice-President: PHILLIP KEANE.

Treasurer: TREVOR FULLER.

Secretary: JEFFREY PITTS.

Publicity Officer: FREDERICK LE MESSURIER.

Asst. Secretary: PHILLIP RINDER.

Hysteresis Editor: PETER MOORFIELD.

Advertising Manager: ADRIAN REDDEN.

Back row: Jim Vassos, John Sandland, John Gillett, Adrian Redden, Phil Rinder, Graham Burton. Fred Le Messurier, Ian Menadue, Ian Clutterham.
Front row: Trev. Fuller, Phil Keane, Peter Moorfield, Jeff Pitts, Peter Davey.

ENGINEERING AND GEOLOGY

by Prof. E. A. Rudd,
(Department of Economic Geology)

It is difficult to imagine any civil engineering project that does not involve geology and any mineral development inevitably requires a great deal of civil engineering. Under these circumstances it is well to look at the ways geology can serve engineering and the trends that are developing in the practice of engineering geology.

With small structures and minor projects the lack of interest in the geological factors was not always serious and the cost of remedial measures to cover conditions that were not anticipated could be absorbed without undue notice.

With the trend towards larger and more complex structures and projects it is no longer possible to ignore the geological features that are present. In fact it may be that these are the very factors which decide whether a project is feasible or not. If it is feasible it may be that the main geological considerations become aspects of safety or cost.

In Australia in the past there existed the attitude that geological troubles could be dealt with as they were encountered and there was no need to look for these in advance. This was very much the attitude when day labour was employed by the owner who conducted his own construction programme. With the growth of contracting and the need for competitive bids for large jobs the need to appreciate the critical geological features has become inevitable if the contract is to be successful. It is important to both the owner and the contractor that the contract should be successful for few projects benefit from a second bid on an incomplete and interrupted job.

One aspect of the geology of most engineering construction is that the geological features cannot be determined with the accuracy common to other construction materials such as steel or concrete unless an unreal amount of exploration is undertaken beforehand. This lack of accuracy tends to irritate engineers to the point where geological assumptions are made and the geology then omitted from further design considerations. What is necessary is an appreciation of the range within which the geological conditions can occur so that due allowance can be made in design.

Frequently the geological factors appear at first sight to be simple. For example drilling may have indicated that fresh rock occurs at a depth of say 120 feet below the surface and on a drawing this can become shown as a line when in fact fresh rock may be 130 feet deep in one place and only 110 or 115 feet in others.

If based upon the design plans the programme called for siting a crane or other equipment at precisely the 120 feet line then there could be trouble. Therefore while engineers may rely on geologists for information they must themselves have an understanding of the information presented to them.

Little progress was made in the use of geology on engineering projects while the geologist was a visitor to the construction site. Too often he was called in when trouble had already been encountered and apart from absorbing some of the blame he could do little to save the trouble which might otherwise have been avoided.

Real progress has only been made since geologists became involved right from the beginning of an engineering project through feasibility study, investigation, design and construction. In other words it is necessary for a geologist to "live" on the site with the engineers so that he can appreciate the problems and the possible effect of the geology concerned.

There are a few basic principles that should apply on all major construction projects.

Firstly the construction should never reveal geological conditions radically different from those which could be anticipated

from the investigations. This frequently calls for an understanding of the geology around an area as well as within it.

Most engineering construction involves disturbing in a short time geological conditions which have reached a delicate state of balance over a long period. As long as this is understood and anticipated then it need not be the basis for difficulties or disaster. A simple example is the undercutting of the toe of a slope which could result in a landslip.

The change in groundwater conditions can be anticipated and the effects must be assessed. The disastrous landslide into the Vaiont Dam was found to be due to the instability of the mountain because of the raised water table.

There has been a marked change to rock and soil by the engineering profession in later years. The many rock fill and earth dams indicate how well the properties of these materials are becoming known.

In recent years it has become recognised that frequently the rock blasted from an excavation is better than the concrete that has to replace it and much more care is now taken in excavating so that less rock is broken and consequently less concrete has to be put back. Care is also taken to do less damage to the rock that remains. In other words with proper understanding of the rock conditions the rock itself can be designed into the structure.

Litigation is one aspect of this involvement of geology in civil engineering projects which will become more apparent in Australia as our population increases and we become more involved in construction by contract.

Frequently in large contracts where there are claims for changed conditions involving greater costs the factor that can lead to this claim may be geological. It may be that because geology is not as precise as other aspects of engineering that this becomes the best point on which a contractor can lodge a claim.

One has only to realise how much time and effort is spent in countries like the U.S.A. on litigation of this nature to realise how important it is for the engineers concerned to understand the geology of the site on which their construction is set.

If these are the problems of geology for engineers then it is pleasant to record that geology is making a tremendous contribution to civil engineering in Australia.

Most Australians are well aware of the fantastic discoveries of mineral wealth in this country in the past ten to fifteen years. While all the interest has been centred on the minerals, iron ore, bauxite, manganese, nickel, oil and natural gas and phosphate, the population generally do not realise the great contribution this has made to the practice of civil engineering.

Perhaps it is only necessary to indicate the various works which have become necessary because of the mineral discoveries to illustrate the development of this country which has only just started.

First there are the harbours that have been created and developed from Geraldton in Western Australia around through Dampier and Port Hedland, Yampi Sound to Gove and Groote Eylandt in the Northern Territory to Weipa in Queensland. There is the possibility of further ports in the Kimberley's for bauxite and near Burketown in the Gulf of Carpentaria. Except for these there was previously only the one useful port at Darwin between Geraldton and Townsville.

The mineral developments have necessitated railways, towns, airstrips and water and power supplies and all these have brought a new standard of construction. One has only to contemplate the railway construction to Mt. Tom Price and Mt. Newman to realise that this has brought new methods to Australia.

One other aspect of the mineral boom that will leave its mark on civil engineering is the discovery of oil and natural gas. The construction of offshore drilling rigs and platforms has opened up new horizons and new areas on the continental shelves.

Gas pipelines will be laid and buried at a rate, and in a manner which must make the people who construct water pipelines think again. Pipelines will be used for other commodities. Already iron ore is transported by this means in Tasmania.

The very size of equipment used in the winning of minerals; the 100-ton trucks for iron ore: the 130 cubic yard bucket on the dragline on the Queensland Coalfield these will affect our attitudes to other construction. Already there are 75-ton trucks in use on the Talbingo Dam in the Snowy Mountains area.

Whichever way we look at Civil Engineering or Geology it seems that the two are intriguingly and inevitably involved the one with the other.

'68 DINNER REPORT

OR: "COUNTRY CLUB CAPERS", PART 3

As with all enjoyable experiences, the Society Dinner this year was memorable in all three stages—before, during and after. Once again our hosts were the Adelaide Country Club, and as tradition decrees, the Wednesday of Prosh Week was the chosen time. This year saw a great innovation—either by accident or design—which appears likely to endure through the years: a tour of a local Brewery in the afternoon. Such was the response that a second tour was promptly arranged; could it have been only coincidence that arrival times were scattered over a two-hour period, with dress varying from dinner suit to casual gear?

With such a solid (?) foundation, the dinner itself could not fail to be anything but a roaring success. Chaired by our genial President, the inimitable Moorfield, proceedings went smoothly—apart, that is, from a unique toast list (in which the Dean alone was the sole official speaker), microphone trouble and occasional chaos at the head table. Needless to say, the head table drinks expenses doubled those of previous years.

The highlight, fittingly, was the guest speaker, Mr. A. K. Johinke, Deputy Commissioner of Highways, who rapidly gained the support and respect of his audience, which he enlightened in great fashion on all subjects from matrimony to "How to be a success in governmental engineering".

"Up with Johinke"

The air of informality was continued during the Dean's response on behalf of the staff, and afterwards over coffee and liqueurs with the younger members (particularly the 2nd year Civils) leading the way with jokes and songs.

Ball-crashing, that traditional after-dinner activity of the sporting engineer, was once again successfully negotiated; this year the honour of our presence befell our worthy "comrades" from Frome Road—the Technology Ball at 20 Plus was the rendezvous.

The Elecs. Table (well represented).

Led by John Sandland and Ron Sainsbury, the crashing was its usual success, complete with broken windows and sore heads.

The older crowd, more refined (or perhaps simply "married") preferred the atmosphere of a few quiet beers, although the final year Elec. party at Neil Smith's, complete with wild stereo and crazy whistle-blowers, hardly entered this category. Full marks must surely go to the Dean for battling through there until 3.00 a.m.

Thus passed the '68 Dinner, the best attended and most enjoyable of recent years, joining the haze of Prosh nights and missed Thursday mornings of the past.

H. L. SMITH,
Convenor.

An American officer on R. & R. leave in Sydney told an Australian:

"A Viet Cong sympathiser has been taking pot shots at us for four years."

"Why don't you go out and get him?"

"Not on your life. He may be replaced by a good marksman."

THE FORMING OF A COMPANY

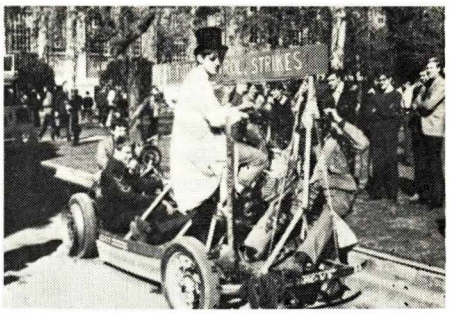
(The true story of the development of the Crankpowered Auto-trolley Company, as told by the General Manager, Hamish Tristram G. Robson.)

In an era where society has an almost complete dependence on forms of transportation undreamt of a century ago, a fuel supply stoppage has a very dramatic and catastrophic effect. Thus it was hardly surprising that during the great oil strike of '68 a small group of engineering students should investigate the possibilities of making man-powered craft. The advantages of such a machine were obvious: lubrication problems and exhaust fumes would be kept to a minimum, the vehicle would have an indefinite range (over an indefinite time) and the speed and chaos of heavy traffic could be reduced to a dignified and orderly pace, thus increasing road safety.

Hamish T. G. Robson, a mechanical engineering student, who had long nurtured the secret desire to pump a railway handcart down Rundle Street, hastily decided to found the Crankpowered Auto-trolley Company. He was soon joined in this aspiring endeavour by Bruce Muggleton, Barry S. Griggs, Trevor Johnsson and David Basil Mayo. Even at this embryonic stage of development the scheme might never have reached fruition had not the great financial magnate Jonathan Davies agreed to support the company. From that moment onwards the crankpowered auto-trolley was assured success.

Early designs were earnestly discussed in the Company's seminar room, which at other times became known as the refectory. Model I, the Crankmobile Mark I, consisted of a three-wheeled bicycle with epicyclic chank attachment but, unfortunately, the production problems involved eventually led to its abandonment. Similarly Marks II, III and IV, none of which ever reached the manufacturing stage, were found to be too complex to construct in time for the next petrol strike. Nevertheless, of all these attempts the Mark III was an interesting design which may be mentioned in passing. Six bicycles were to be welded together in such a way that a platform with accommodation for up to ten passengers could be assembled on top. Only a lack of bicycles and/or kleptomaniacs prevented the manufacture of the Mark III.

With time running out for the enterprising industrialists, Mr. Davies provided the badly needed stimulus by suddenly producing a complete Ford Prefect chassis, and after some hasty boardroom discussions the series 2 Mark V Proshmobile was born. Basically the idea was to mount a N.N.E.-S.S.W. four man chankshaft on the chassis to chain drive a sprocket gear wheel welded onto the differential end of the original drive shaft, using as many of the original Prefect parts as possible.



"Full crank a-head"

Immediately the company was geared for action. The chassis, differential and front suspension were shipped from a Prospect warehouse to the Company's factory at St. Marys. (This factory had been previously owned by Muggleton Engineering Ltd., a firm which wishes to be completely dissociated from the Proshmobile project.) Mr. Johnsson, universally regarded as the chain specialist, was not slow in producing several chains and two drive gear wheels. Files, hacksaws, welding equipment and large quantities of paint were obtained by devious means and on the cold, miserably wet morning of July 22nd construction began.

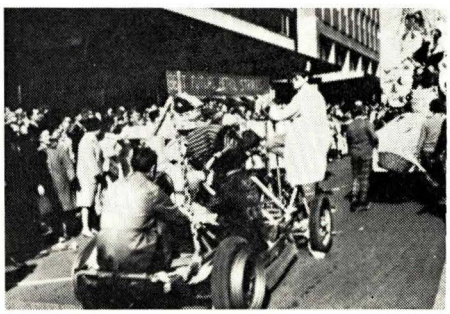
Making a four-crank auto-trolley can be much harder than anticipated. One of the basic requirements is that all the crank bearings lie in the same straight line. This fact was somewhat overlooked during the early part of the building, with the result that the vehicle eventually incorporated a new device called the Muggleton free floating bearing. It will be apparent to the hardened crankmobile manufacturer that

it is also necessary to keep the two gear wheels of the chain drive in line with each other and thus the Mayo manual two way chain-slack adjuster was developed. Apart from these setbacks progress on the machine was spasmodic. An excerpt from the diary of one of the workmen reveals the dedication and enthusiasm with which the students tackled the project.

"As I approached the factory I could see a hive of activity in the lane. Trevor, one hand clutching a large mask, frowned with concentration as he randomly splashed sizeable lumps of molten metal all over the chassis. Bruce, sweat trickling down the cheek, held grimly to a piece of angle iron being devoured by a spark spitting wheel, while Barry and John slapped paint with desperate haste over lumps of grease, molten welds and other various parts of the vehicle. Hamish and David stood in a puddle of water shivering miserably. Nearby several grubby children stared with hypnotic fascination at the blue flashes from the arc welder."

Although the crankmobile developed slowly, by Monday, July 29th, it was ready for prelminary trials. News spread rapidly along the street and in some quarters a half holiday was declared. Workmen in large crowds poured forth from local offices and factories to watch as the first manpowered car lurched into view. Although feeling in the crankmobile camp was that of quiet confidence, it was sensed that now was the time when, if things were going to break, they would. They did. Firstly, due to some oversight it was found that the steering, having been swung into a vertical position, would turn the wheels to the right only. To turn left a series of complex geometrical configurations was necessary. Secondly, the chain refused to listen to human reason and came off without the least provocation. Thirdly, the seat for cranker number one became detached and neatly deposited said person onto the front wheel. Fourthly . . . fifthly . . . sixthly . . .

Somewhat disheartened by these calamitous events, not to mention the jeers from spectators, the crew returned to the depot to reconstruct the machine. They were ably assisted in this cause by an unknown workman who sauntered over from across the road and pointed out, in the space of about fifteen seconds, ten major trouble spots which had evaded the notice of the engineering students. Several days later and after many readjustments, the untiring team had the test vehicle back in operation. This time the first forward run of the second trial was so successful that, in a moment of elated madness, an attempt was made to break the reverse land speed record. As might have been expected, disaster struck in no uncertain manner. Just as the craft reached a respectable 5 m.p.h. the main crank gear wheel failed in a spectacular exhibition of bad engineering and the six adventurers creaked, rattled and thumped to a halt.



Doing a "Rundlie"

A less determined company might easily have accepted defeat at this stage but the Crankpowered Auto-trolley Company was controlled by obstinate men whose courage and foresight was equalled only by their idiocy. Wheeling the prized machine back through the crowds of onlookers, everyone went home for tea. That evening several thesis and papers were prepared suggesting remedies for the situation and the next day the offending gear wheel was reinforced, heat treated and welded solid. Also some additional luxuries including seats, a hand signal, brakes and a warning device were attached in preparation for the big road test planned for Friday, August 2, 1968.

The morning of the 2nd dawned cold yet sunny. By 1 o'clock a large crowd had gathered along the proposed test route and such was the interest in this incredible man-powered vehicle that police were needed to keep the onlookers back. Regretfully, and to the undying shame of the other faculties, a number of irresponsible students tried to disrupt the proceedings and the test run was marred by the presence of many gaily painted trucks.

Nevertheless the demonstration forcefully showed the public what a reliable handy form of conveyance the crankmobile could be. Large crowds pushed and struggled to get a better look at this revolutionary machine and in many places people climbed onto verandah roofs to catch a glimpse of it. One reporter aptly summed up the situation.

"These students have shown the public what they could have been had they been trying to do what they should have been doing when they started."

After such a welcoming response, success was inevitable. Within months the Torrens Island assembly plant was manufacturing ten vehicles a day, yet the demand showed no signs of abating. Crankmobiles could be found in the remotest corners of the State — Port Adelaide, Glenunga, even Gawler. The fourty-four man bus mobile was developed, along with the sporty double crank hard top. The day of the crank had arrived and it was the dawn of a new era in transport.

(For further information write for free brochure and sales pamphlet.)

FOOTBALL CARNIVAL

by Ian Menadue (Mech. IV.)

One of the great sporting spectacles of our time must be the Engineering Football Carnival. This is a competition between departmental teams. Every year we are blessed with vast numbers of spectators eager to see the unique style of football produced, the like of which cannot be seen at any other time or place in the world.

This year it was decided to play two matches instead of three as in previous years. The early game was between Mechanicals and Electricals. Although the first match was timed to start at 11.30 a.m. it did not get underway until much later. Sixteen of the Mechanical team had arrived and were eager to start but it was found that the hush-hush Electrical team numbered six. The players available were divided into two teams of about twelve, the umpire was assigned to play for the Electricals and the match got under way in rather bad conditions owing to there being three inches of mud covering the oval. The Mechanicals could not produce their usual form in the trying conditions on the day and failed to take home the biscuits.

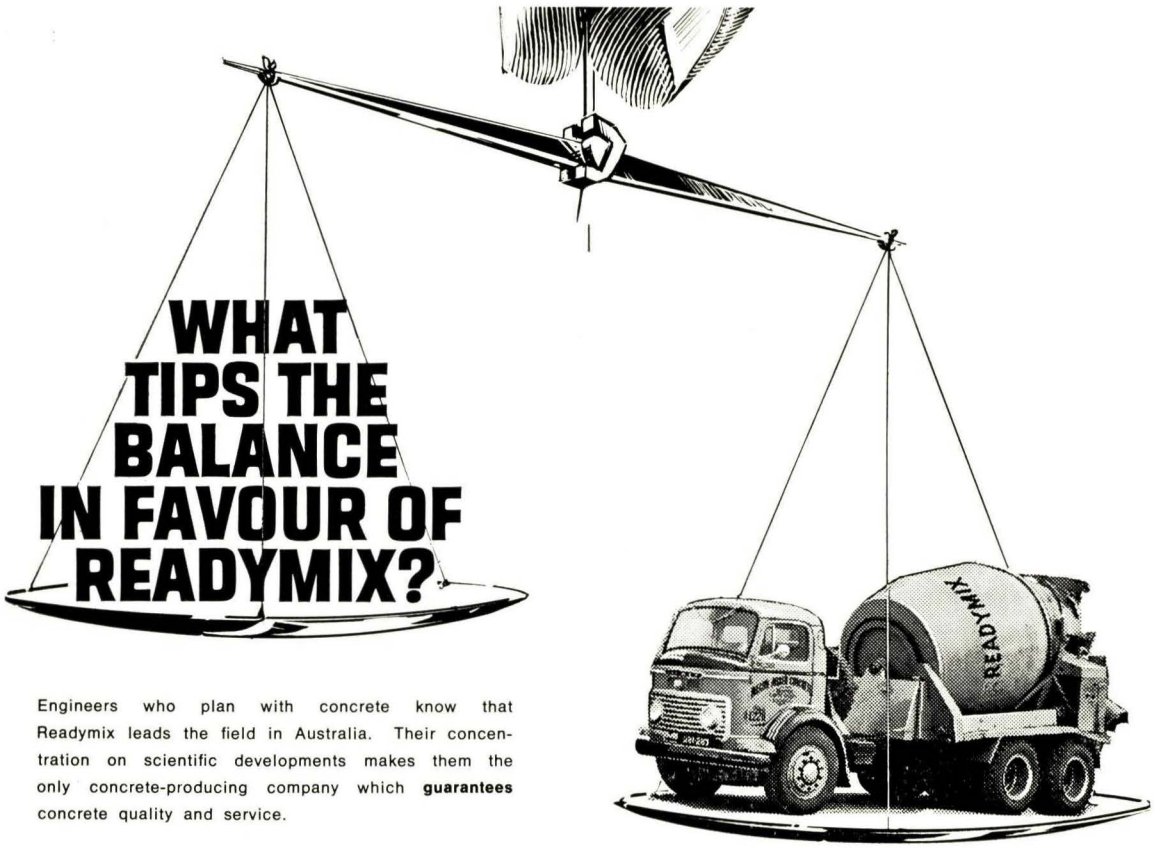
The late game was played between Civils and Chemicals. The Chemicals failed to produce the class of game for which they have become renowned and so the Civils had an easy victory. It should be stated, however, that both teams were playing to the crowd and not to win the game. They proved this by dragging the umpire by the feet through the muddy centre patch at half time.

A nigger for an ump.

It was unfortunate that rain on the day before the match had made the oval extremely muddy. However, most players soon forgot this over a few glasses of ale.

This year it was disappointing to note the absence of Victorian talent scouts among the crowd. We also failed to get full radio, press and TV coverage but if "Hysteresis" circulates into the right hands they are sure to be there next year.

On the serious side our thanks should be given to Richard Drewer who has umpired the games for the past two carnivals and to the caretaker of the Kangarilla Oval where the games were played.



WHAT TIPS THE BALANCE IN FAVOUR OF READYMIX?

Engineers who plan with concrete know that Readymix leads the field in Australia. Their concentration on scientific developments makes them the only concrete-producing company which **guarantees** concrete quality and service.

THERE'S ONLY ONE TRUE

Readymix

LABORATORY CONTROLLED CONCRETE

The key part of every Readymix plant is the laboratory. It's here engineers and chemists make exhaustive tests in every phase of production—ensuring the final product is perfect.

Because Readymix has no financial interest in any building organisation, unbiased advice is always available. Readymix service is second to none, with a radio-controlled fleet of trucks which deliver with clockwork precision.

READY MIXED CONCRETE (S.A.) PTY. LTD.
82 East Terrace, Adelaide **Phone 23 3366**

DEPARTMENT OF MECHANICAL ENGINEERING

Professor H. H. Davis
(Head of Department)

Staff Change

Mr. R. B. King, appointed in 1959, leaves the position of Senior Lecturer to become Managing Director of Noise Suppression and Acoustics Pty. Ltd. During his period on the staff he has developed a major activity in engineering acoustics and noise control at undergraduate teaching, research and consulting levels and has been responsible for the development of extensive laboratory facilities for the work after visits to leading centres in U.S. and Europe.

Industrial Fellowships

A Simpson-Pope research fellowship in engineering noise control has been held for two years by Mr. P. L. Goodale working on the basic mechanisms of flow noise generation in aerofoil-type fans. He has now left to become a consultant in acoustical and general mechanical engineering.

An Australian Mineral Industries Research Association fellowship has been offered for 3 years for work on the problems of rock drill noise which is a major hearing loss hazard. It is hoped to make an appointment shortly.

A.R.G.C.

Research grants have been held over several years by Dr. J. Mannam for work on gas lubricated bearings and by Dr. M. K. Bull on boundary layer turbulence studies.

A.I.N.S.E.

Research grants have been received by Dr. Bull for turbulent flow studies and by Mr. J. R. Dyer for studies in heat transfer.

Prizes

The most recent recipients of prizes are for penultimate year S. G. Lim (Shell Prize) and for final year honours H. Heydrich (Forwood Down Prize).

The British Tube Mills will be offering a new prize from this year for Engineering Management.

Gifts to Department to total of $12,000 from
Bradford Insulation Ltd.
Alfred Martin
G. M. Holdens Ltd.

New Post-Graduate Awards

I. N. Paech (Commonwealth Post-graduate).

U. E. Nilsson (Commonwealth Post-graduate, from Tasmania).

D. Q. Dac (Research Fellowship, Calgary, Canada).

P. D. Dean (Industrial post-graduate award, U.K., and G. Murray overseas travelling grant) to proceed to Ph.D. at Southampton after completing the M.E. here.

Higher Degrees Awarded

M.E.: S. N. Gower, I. C. Flower.
Ph.D.: M. R. Hale, G. A. Morgan.
D.Phil. (Oxford): G. Brown.

Lectures to Learned Societies in Australia

Dr. M. K. Bull to R.Aero.Soc.(S.A.). "Aerodynamic noise generation."

Mr. W. D. Doble to S.A.E.(Aust.). "Hull design of power boats."

Mr. R. B. King to Aust. Symposium on Noise in Industry. "The engineer's approach to industrial noise control."
To I.E.Aust. "The community and the problem of noise."
To I.E.Aust. (G. & S.) "The why and how of noise control."

Dr. J. Mannam to 3rd Aust. Conference on Fluid Mechanics on "Tapered land bearings".

Dr. J. M. Pickles to R.Ae.Soc.(S.A.) Hovercraft Symposium. "Air lubricated planing hulls."

Dr. A. G. Thompson to S.A.E.(Aust.) on "Suspension requirements".

Attendance at Overseas Conferences

Dr. J. Mannam at 2nd International Conference on Gas Lubrication, U.S.A.

Mr. A. Shaw, at A.S.H.R.A.E., U.S.A.

Mr. P. D. Dean (for Mr. R. B. King), International Conference on Acoustics, Japan.

Visitors to Department

Visitors to Aust. Symposium on Noise in Industry. (120).

Professor F. J. Richards (Vice-Chancellor of Loughborough University).

Professor B. Downs (Dean of Engineering Loughborough University).

Dr. A. Glorig, University of California, U.S.A.

THESIS TOPICS

Final Year Projects

Blake, A. J.—Vehicle suspension control.

Chee, Y. P.—Sound attenuation in lined ducts.

Connolly, J. C.—Heat transfer.

Freeman, P. S.—Shock-wave attenuation.

Fung, E. Y. F.—Combined stress apparatus.

Hall, R. E. I.—Chimney stack wind excitation control.

Lam, S. G.—Heat transfer.

Pitts, J. G.—Hydrojet propulsion.

Presnail, R. J.—Hydrojet studies.

See, L. C.—Air-lubricated planing hull model tests.

Tyler, C. A.—Air-lubricated planing hull.

M.E. Projects

Dean, P. D.—Attenuation of shock-waves in duct systems.

Goodale, P. L.—Mechanisms of sound generation in aerofoil fans.

Sawley, R. J.—Sound transmission through panels.

Ph.D. Projects

Boas, R. V.—Mechanism of noise generation by aerofoils. (Dr. Bull).

Carpenter, A. L.—Gas lubrication in tapered and stepped bearings. (Dr. Mannam).

Lim, K. B.—Boundary layer turbulence pressure fluctuations. (Dr. Bull).

Morgan, G. A.—Heat transfer in gaseous combustion. (Dr. Mannam).

Nilsson, U. E.—Machine Noise. (Dr. Mannam).

Paech, I. N.—Hydrojet ship propulsion. (Dr. Pickles).

Shaw, A.—Heat and mass transfer in biotron systems. (Prof. Davis).

RESEARCH

(A) Gas Dynamics

1. Air lubricated bearings

Work proceeds on theoretical and experimental studies of novel forms of aerostatic tapered and stepped land air lubricated bearings developed in this department.

Because of the low friction characteristics, ability to function under extreme temperature conditions, and the avoidance of contamination, these bearings have become important in nuclear power, space vehicles, and other special situations.

Applications are also being studied here to dental drills and other high-speed rotors.

2. Wall-pressure fluctuations in turbulent boundary layers

It is well known that in a turbulent boundary layer the fluid velocities fluctuate in a random fashion about their mean values. These velocity fluctuations have associated with them corresponding pressure fluctuations which give rise to a wide range of engineering problems from fatigue of and noise generation in the fuselages of high-speed aircraft to underwater acoustic detection of submarines.

An investigation is being carried out to measure the effects of mean streamwise static pressure gradients on various statistical properties of the fluctuating pressure field in a turbulent boundary layer, and to understand better the mechanisms which operate in such a fluid flow. The work is being done in a specially designed wind tunnel, the working section of which has one flexible wall which allows the pressure gradient to be adjusted to any desired value. Fluctuating pressure measurements are being made with piezoelectric transducers and fluctuating velocity measurements with hot-wire anemometers.

3. Noise generated by air flow over aerofoils and other solid bodies

This work has arisen out of the Department's interest in the noise generated by air-flow in centrifugal and axial flow fans. The project is at present concentrated on the measurements of noise generated by single two-dimensional aerofoils, and its relation to the fluctuations in pressures and forces on the aerofoil surface as a result of turbulent boundary layer flow. The measurements are being made in a wind-tunnel specially designed to have very low internal noise levels.

4. Axial-flow fan noise

An investigation into fundamental mechanisms in 3 above is being supplemented by theoretical and experimental studies on actual fan noise generation. A system with many variable parameters is being set up in the reverberation chambers

of the acoustics laboratory to relate sound power generation under varied design and operating conditions. Aerofoil fan noise is a major problem in all heavily loaded aerodynamic fan, propeller and compressor systems.

5. Attentuation of shock-waves in internal-combustion engine silencer systems

The component of engine exhaust noise least amenable to normal acoustic filter attenuation are the shock waves, particularly those of large magnitude in two-stroke engine exhaust systems.

In order to develop a design approach to more compact and acoustically efficient silencers with negligible influence on engine performance, an experimental study has ben made with Schlieren optical photographic shock-front visulation system and shock-pressure transducers. Two dimensional studies on a range of configurations have indicated interesting possibilities for high shock attenuation and low flow resistance.

(B) Hydrodynamics

6. Hydro-jet ship propulsion

Work is continuing in the water tunnel on submerged ducted impeller propulsion for displacement ships with a view to virtual elimination of vibratory components of torque, thrust, bending and pressure field associated with free-water propellers at the stern of a ship. The major problem is to integrate the design of duct and impeller to maintain high propulsive efficiency without cavitation.

7. Hydro-jet marine surface-craft propulsion

As a means of propulsion for fast marine surface craft, the open-water propeller is seriously affected by cavitation above speeds of the order of 35 knots.

By enclosing a propeller in a duct which inducts water from below the hull and discharges it above the water, the propulsive efficiency at higher speeds could be better than that of the open-water propeller. To achieve this the inlet to the unit is very critical and would need to have a high efficiency. Investigation is proceeding by mounting a jet unit on the research water tunnel and investigating inlet shapes.

8. Air-lubricated planing hulls

The present interest in high speed marine surface craft has prompted new approaches to the reduction of hull resistance. The department is investigating a method achieving this by inducing a layer of air beneath the hull. The hull form is flat-bottomed with an upswept bow and with side walls. At a sufficiently high speed air is trapped between the hull and sidewalls and forced beneath the hull. A transparent model has been constructed, which will enable the flow beneath the hull to be studied. Resistance testing will shortly begin in the S.A.I.T. towing tank to confirm earlier encouraging results obtained with a wooden model. A scaled-up hull, carrying a crew of two, is being constructed and this will enable some estimation of scale effect as well as data on hull pressure distribution and an assessment of sea-keeping and manoeuvrability characteristics.

(C) Dynamics of Machines and Systems

9. Vehicle suspensions

Mechanical analogue and laboratory model investigations have explored certain possibilities for optimising feedback control of damping in vehicle independent passive suspension systems for maintaining good ride quality and wheel-to-road adhesion.

Analytical and analogue computer studies have extended this work to the computing of optimum damping rates in front suspensions with both statistical and deterministic forms of input in regard to ride comfort and roadability of a vehicle.

Theoretical studies have resulted in realisable designs for active (powered) suspensions with outstanding capabilities including induced banking on turns instead of the roll-out associated with conventional systems. Preliminary work on electro-hydraulic servomechanisms has this development in view.

Extended analogue computing facilities will shortly permit the extension of investigations to the influence of non-linear damping on rear-axle tramp, and the minimising of pitching in conventional systems.

10. System control

Development of a 4-stage pneumatic process control unit has been used in conjunction with analogue simulation to study the influence of system parameters on stability and response.

Fluidic units will shortly be available to extend this work.

Parameter plane methods are being studied with regard to the investigation of non-linear systems, and systems with dead-time and distribution lags.

11. Vibration control

Wind induced vibration in cylindrical structures (unstayed chimney stacks) occurs as low wind speeds associated with regular vortex shedding and at high speeds due to frequency selection from a random gust spectrum. As the response in either case can be large, and occurs essentially at the fundamental beam frequency, investigations into the use of a ring-type omni-directional tuned dynamic absorber for control or prevention of vibration has been investigated.

Refinement of design for minimum dimensions is now being investigated.

(D) Thermodynamics

12. Internal-combustion engine spherical pistons

If a sphere is either rolling within or translating along a cylindrical bore in the presence of an oil film, it will develop a pressure between itself and the wall either by the squeezing action as it rolls or the wedge action as it translates.

An investigation is proceeding into the possibility of using a ringless piston of spherical form which utilizes this oil film to resist gas pressures.

13. Natural-convection heat transfer in vertical ducts

If the wall of a duct is at a temperature in excess of the ambient, buoyancy forces due to density differences cause the fluid to flow through the duct from bottom to top. Being a natural convective process, the fluid flow mechanism and the transfer of heat from the wall are coupled together.

The rate at which heat is transferred is obtained by solving simultaneously the equations which govern the flow. The theoretical results are verified by experiments.

PUBLICATIONS IN JOURNALS AND CONFERENCE PAPERS—1968

1. M. K. BULL—"Velocity profiles of turbulent boundary layers." R.Ae.Soc.Jl. (U.K.).
2. M. K. BULL & K. B. LIM—"Effects of Reynolds No. on wall pressure fluctuations in constant pressure turbulent boundary layers." 3rd Aust. Confce. Fluid Mech. (I.E.Aust.).
3. H. H. DAVIS—"The elements of the theory of vibration and its control."
4. J. R. DYER—"The development of natural convection in a vertical circular duct." I.E.Aust.Proc. Aust. Symp. on Noise in Ind.
5. R. B. KING—"Criteria for ambient noise levels in auditoria." Proc.Int.Confce. on Acoustics (Japan).
6. R. B. KING—"The engineer's approach to industrial noise control." Aust. Symp. on Noise in Ind.
7. J. MANNAM & A. L. CARPENTER—"Tapered lands hydrostatic journal bearings." Proc. I.Mech.E., 1965, Vol. 179, Pt. 3J.
8. A. SHAW—"Dual-duct system: criteria and basic design procedure." A.S.H.R.A.E. Jl: (U.S.).
9. A. G. THOMPSON—"Contribution to the theory of optimum damping in automobile suspension with random and impulsive forms of input." I.Mech.E. (U.K.).

ADELAIDE UNIVERSITY ENGINEERING SOCIETY
Provisional Balance Sheet to 25th September, 1968

RECEIPTS	$	PAYMENTS	$
Membership	174.00	Social Functions	18.16
Badges	16.00	Ball	453.63
Ties	155.00	Dinner	237.75
Ball	451.24	Coke	565.10
Dinner	221.10	Hysteresis	647.03
Coke	770.20	Postage	6.95
Hysteresis	682.50	Barbecue	654.39
Car Trial	25.00	Car Trial	51.56
Barbecue	393.00	Sundries	750.10
Sundries	423.05		
Balance B/F	410.16		3,384.67
		Bank Balance	336.58
	$3,721.25		$3,721.25

T. G. FULLER, Hon. Treasurer.

We know about all of them

Whether you want a bolt, to do that handyman job, or a highly mechanised industrial lathe, McPhersons can meet your requirements. McPhersons have many different departments, all specialising in their own field. These departments have men qualified to give you maximum service, and men who know their products.

We feel that by having the right people, our customers will receive the very best service available. During the past hundred years McPhersons have grown from small beginnings to become a large complex Company, supplying the needs of the retailer, industrialist, the farmer, the grower, the engineer, and the handyman.

McPhersons produce Ajax pumps and fasteners, and Macson lathes, all of which have become known the world over. We are also stockists of Hercus lathes, hand and power tools, and wood working machines . . . a comprehensive range that will fill the requirements of any demand that may be made in this field.

The Machine Tool Division handles the requirements of the industrialist, supplying heavy machinery. This is a field in which McPhersons have progressed considerably since World War I, when they entered this field to supply desperately needed industrial lathes for the home front.

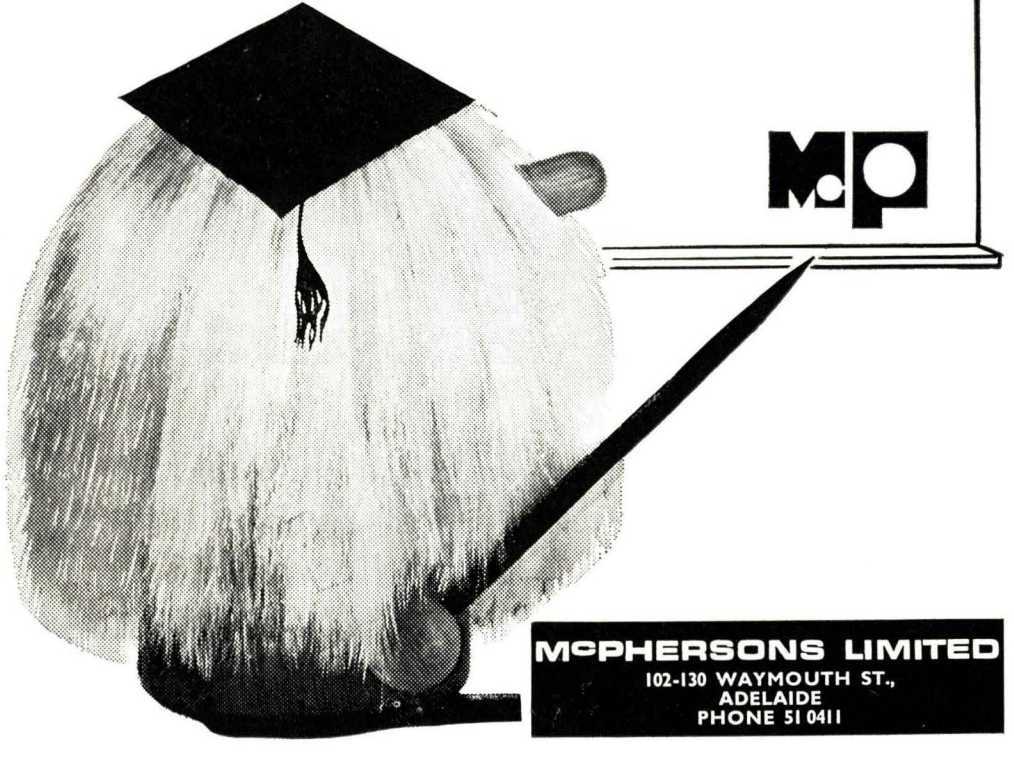
Tubes and steel have always been in great demand, and we have supplied millions of tons throughout Australia. Each is handled by its respective department. Our General Department's diverse range of stock can supply you with paint brushes, castors or wheels, oil cans, heavy lifting equipment, Killrust paint, pulleys, Nylex pressure hoses, pressure gauges, or almost any industrial products required.

Abrasives are an essential part of industry that McPhersons cater for. We stock one of the largest ranges of abrasives in Australia.

Tool up for progress at

McPHERSONS LTD

WAYMOUTH ST., ADELAIDE.



McPHERSONS LIMITED
102-130 WAYMOUTH ST.,
ADELAIDE
PHONE 51 0411

TASMANIAN SYMPOSIUM
"ENGINUITY"

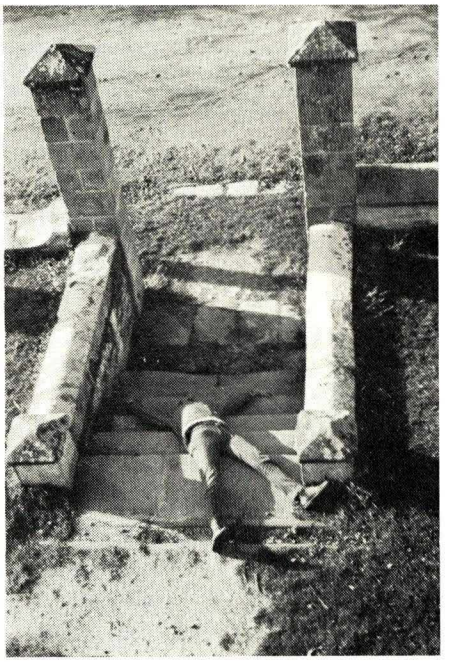
We arrived on the afternoon of Sunday, 19th May, in Hobart. What a greeting Hobart put on for us! It was raining, sleet was over the roads and the wind was howling. A drizzle had been falling all day. First impressions began to form; "What have I let myself in for?"; "What a lousy, bloody city, you'd think they'd turn off the taps!!" However, these impressions faded away the very next day.

The informal welcome on the Sunday night consisted of about 100 gallons of some bitter tasting stuff called "Cascade" ('tis an ale they call beer). The settings weren't ideal, but who worries about surroundings. The biggest worry is whether the glass was full or not. A female type engineer from Melbourne University had come over for the Symposium. She didn't last long at the "welcome" — about 5 minutes I think. The songs and language being used weren't strictly applicable for mixed company. The night was cold and wet and miserable so there weren't too many inebriated engineers that night; even though we weren't particularly walking in straight lines on the way home.

Monday turned out to be a finer day and restored a lot of our faith in the city. Phil Keane somehow got himself elected as F.B.O. (Faculty Bureau Officer). Big deal! Well at least he got a free meal at one of the swankiest hotels in Hobart (Hadley's Hotel). It was also here that Prof. Miller told him that naughty joke he told at the A.U.E.S. Dinner. Free grog was laid on here too, so you could imagine all the F.B.O.'s from each University staggering back for the afternoon lecture by the Deputy Premier of Tasmania (Hon. R. F. Fagan). Or was it something about hydro-electric schemes, and things in general that make their little island prove its worth.

The night turned out to be a very spirited one. What else do you do when they have a show with free beer and spirits? Jack Cuffley and Ion Menadue wacked into the rum and Phil Keane and Bob James got stuck into the vodka. John Queale and Bruce Craven were more interested in stuffing it down the birds' necks. What a waste (of drink) but turned out to be quite a good seducer. Mick Williams was revisiting his old home and therefore renewed a few old acquaintances and had a drink or two or three, maybe more (who's kidding who? He was throwing them down, spirits too).

Somehow we ended up at a party that went to about 3 a.m. Next you expect me to say that we didn't get up for the lecture in the morning. You're wrong; but we shouldn't have! The topic was "Cunning Engineers of the Past", and I'm afraid we had heard a lot of the stories from Prof. Bull in our earlier years at Uni.



A Hard Day's Night

By this time, four of us had rented a car and we decided we didn't want to run up too many miles, so something had to be done with the speedo cable—it was done!

The afternoon topic was called "Originality in the Design and Construction of Dams", which was a purely civil subject. Tuesday night was the Power Cruise and Barbecue. The grog was on the bottom deck and dancing and carrying on was on the top deck. Birds at these shows were mainly hockey birds or locals. By this

time J.C. had something he didn't want (not that type anyway), R.J. was still looking, I.M. was getting "punch" drunk, P.K. had dipped out on the bird he had been raving on about the night before, but ended up with about the wealthiest bird in Hobart. J.Q. was still with some Melbourne Uni. bird, B.C. was on and off, mainly on and M.W. was getting himself full again—hell! he liked that Cascade. No one managed to get sea-sick, Well, can't remember being sick!

Wednesday comprised a day tour of the Hydro-Electric Schemes. We went to the Great Lakes Scheme at Poatina. Those who were lucky managed to get invited to the Hockey Ball that night; those who were unlucky went anyway. Free beer and spirits again—but would you believe three bottles of each spirit. This was gone by 9.30 p.m. can you blame them?; birds ran the show! It wasn't very wise to get a bird who was playing hockey in the intervarsity, she had to be home by 12 because "we've got a match tomorrow".

Thursday's line up of lectures didn't seem to impress us, so we decided not to go to the one in the afternoon and went sightseeing instead.

This night's social event was the Ball which went from 8.30 p.m. till 2.00 a.m. (supposed to have been 3.00 a.m. but the police objected). Free beer and spirits again. That's right we were never sober. Poor old Will didn't make it. Apparently he had stomach trouble on the way to the show. The one, and only one, from Adelaide to throw up while we were away. By this stage of the week we were all on rum and coke and I'm afraid most of us were quite full by the time two o'clock came around. 'Tis sad to relate, that at this late day of the week, one of our group still hadn't conned a bird.

This last lecture turned out to be the most interesting of the lot. The topic was "Engineers Are Inclined to be Ingenious", which the speaker agreed with, but—he said engineers weren't creative, and boy was he stirring. What could you expect though, poor bastard was an architect, and also had a B.A. with which he majored in, wait for it, Psychology.

I was glad to see he was human, though, when he went red with embarrassment with a slight dig from P.K. in his vote of thanks.

After this lecture, a keg was thrown on down at the local tavern (what! no spirits). This proved to be a warming up period for the dinner. Unfortunately the food was cold and not very appetizing. But once one had a few glasses of claret, apple cider or good old Cascade; one forgets that he was even eating.

Every now and again during the dinner we were disturbed by those F.B.O.'s getting up and giving their appreciation of the Symposium and by tradition had to tell at least two, not too clean, jokes. Phil Keane had a couple of good ones which he told, but by involuntary forgetfulness (inebriated) he managed to leave a few phrases out of the jokes and they consequently didn't go over too well. Others who attempted to tell jokes were Ion Menadue, who put over a rough one. He also mixed his phrases a bit, but managed to get his idea across. John Queale also had a couple of roughies. I liked it best when a speaker would get up and then ask the waitress to leave the room before telling his joke.

We didn't feature in the sculling events, after teaming up with W.A. The official sculling glass was 10 oz. The order of sculling races was eights, fours, pairs and then singles, and these fellows were still standing at the end of it.

Somehow we managed to get back to the college we were staying at and quite glad of the fact that the plane wasn't leaving till the afternoon on the Saturday.

Even the ride home on the train was an experience and one of our group seemed to have ended up quite snuggled up with a bird (no names mentioned please—by request).

Everyone who went on the Symposium thoroughly enjoyed themselves and were quite convinced that their money was well spent. Just ask anyone whose name has been mentioned whether they would go to a Symposium again. The answer will be "Yeh!—You bet".

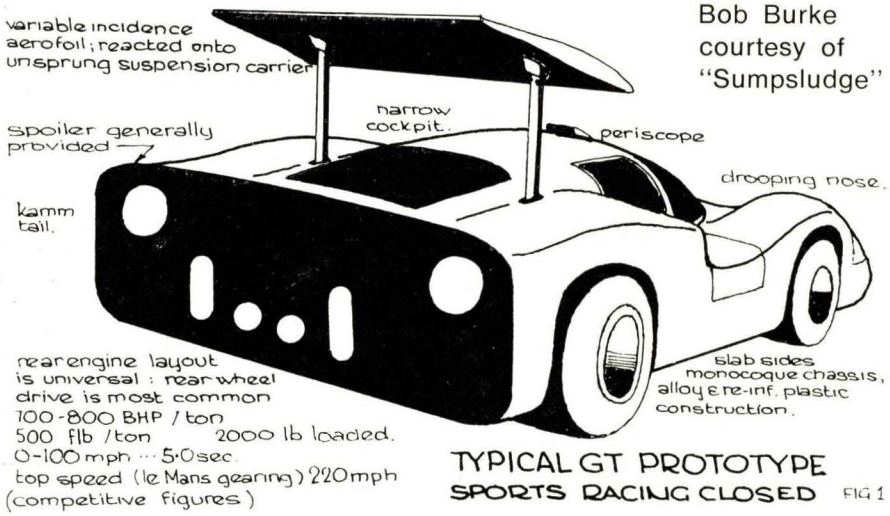
I would like to suggest to students that they start thinking about going to the Symposium next year in Sydney. The expense is very little compared with the enjoyment received.

Don't wait till your final year to decide to go, because you will want to go the next year, but then you will have graduated—disappointment plus.

Remember also, that the best time to travel is while you are a student when you get quite a few concessions.

AERODYNAMICS OF THE SPORTS RACING CAR

Bob Burke
courtesy of
"Sumpsludge"



TYPICAL GT PROTOTYPE
SPORTS RACING CLOSED FIG 1

In order to improve the speed/power characteristics of a motor vehicle, some attention must eventually be given to the reduction of aerodynamic drag. Drag is proportional to the square of the velocity, and so in the higher speed ranges this retarding force becomes increasingly significant. This is one reason why trucks, which rarely exceed 60 m.p.h., are today still as bluff and square-looking as they have always been. Passenger cars on the other hand, with speeds now commonly in the 100 m.p.h. area, have generally shown a marked improvement in drag reduction.

The ideal shape for a streamlined motor car has been recognised for some years, and is typified by the land speed record cars of Cobb and Campbell. In the 200 plus m.p.h. range currently being achieved by racing sports cars, this ideal streamlined shape is desirable for maximum speed, but cannot be used for various practical reasons —among them the necessity for steering, all-round vision, and manoeuvring in heavy traffic. The problem, then, is to adapt the ideal shape to these various requirements.

Another, and until quite recently unrecognised, aspect of the problem is that of aerodynamic lift. Any vehicle subject to a higher velocity air flow over its upper surface than over its lower surface experiences a lifting force. This force can be of the order of several hundreds of pounds—for example, current American sedans develop a lift force of 300 lbs. weight or more at 100 m.p.h. On a car weighing 4,000 lbs., this effect only manifests itself in such phenomena as the billowing of convertible tops. On a car weighing only 1,200 lbs., however, it is easy to see that at slightly higher speeds serious problems of traction or steering can arise. At speeds of 150 to 200 m.p.h., in conjunction with an otherwise harmless bump, cars have been known to become completely airborne. The problem thus resolves itself to be the determination of a suitable non-lifting, low drag shape. Fig. 2 shows typical pressure distribution around a competition sports car.

A further complication is the requirement that the car should be stable under cross wind conditions, and more particularly under suddenly changing conditions such as occur when driving from the shelter of a building into a strong cross wind.

Prior to 1940, much work was done towards decreasing drag, particularly by constructors of racing and speed record cars. The fundamentals of streamlining were laid down in this period, the interesting point being the length of time it has taken manufacturers to apply these fundamentals. In fact, in his book "Das Kraft fahr seug" in 1935, Professor Kamm made the first recorded attempt to adapt the fully streamlined automobile for road use. He made use of a previously known aerodynamic phenomena, and merely cut the ideally tapered after-body squarely off at the longest length he

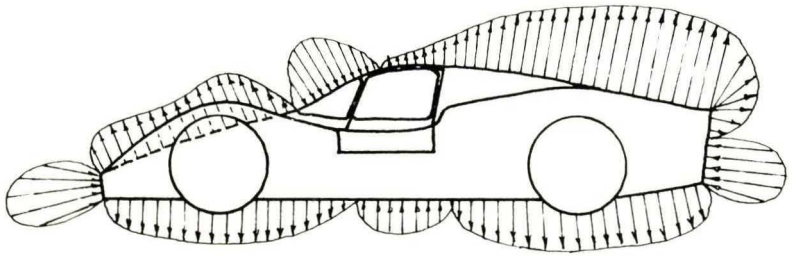
could tolerate. This is a very successful compromise since each successive increment of length towards the tail contributes considerably less drag than the preceding section. Fig. 3 illustrates the Kamm principle.

Barth in the 1950's in Germany, presented a table of experimental drag and lift coefficients for various types of car under several cross-wind situations, showing that the lift coefficient could be as high as 1.32 under severe cross-wind situations for a normal sedan or sports car. He also showed how lift could be reduced by reducing the height of the passenger compartment, which is the section with the largest negative pressure, and by using a convex underside.

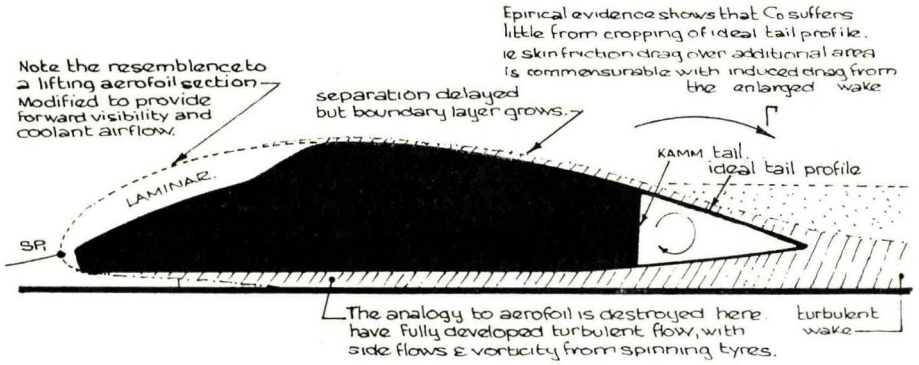
A modern development has been to add a spoiler to Kamm-tailed vehicles, mostly in order to reduce lift by providing a downward force on the rear wheels. It has been shown that this need not necessarily incur extra profile drag, and in fact can reduce it, by stabilising the vortex flow behind the car.

In 1964 the Ford Motor Co. commenced sports car racing with a reputed annual research and development budget of $5 x 10^6. This represented the first really analytical approach to sports car design, and has resulted in cars which have won the 24-hour races at Le Mans and Daytona, and the 12-hour race at Sebring. The cars reach speeds of 220 m.p.h. at Le Mans, and have achieved the feat of remaining controllable at these speeds. Needless to say, this has not been accomplished without extensive research, but the desire to stay in front means that this information has not been published. We can, however, observe the finished article. See Fig. 1 (chaparral 2F).

Current practice in high performance vehicles has, however, remained largely empirical and somewhat haphazard.



TYPICAL PRESSURE DISTRIBUTION : LONGITUDINAL SECTION. FIG 2
Note that the form drag is given by the surface integral of the appropriate pressure componant.



SECTION THRU. VEHICLE (SCHEMATIC) FIG 3.

Today's faster racing sports cars are basically very similar aerodynamically. The fundamental shape is a closed rear-engined two-seater, incorporating the Kamm tail with some degree of spoiler, and a drooping wedge-type nose.

Figure 1 shows the general arrangement—the front wedge and rear spoiler provide downward thrust at each end, at the expense of a higher CD; the passenger compartment is as narrow as possible, showing an appreciation that the greatest lift is produced here; the closed coupe is almost universal today, due mainly to the previously mentioned high suction, which draws dust, fumes, etc. into an open cockpit.

Ford have shown an appreciation of the three dimensional aspect of the flow picture by using spoilers to direct the flow from the side of the vehicle onto the upper surface, to reduce the top surface suction. Mercedes introduced driver-controlled aerodynamics some 11 years ago, in the form of an air brake, and this subject has been revived lately by the American Chapparal organisation. These cars extended the existing rear spoiler to a greater height, and pivoted it so that the driver could control the angle and hence the downward force. The latest version now mounts an aerofoil above the car on 30 inch struts, and this again is controllable for incidence. Another car, the Ghia-de Tomaso, uses a slightly neater version of the same idea.

The fact that a car body travels in close proximity to the ground alters its free stream aerodynamic characteristics. Just what the alteration is, seems to be somewhat in doubt. This is in fact the main stumbling block to advances in this region: it being difficult to simulate the effect of the relative velocity of the car undersurface and the ground under static test conditions. Such tests on models are a useful guide but the only effective experiment is one carried out with an instrumented full-size prototype under "live" conditions. The limitations of this as a method of research are very obvious.

Again, neglecting the trees and viewing the forest as a whole, the panorama is rather bleak. The stylist dictates the aerodynamics of the production vehicle, which may seem lamentable but it is very evident that sales are more influenced by aesthetics than aerodynamics. Some manufacturers have in fact given the problem some consideration with quite remarkable results. It may seem odd but the blunt functional Renault R8 has a markedly better drag co-eff. than all the heavily styled American fastback "sporting" motor cars. The gains in fuel economy, stability and comfort at touring speeds, and noise levels are well worth while. However, the limited incentive and the cost of research will probably mean that the shape of our mundane transport will not change much other than to follow transient fads.

High performance and competitive vehicles are a challenge. The need for new knowledge is pressing as all manufacturers realize the inadequacies of current practice and the advantages to be obtained in this field. However, next year's CAN-AM must be produced regardless of whether the information is available or not. Preparation and development demands are heavy and money and time for research are short.

FINAL YEAR ELEC. CLASS NOTES

Prof. Woodward—The Prof. really became "one of the boys" this year. By the way he swung with the beat at the ball, I'm sure he and his wife enjoyed themselves. He became a "real gas guy" after accepting an invitation to go to Neil Smith's place after the dinner. He stayed 'til 2.30 a.m.!! Statistics show that he will be wearing his plain red tie next year. Watch out for it!!

Prof. Willoughby—He had the students on a treasure hunt this year, looking for something called physical weights. We were glad to see him taking helpful criticisms in a light-hearted manner, He was noted as saying with a sarcastic tone, "I'm going to miss you fellows next year"!

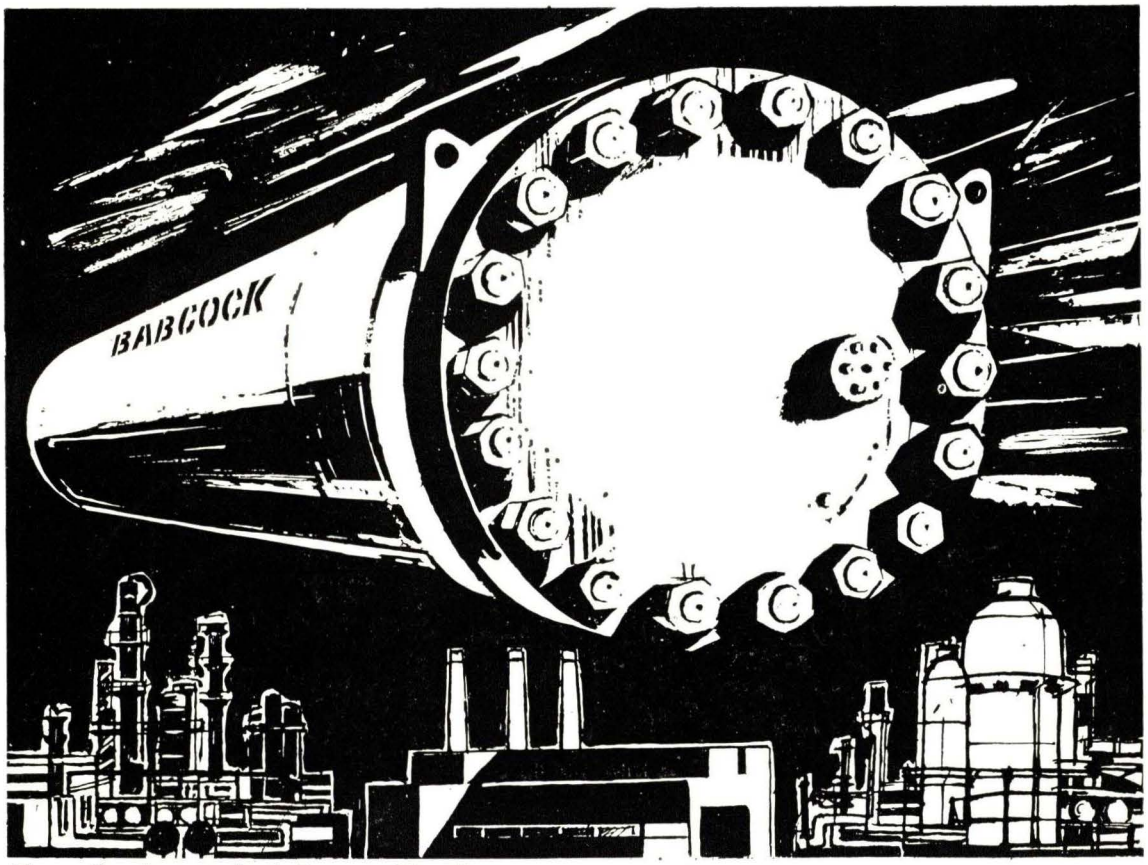
Dr. Cole—How's this for organisation? Two pre-ball parties were held for the class. Prof. Woodward was invited to one, Dr. Cole to the other. Dr. Cole went to one on the other side of town from his place. Prof. Woodward went to the other one, which was in a block of flats two doors away from Dr. Cole's flat. These two lecturers were the only staff from the whole Engineering Department at the ball. Presence of others was sadly missed!

Dr. Griffin—Rumour is that he is related to Groucho Marx. Really excited the students by giving a final exam at the beginning of the second term. Tremendous fun had by all!!

Mr. Pawsey—DCD—noted mainly for his persistent breaking of chalk and never before have we seen so many capital letters between two full stops. Still thought of as one of the "good guys".

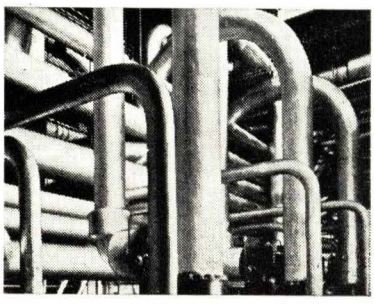
Mr. Pucknell—DAP—Had us all rolling In the aisles in the first lectures of his different topics. After that he setled down

Continued Page 72



For Industrial Installations—

BABCOCK BOILER PLANT
PRESSURE VESSELS & PIPEWORK



BABCOCK is a big name. The world knows it well for first-class, modern, steam-raising plant; for power generation and industrial service. BABCOCK also designs, manufactures and installs an impressive variety of other heavy mechanical and industrial process plant. With great experience and capabilities in mechanical engineering it can come in at the planning stage for new or extension plant in many industrial categories . . .

BABCOCK supplies complete boiler installations and cost-saving waste-heat utilization systems, combustion equipment for oil, gas, solid fuels and waste-product fuels, heat exchangers, separately fired superheaters, steam accumulators, pressure vessels of any size and to the highest specifications, and complete industrial pipework installations.

BABCOCK & WILCOX AUSTRALIA LTD. HEAD OFFICE & WORKS: REGENTS PARK, N.S.W.
Branch Offices: Sydney, Melbourne, Brisbane. **Agents:** Elder Smith Goldsbrough Mort Ltd., Adelaide & Perth.
New Zealand: Babcock & Wilcox (New Zealand) Ltd., Auckland.

DEPARTMENT OF CIVIL ENGINEERING

Mr. G. Sved
(Acting Head of Dept.)

The following is a brief history of the Civil Engineering Department's fortunes over the last year:—

Two members of the Civil Engineering Department (Dr. M. Arnold and Dr. D. S. Brooks) were awarded the degree of Doctor of Philosophy. The Master of Engineering degree was conferred on Craig Duncan, Christopher Olsen and Barry Tozer for work done in the Department. There are a number of graduates working for their Master's degree at present.

One of the highlights of last year was the Open Day, conducted on 31st May and 1st June. With the active co-operation of the students, we were able to construct and man a number of exhibits that attracted very favourable comments from experts and laymen alike.

A Concrete Design Course was organised by Mr. D. B. Crawley, in conjunction with The Cement & Concrete Association and the Adult Education Department of the University. The course was attended by about 100 engineers and architects. The lectures were given by interstate and local experts in various facets of concrete design; the success of the course extending over 10 late afternoon lectures can be gauged by the fact that there was no falling off in the number of participants.

The Department was active in consulting and testing right through the year. The advice of the members was sought on topics ranging from the construction of storm water inlets to the mechanical properties of foundry sands, from the stability of flow of water containing large quantities of solids to the stability of structures. The geographical origin of the problems was equally widespread; most came from Adelaide, but others from places within the State to the Pacific Islands. Two members of the staff were called as expert witnesses by a State Department to give evidence before an Arbitrator on a claim involving approximately $500,000; the Arbitrator's judgement was in favour of the State Department (probably in spite of our evidence). The opinions of our Department were also sought by the State Public Works Standing Committee in conjunction with one of the major projects under consideration. Mr. R. Culver acted as consultant to the Cultural Centre which opened recently in Melbourne.

Professor Bull was away during most of the year on Study Leave—you can read about some of his exploits elsewhere in this issue. Dr. Brooks is off on his Study Leave—following in the wake of Sir Francis by rounding the southern tip of South America on his way to the U.K. (even if D.S.B. does travel in a slightly larger boat). Mr. Crawley is due to fly off to London before the end of the year.

To prove that the traffic is not all one way, we had a number of callers from overseas who visited Adelaide in conjunction with the International Soil Science Congress. Professor R. H. Evans and Mrs. Evans spent nearly a week in Adelaide during April; he had several discussions with members of the Department, gave one Seminar and one well attended public lecture.

STRUCTURES

One of the major problems confronting house builders in Adelaide is the cracking of brick walls; in a great proportion of cases this cracking is caused by the movement of expanding clay soils. The Department has embarked on a research programme to investigate the factors that affect this cracking; a better understanding of these factors is a prerequisite to finding ways and means of preventing the cracking.

Four single leaf test walls were built on the strong floor of our testing laboratory. Each wall was 36 feet long, 9 feet high; they had no openings. The walls were

built on concrete beams; each of the concrete beams was supported on 13 individually adjustable steel cross beams. By raising the central cross beams a "hogging" movement was imposed on the wall; lowering the central beams caused sagging.

Full cycles of ± ⅛ inch and ± ¼ inch central deflection caused no cracking (each cycle took about a fortnight). The supporting cross beams were adjusted at each step so that they defined a circular arc; however, it was noticed that the concrete beams lost contact near the ends at hog, near the centre at sag. This indicated that the weight of the walls + beams + a super imposed load of 200 lb. to represent the roof load is not sufficient to cause deflections of this magnitude in a continuous brick wall that has no openings. When the ends were tied down to the strong floor and the centre was lifted ⅝ inch, severe cracking was noticed in the lower courses near the ends.

To investigate the effect of openings and junctions a large (approximately 50 feet square) flexible slab will be built; the curvature of the slab can be controlled by hydraulic jacks.

The investigation of elasto-plastic behaviour of steel members was continued. Previous calculations relating to combined torsion and axial loading and torsion and bending were confirmed experimentally. Theoretical work continues on the effect of strain hardening on the propagation of the elasto plastic interface under combined loading.

A new project started concerns the effect of moving liquid bodies on structures. A perspex tank mounted on flexible supports was built; a variable speed, variable amplitude drive was used to get experimental values for displacements and strains in the tank. Comparison with calculated values is proceeding.

A new programme was written for calculating the stresses in cylindrical shells; a micro-concrete model is used to verify the results of the calculations.

There are a number of other projects in the initial stages: difference methods for plane stress and shell problems, optimization of structures under multiple loading, fringe multiplication methods for photoelasticity to mention only a few.

HYDRAULICS

The five year research study of the behaviour of the Adelaide Beachfront is now in its third year. Old protographs and maps coming from the most unexpected places are helping appreciate its condition in past years. Surveys of sand distribution, dune plantings, frontal state surveys, sea and wind conditions, sand dune building experiments have been conducted in the past year. Further hydrographic surveys and bottom caring runs are proposed for this coming summer. The computer is playing a vital part in assessing wave refraction effects and in "generating" yearly storm patterns from existing wind records. A model study of the Patawolonga area is well in hand in the laboratory and it will be followed by one of the Torrens Outlet area when survey data is obtained this summer.

A scale model of a section of roadway (1 : 2.5) will it is hoped enable improvements to be made to gutter entry structures in a study being conducted for the Highways and local Government Department. More efficient drainage entry structures will ensure that the performance and economy of urban drainage systems will be optimal.

Irrigation research studies have shown a possible classification of irrigator heads with a figure of high performance heads. Limitation to ultimate improvements in head design has been shown to be due to basic jet instabilities.

Studies of various industrial and mining activities have been undertaken in Northern N.S.W. and Queensland and on Bouganville.

SOIL MECHANICS

Research in the Soil Mechanics Section has been somewhat limited during the past twelve months.

A programme to investigate the fabric of local clays by means of electron-microscopic examination of ultra-thin sections has been delayed by the inability to obtain certain specialized equipment and only preliminary studies have been made into the suitability of various embedding medium into the airfilled voids of partially saturated clays has been overcome by subjecting the specimens to a pressure sufficient to drive the trapped air into solution after which the dehydrating agents are able to replace the water by normal diffusion processes.

No postgraduate work has been carried out during the year and final year student project work involved the initiation of a programme aimed at extending overseas research into the applicability of deformation characteristics of clays. A second student project was directed towards the development of a suitable method of stabilising a chemical waste from a local factory in order that it might be used as fill for future development areas adjacent to the Port River.

PUBLICATIONS

A number of papers written by members of the Department appeared during the year:

Culver, R. and Till, M. R.—"Some measurements of tree size", Aust. J. Agr. and Animal Husbandry, Vol. 7, pp.587-592, December, 1967.

Culver, R.—"A preliminary assessment of the use of quartz thermometer for the determination of pump efficiency in situ", J.I.E. Aust., Vol. 40, No. 1-2, pp.13-21, January, February, 1968.

Culver, R.—"Sprinkler Irrigation", Water Res. Found. (Aust.), Report No. 25, pp.22-34, March, 1968.

Crawley, D. B.—"Commentary on the code for the use of concrete in buildings, AS-CA2-1963".

Pt. 1. Bases of Design. (No. 6, June, 1968).

Pt. 2. Design Based on Permissible Stress. (No. 7, July, 1968).

Pt. 3. Design Based on Permissible Stress. (No. 8, August, 1968).

Pt. 4. Design Based on Permissible Stress. (No. 9, September, 1968).

Constructional Rev., Vol. 41, No. 6-9, inc., June-September, 1968.

Sved, G. and Ginos, Z.—"Structural optimization under multiple loading", International Journal of Mechanical Science, Vol. 10, p.803, 1968.

STAFF-STUDENTS' GOLF DAY

by John Forrest (Civil V.)

I will begin with a quick whinge, which offers no reflection on the day itself. Engineers often find that many words can be substituted by a table which clearly emphasizes a fact. The one below is a good example and I feel no further comment is required.

	Staff	Students
People previously acknowledging their attendance	7	30
Actual attendance	7	10 (plus two apologies)

On the 15th August, a number of brave, optimistic "golfers" finally arrived at the Ashbourne 9-hole golf course for what proved to be a most enjoyable day in one way or another. Determined Doble arrived first. He was seen and heard by more punctual members searching in long grass. His facial expression showing obvious guilt and disappointment. Further investigation revealed that he had somehow lost his new ball with his first shot.

The scene was set. The day was perfect and the course looked embarrassingly comfortable and serene at this stage. Tension began to mount as the field was arranged. Staffs' joints were cracking curiously with eager pre-match preparatory swings, while students were making preparations for the thirsty trek ahead of them. The first four (to be nameless) drove off, and boy were their drives off, everywhere but on the still seemingly smiling virgin fairway. On the first hole Concrete Crawley appeared a little overstressed in the beginning with the resulting failure and a general cracking up of some of his low-ironed eflorts, but finally with a little more sheer determination, his stresses were earned and his confidence reinforced by holing a long putt on the opening green.

Also Thirsty Templer had a little trouble earlier on in lifting his head, but as the round (or number of rounds) increased he managed to lower it appreciably, his score, however, increasing in the process, perhaps because of the greater display of elbow bending. Marine Male had difficulties in addressing his ball, his numerous neurotic nautical terminologies often leaving the ball and accompanying players bewildered. However, after many trials and tribulations the pace (apart from the scores, divots, airies, refreshments and

Continued Page 52

COMMEMORATION

1968

Anne Musker
(First Female Eng. Graduate)

The Dean of the Faculty of Engineering (Prof. J. L. Woodward) presented to the Chancellor:—

For the Degree of Doctor of Philosophy:

Arnold, Maurice, B.Sc. (Eng.) ..... Civil Eng.
Clegg, Michael John, B.E. ..... Chemical Eng.
Vu, The-Bao, B.E. ..... Electrical Eng.
In absentia:
Hale, Malcolm Robert, B.E. ..... Mechanical Eng.
Ad eundem gradum:
Cole, Peter Harold, Ph.D. (Sydney)
Pickles, John Martin, Ph.D. (Cambridge)

For the Degree of Master of Engineering:

Flower, Ian Cameron, B.E. ..... Mechanical Eng.
Gower, Stephen Newman, B.E. ..... Mechanical Eng.
Olsen, Christopher John, B.E. ..... Civil Eng.
Tozer, Barry Allan, B.E. ..... Civil Eng.
Duncan, Craig Thomas, B.E. ..... Civil Eng.
McLean, Alexander John, B.E. ..... Mechanical Eng.
Sydenham, Peter Henry, B.E. ..... Electrical Eng.

For the Honours Degree of Bachelor of Engineering:

2A	Arbon, Peter Fulton	Civil Eng.
2B	Bailey, Gregory John	Chemical Eng.
1	Bartlett, John Phillip, B.Sc.	Electrical Eng.
2B	Brenton, Kevin John	Chemical Eng.
1	Bullock, Frederick George	Electrical Eng.
2A	Bundrock, Anthony John	Electrical Eng.
2B	Burke, Robert Stanley	Mechanical Eng.
1	Colebatch, Phillip Maxwell, B.Sc.	Electrical Eng.
2A	Davies, Graham	Electrical Eng.
2B	Fitch, Phillip Stanley	Electrical Eng.
2A	Fuller, Peter Gilmour	Chemical Eng.
1	Ginos, Zisis	Civil Eng.
2A	Hayford, John Ralph	Civil Eng.
1	Kikkert, Cornelius Jan	Electrical Eng.
2B	Lee, Anthony Ralph, B.Sc.	Electrical Eng.
2B	Liney, Richard John	Civil Eng.
1	McCarthy, Michael Anthony	Chemical Eng.
2A	Miles, Raymond Thomas	Civil Eng.
2B	Nguyen, Tran Van	Electrical Eng.
2A	Ochota, Peter	Civil Eng.

2A	Paech, Ivor Neil	Mechanical Eng.
1	Savine, Percy Victor Harvey, B.Sc.	Electrical Eng.
1	Sutton, John Murray	Civil Eng.
2B	Tsiros, Petros	Chemical Eng.
1	Yong, Poh Kon	Mechanical Eng.
1	Heydrich, Hans	Mechanical Eng.
1	Jenkins, Graham Keith, B.Sc.	Electrical Eng.

For the Ordinary Degree of Bachelor of Engineering:

	Arnott, Peter Thomas	Mechanical Eng.
	Bruce, William, Andrew	Civil Eng.
	Cantwell, Jeffrey Richard	Civil Eng.
	Chominsky, Jurgen	Chemical Eng.
	Cox, Richard Gordon	Civil Eng.
	Golin, Reg John, B.Sc.	Electrical Eng.
	Graham, Neil David	Electrical Eng.
	Hamdani, Usman	Electrical Eng.
	Harahap, Salman Paris	Chemical Eng.
	Hew, Kam Fatt	Electrical Eng.
	Kemp, Gregory John	Civil Eng.
	Koerber, Peter James	Electrical Eng.
	Koukourou, Peter Stanley	Civil Eng.
	Kwok, Hae Meng	Chemical Eng.
	Langmaid, Malcolm Dean	Civil Eng.
	Lukasik, Andrew Zbigniew	Civil Eng.
	McCusker, Anne Marie	Civil Eng.
	Mere, Rein Peter	Electrical Eng.
	Peake, Stephen Robert	Civil Eng.
	Pocius, Eugene Arvydas	Civil Eng.
	Pritchard, Dean Antony	Civil Eng.
	Read, David Norman	Electrical Eng.
	Riegel-Huth, Ronald David	Chemical Eng.
	Rowe, Michael John	Civil Eng.
	Shaw, Graham William	Electrical Eng.
	Smith, Robert Lyall	Civil Eng.
	Stacey, Ian Hamilton	Electrical Eng.
	Storer, Andrew John	Mechanical Eng.
	Suhardi	Electrical Eng.
	Turangan, Julius Alexander Marcus Einstein	Mechanical Eng.
	In absentia:	
	Chan, Kok Meng, B.Tech.	Civil Eng.
	Drew, Keith William	Mechanical Eng.
	Ad eundem gradum:	
	Cumming, Denis Arthur, M.A. (Oxford)	
	Male, David John, M.A. (Cambridge)	

For the Honours Degree of Bachelor of Applied Science:

	Varcoe, Thomas Richard, B.App.Sc.	Secondary Metallurgy

Degrees conferred since the last Annual Commemoration:

July, 1967

	M.E.:	
	Sobolewski, John, B.E.	Electrical Eng.
	Honours B.E.:	
	Trott, Geoffrey William, B.Sc.	Electrical Eng.
	B.E.:	
	Stanley, Ian George	Mechanical Eng.

Degrees conferred in July, 1968:

	Doctor of Philosophy:	
	Brooks, David Stirling	Civil Eng.

(Ed.—Dr. Brooks is the first graduate of the Adelaide University Civil Engineering School to achieve first an M.E. and then a Ph.D. at Adelaide.)

SCHOLARS AND PRIZE MEN FOR 1967

JOHN PHILLIP BARTLETT, B.Sc.: The Cable Makers' Association Prize; a Commonwealth Postgraduate Award (in Electrical Engineering).

CYRIACUS ADRIANUS BLEYS: The Philips Electrical Industries Prize for Elements of Electronics; the E. V. Clark Prize for Electrical Engineering (shared).

KEVEN JOHN BRENTON: The Union Carbide Prize for Honours Chemical Engineering (shared).

PHILLIP MAXWELL COLEBATCH, B.Sc.: The Philips Electrical Industries Prize for Electronics; the Electricity Trust Prize for Electrical Power Engineering.

ROSS MURRAY DALY: The I.R.E.E. Fisk Prize (shared).

ANDREW RICHARD DOWNING, B.Sc.: The I.R.E.E. Fisk Prize (shared).

ROBERT ALEXANDER FRASER: The James Hardie Prize for Civil Engineering (shared).

PETER GILMOUR FULLER: The Union Carbide Prize for Honours Chemical Engineering (shared),

ZISIS GINOS: The Humes Prize for Civil Engineering; the Australian Institute of Steel Construction, Senior Prize.

MICHAEL PETER HARDY: The Australian Institute of Steel Construction, Junior Prize.

JOHN RALPH HAYFORD: The Australian Welding Institute Prize:

HANS HEYDRICH: The Forwood Down Prize for Mechanical Engineering.

HIA, CHEK PHANG: The Petroleum Refineries (Australia) Pty. Ltd. Prize for Chemical Engineering.

BRYAN ROBERT JENKINS: The Sir Robert Chapman Prize for Strength of Materials (shared).

CORNELIUS JAN KIKKERT: A Commonwealth Postgraduate Award (in Electrical Engineering).

LUCIO PETER KRBAVAC: The E. V. Clark Prize for Electrical Engineering (shared).

LIM SIONG GUAN: The Sheel Prize for Mechanical Engineering.

MICHAEL ANTHONY McCARTHY: The Rutter Jewell-Thomas Medal and Prize; the Lokan Prize.

ROMAN MARIA EUGENE OLESNICKY: The Gerard Prize (shared).

LEWIS WILLIAM OWENS: The Sir Robert Chapman Prize for Strength of Materials (shared).

IVOR NEIL PAECH: A Commonwealth Postgraduate Award (in Mechanical Engineering).

ROBERT LUXMORE PAYNE: The Gerard Prize (shared).

RONALD DAVID RIEGEL-HUTH: The Albright and Wilson Prize for Chemical Engineering Design.

RHYS AINSLIE ROBERTS: The James Hardie Prize for Civil Engineering (shared).

PERCY VICTOR HARVEY SABINE, B.Sc.: A Commonwealth Postgraduate Award (in Electrical Engineering).

NEIL INNES SMITH, B.Sc.: The S.A. Chamber of Manufactures Prize for Electronic Control.

IAN HAMILTON STACEY: The Electrical Trust of South Australia Prize.

CHRISTOPHER ROBERT STANLEY: The Sir Robert Chapman Prize for Engineering I.

RICHARD KIMPTON SULLIVAN: The Esso Prize for Engineering Materials (shared).

JOHN MURRAY SUTTON: A Commonwealth Postgraduate Award (in Civil Engineering).

MICHAEL JEFFREY WRIGHT: The Shell Prize for Chemical Engineering; the Esso Prize for Engineering Materials (shared).

Robert S. Freeman (Water Skier)

Robert is a final year Mechanical Eng. student who began water skiing about 11 years ago. He first began competitive skiing 8 years ago. He represented South Australia in the National titles in 1963, '64, '65, '66, '67, and '68, and has been a member of the Adelaide University Intervarsity team in 1966, '67, and '68, being captain in '67 and '68.

State titles held: Junior tricks and over-all, 1963; men's trick, 1966.

Inter-varsity titles held: Men's trick, 1966 and '67; men's slam, 1968.

Robert was awarded a half blue in 1966, became A.U. water ski club president in 1967, and was awarded a full blue in that year.

HOLD TIGHT! NEXT STOP LONDON

By Professor F. B. Bull

(Professor Bull spent 1968 on a study tour in England and North America. He travelled to Europe most of the way by road. In this article he describes some of his experiences early in the journey.)

"The journey of a life-time"—that is how the travel leaflets described it. They were right. They went on to say (in somewhat smaller print) "you will have moments of discomfort on the journey"—they were right about that too.

Blazoned along the side of our coach was the legend "Australia-England-Overland", but that somewhat overstated the case. The actual ride was from Calcutta to London, but even that shorter distance was quite a ride. By the time we finally pulled into Victoria Coach Station in London, 11,000 miles of road lay behind us. This is much greater than the shortest route from Calcutta to London, for our journey included many side trips to see as much as possible of the countries through which we passed.

There is nothing particularly pioneering about the journey these days and many thousands of people have done the trip. The route is quite practical for any car in reasonably good condition. Weather hazards such as floods, wash-a-ways, land slides, snow drifts and sand storms must be expected and may cause some delay. The political situation is another hazard and one can only start out in the hope that none of the potentially dangerous situations flare up while you are passing through the countries concerned. The advantage of going by coach instead of driving oneself is that someone else has all the worry of dealing with the red-tape formalities, particularly at international borders (and these can be quite formidable). The coach crew have done the journey before and know where to go and what to see. Finally, if the scenery is dull and the afternoon is hot and you feel like nodding off—well, it's not your responsibility to keep the bus on the road.

Why go by bus at all? You can fly in little more than a day, go by ship in about 3 weeks, so why be mad enough to take 10 weeks by road? A very good question, and one we were inclined to ask ourselves when later we were stuck thousands of feet up in the Elburz Mountains (Iran) with a snow storm raging outside, sub-zero temperature, a hundred miles from the nearest township and two big ends gone.

If seeking a justification I suppose one could blather about the object of being to study the Impact of Western Technology on the Rural Communities of Asian Countries. If all that mouthful means is to see how the people lived, then I guess that is why we went. This is one of the few ways in which it is possible to see something of the countries away from the big cities. Then again the magic of those "far away places with strange sounding names" is hard to resist; Kathmandu, The Khyber Pass, Kandahar, Isfahan, Istanbul—why seek for justification?

So to Calcutta to join the bus. Calcutta is an ugly mess. It it true that we did not encounter the distressing sight of starving men, women and children, for which we had steeled ourselves, but then we did not go looking for such sights. By any standards, Calcutta is not a comfortable city. The climate is oppressive and the political tension even more so, Democratic government in West Bengal (the State in which Calcutta lies) appeared to have broken down almost completely and rioting appeared to be the most popular local pastime. It is true that those responsible for organising these "spontaneous" uprisings had the decency to advertise when they would take place, so that those not wishing to play could stay at home. The next riot was due 3 days after our arrival so that it was with some relief that we found our bus and slipped out through the seemingly endless suburbs with still 36 hours to spare.

The coach itself was a magnificent, sophisticated piece of machinery, with all the most up-to-date features. Air conditioning—it is true it didn't work, but the idea was a good one! Air suspension, again an excellent idea, provided you can maintain the air in them. Lay-back seats, which were inclined to take the lay-back operation into their own hands (perhaps arms would be more appropriate) whereever we hit real bumps, and four independent systems of braking—ah well! the hand brake never went wrong!

On European roads, for which it had presumably been designed, the bus behaved excellently, but for the rough conditions in Asia, something less sophisticated might have been more suitable.

Our score up to the time we arrived in Greece was:—2 major engine breakdowns, 6 failures of the air compressor (with consequent loss of foot brake and air suspension), 3 failures of auxiliary brakes, 3 complete replacements of shock absorbers, 3 major fractures of the main casting in the rear suspension system, one cracked chassis, one disintegrated ball race, one rubbed through fuel line, one burst front tyre (at speed), one major ditching (when the road edge collapsed under us) and numerous minor collision with bullock carts, horse carts, bicycles, buildings, bridges, boulders and snow drifts. Apart from that we had very little mechanical trouble! But we got there, and only six days late at that.

Our route took us across the Ganges to Kathmandu in Nepal, where we spent four glorious days, then back to India, where we used the Grand Trunk Road for hundreds of miles crossing the Northern Plains. On through Agra, Delhi and Aritsar we crossed over to Pakistan to Lahore and Peshawar. Then through the Khyber Pass we continued into Afghanistan, with 30°F of frost in Kabul. Through sand storms and snow storms our route continued across Afghanistan and Iran to the shores of the Caspian Sea. From there we made a side trip of 1,500 miles to Teheran, Isfahan and Shiraz, the latter in South Iran. On again we passed from Iran to Turkey, where we met the worst storm of the year and spent hours stuck in snow drifts. Across Turkey and crossing the Bosphorus we reached Europe at Istanbul. From then on the route was a normal tourist track (although not in much use in March when we were there), Greece Yugoslavia, Italy, Austria, Germany, Belgium and finally England followed in rapid succession.

Our first night's stop out of Calcutta was at Buddh-Gaya, which is one of the most holy places for Buddhists; for it was here, 2,500 years ago that the Prince Siddhartha meditated 49 days under a peepal tree and became the Buddha or the Enlightened One. The spot is suitably marked by many Buddhist shrines. The central Temple is an imposing tower-like structure, 160 feet high, built about 1,600 years ago; within is a colossal gilded image of the Buddha.

Small country towns in India do not have tourist hotels and in towns like Buddh-Gaya we stayed at the Government Rest House. Sometimes beds are provided, sometimes not. The Indian usually takes his bed-roll with him on walk-about, so—("when in 'India' do as the 'Indians'") we too carried camp stretchers and sleeping bags for use on such occasions. Eating at these Government Rest Houses is somewhat of a problem. Kitchens and dining facilities are provided, but no stocks of food are kept. On arrival, therefore, one must pay a lad to go down to the bazaar to buy food. The bazaar may be some miles away and with luck the supplies will arrive a couple of hours later. After this, the somewhat leisurely preparations of the meal can begin, With any good luck you can eat between 3 and 4 hours after arrival. On that first night we started our evening meal just before midnight.

Between Calcutta and Buddh-Gaya one has to cross the State border between West Bengal and Bihar, an experience which makes all too clear the tragic disunity of India. Customs and Police inspection at the border would make you think you were crossing an international frontier, but it is in the attitude of the English language one sees most difference. In Calcutta and West Bengal, with their long commercial contacts with England, the English language is accepted and most street names and road signs, for example, are in English. Bihar is fanatically opposed to English in any form and all the old road signs with English lettering have been blotted out (without substituting anything else). It is unsafe for an Indian motorist with West Bengal registration plates (in English letters and numbers) to drive his car over the Bihar border without removing the offensive English plates and substituting those in the native form. Failure to attend to this elementary precaution will result in smashed windows all round, or worse. So far the fanatics have not got around to tackling international travellers, but we were stopped by one border official who wanted to stop us from going on because he did not like the colour of our plates (they were the red on white used in Belgium). He would no doubt have objected even more if he had found they were in the offensive English—but he probably could not read. On such occa-

sions high handed bluff and bluster is effective and on we went. Another difficulty in finding your way is the refusal of minor officials, border guards, police, etc. to understand when asked for directions in English. It is a matter of honour not to understand, although it was fairly clear that in many cases the request was clear enough.

All this is oddly at variance with the messages one sees throughout India (at least in those parts where English is tolerated)—"Tourists are our honoured Guests", "International Tourist Year" (that was 1967, but the notices were still up). The idea does not appear to have filtered down to the petty official with whom the tourist has to deal. Almost without exception they were 'difficult" for no apparent reason other than to boost up their own impression of what their purpose in life was.

As a result of this lack of direction signs or advice we spent our second day on the road getting lost in the complex system of roads approaching the Ganges. We finally reached the river at a point which turned out to be 30 miles downstream from the town of Patna, where we were to cross on a ferry. At last we found someone willing to answer questions in English and so found out the route back to Patna. As an afterthought he added that there really was not much point in going there because the ferry had just been discontinued. The next crossing was a bridge a further 60 miles downstream. We were already late and the further detour down to the bridge and back again on the north bank made it obvious that we were not going to make our destination (which was over the Nepali border) by nightfall. The border post shut at sundown and there was no accommodation at all at the border, so we looked around in the nearby towns to see if we could find anywhere to spend the night. At Muzaffarpur we tried at what had once been the British Army Officers Club (these have often been turned into hotels). In this case the building, which was only small, had been retained as a club, and as we arrived a Rotary meeting was about to start. When the Rotarians heard of our difficulty we were treated to an amazing display of hospitality and generosity. This was certainly the other side of the coin from the treatment we had been given all day by the little men in uniform. Someone was sent downtown for food and while this was coming we were driven around Muzaffarpur by our new friends. Some of us were in need of food supplies (we carried our own food for mid-day and for emergency purposes) and if the shops were shut, a few telephone calls soon had them open again for us. Then back to the club for the meal, after which the Rotarians abandoned whatever it was they had been going to do and held a combined meeting of International Goodwill. Short speeches were made on our respective countries and we sang our national songs; a good time was had by all. Finally we cleared out the furniture from a couple of rooms, set up our camp beds, and so to bed.

Next morning we went on to the Nepal border. Later I was to .evolve a theory that the time taken to cross an International border is inversely related to the importance of the countries concerned. For example, to pass 50 passengers from Germany to Belgium took 3 minutes. To pass from India to Nepal took 5½ hours. Nothing was achieved during this period, no luggage was examined, no individual passengers questioned. It is true that each passport carried another four or five rubber stamps when it was finally returned. The main purpose of the delay appears to be to impress on the traveller the self importance of the border officials.

At last it was over and we were through, and on into Nepal. Nepal is one of the little known countries on the earth. It is an independent kingdom which managed to survive the spread of Imperialism both from the British in India and from the Chinese to the North. For hundreds of years Nepal has tried to protect her independence by sealing her borders against the admission of any foreigners and this policy has only been relaxed within the last few years. Now there is the beginnings of an awareness that tourism could be an important item in the economy. So far the country has hardly been touched by Western civilisation, and it is a rare experience to see the land and its people after such a long period of isolation.

Until ten years ago the only way to get to Kathmandu was to walk in or to fly in. There were no roads connecting the capital to the outside world. Now a road of sorts exists, and, provided you have a cool nerve, you can drive in. The road starts from the border village of Birgunj and for the first 25 miles runs through the jungle

country of the Terai. Here there are still plenty of wild elephants, tigers and many other animals. Even the rare one-horned rhinos still managing to survive there. North of the Tehai the road climbs steadily to over 8,000 feet, where from the top (when the clouds allow) the high wall of the Himalayas can be seen, about 90 miles away. From the highest point the road drops steeply to Kathmandu itself, which is only about 4.500 feet up. The entire distance from Birgunj to Kathmandu is only 129 miles, but so steep and winding is the road that at least 10 hours must be allowed for the journey. Relatively little earthworks have been carried out and the road, for the most part, is a narrow ledge blasted out of the hillside winding up and down at the contour gradient. Sometimes after going four or five miles one finds oneself back over the same spot but perhaps 2,000 ft. farther up the hillside. Safety rails have not been heard of and negotiating our 40-foot bus round the sharp hairpin bends (which have been designed for small trucks of half that length) was quite exciting. The narrow bridges across deep gorges were a further problem. The clearance between the steel girders was barely 18 in. wider than the bus, so that it was imperative that one was well lined up before trying to cross. The difficulty was that the bridges usually connected to the road through a tight 90° bend at both ends and this left no room for manoeuvring. Anything up to 30 minutes could be spent in trying to get across such bridges without too much damage to either the bus or the bridge.

Our time for the 129 miles was 34 hours, for we had a spot of bother on the way. We had barely climbed out of the Terai when we came to a spot where the road had slipped into the valley. A rough diversion had been cut down into the river and ran actually through the river to rejoin the proper road about a mile further up. For the most part the diversion road lay across the shingle banks in the river, but every so often it crossed the stream. The second of these crossings we hit with a fair turn of speed as it was obvious that we had to climb a steep bank to get out on the far side. Half way across we stuck—no question of wet ignition this was a Diesel —and furthermore the starter refused even to turn the motor. Scrambling out into about 18 inches of cold water revealed that we had Trouble with a capital "T". The cooling water was pouring out from the block.

We managed to contact a tractor from the road works and this pulled us out on to dry ground so that we could inspect the damage. It then became clear that the water was coming out from a spot on the head gasket where about one inch had been blown clear away. Added to this, the engine was locked solid. The only thing I could think of which would explain all that was that water from the river had been forced up the air intake so fast that it had passed through the air cleaner and gone straight into the cylinders. A piston coming up against a solid cushion of water was likely to make something "go" and we would be lucky if it was only the gasket which had gone, for we carried spare gaskets. The cylinders partly filled with water would certainly explain why the engine would not turn. I have never heard of such a thing happening before, but the air intake was very low down. In any case, noone else had any bright ideas and we were a very long way from help, so we got down to taking the engine to bits where we were. Dark soon came down and it got very cold, but we carried on by torch light until about midnight, when we managed to get half of the head off (the head was divided into two parts, each covering three cylinders). The cylinders were indeed full of water so it was with some assurance that we were on the right track that we packed up for the night. The stretchers and sleeping bags were clustered round the bus—not too far away, for this was still tiger country. We lit some large fires and mounted an armed guard throughout the night. The latter was as much to guard against the locals (who might fancy the tools strewn around the dismantled engine) as against the tigers. The locals were too honest and the tigers had already dined, so the night passed without incident.

By the time we had cleaned up and packed everything back on board, almost 24 hours had gone by since we had first got stuck. Only an hour or two of daylight remained so that it was mainly in the dark that we had to climb that hill and just on midnight when we arrived at a darkened and sleeping Kathmandu.

Four days down, sixty-six still to go! We wanted something different in the way of travel and we could not complain. Not, at least, on that score!

HIGH SPEED WATER TRANSPORT

by Dr. J. M. Pickles

Dr. Pickles

A New Approach Needed

During the past decade or so it has become increasingly clear that there is a serious gap in the available range of vehicles for over-water transport. At one extreme of this range are conventional passenger liners and cargo ships carrying high density, low value bulk cargoes at speeds of around 20 knots. At the other extreme are subsonic transport aircraft carrying low density, high value cargoes at speeds of around 200 to 600 knots. Until a few years ago such vehicles as fell within this speed range had too low an earning capacity to be commercially satisfactory.

Recently the demand for vehicles to bridge this gap, carrying medium to high value cargoes, has grown very strong. For example, the short distance ferrying of passengers and their cars, over stages of 50 to 100 miles, requires a vehicle of this intermediate type. The conventional displacement ship is inefficient for this duty, partly because of limitations in maximum economic speed, which depends on hull length. A smaller but faster vessel could carry the same number of passengers in a day by making a larger number of round trips. The faster, more frequent, journeys please the passengers. The reduced maintenance and operating costs, due in part to the smaller crew size, and the greater timetable flexibility please the operators. It should be noted that aircraft are grossly uneconomic for such short journeys due to the low utilization of an expensive vehicle, which would spend a large part of its time stationery while picking up or discharging passengers.

It is not only in ferry operations that there is a requirement for high-speed water transport. The bringing into service of giant transport aircraft, such as the Lockheed C-5A Galaxy which is capable of carrying 100 tons of freight at speeds approaching 600 miles an hour, will be a serious threat to conventional trans-oceanic cargo ships.

The New Approach

To meet this challenge the U.S. Maritime Administration initiated a study of various types of marine craft that would be able to cruise at 100 knots.

Speeds of this order can only be achieved if the resistance of the craft can be reduced to a very low order. The most rewarding way of doing this is to reduce the wavemaking resistance by separating the hull from the water surface as much as possible, even though the water still provides the supporting force.

The *planing hull* achieves this by having a hull form that will skim over the water rather than pushing its way through it. This idea first appeared around 1870 and was greatly developed during the 1939-45 war, being used for Naval patrol and torpedo boats. However, no parallel development has taken place for use in passenger and Cargo-carrying roles.

There are two main reasons for this. Firstly the form of the hull, with its fairly flat bottom towards the stern, gives rise, even in moderately rough seas (say 3 to 5 feet high waves), to accelerations greater than the 0.5 g considered tolerable for passenger comfort. Secondly, such a design is subject to the square/cube law; that is, the weight goes up as the cube of the linear dimensions, while the supporting reaction force of the water only goes up as the square of the linear dimensions. In addition, because of the high "g" forces, the structural weight must be a large proportion of the total weight so that the payload is relatively small. Planing hulls are therefore uneconomical above about 200 tons displayment.

The *hydrofoil* craft offers an even greater reduction in resistance by supporting the hull well clear of the water on lifting foils operating below the water surface and attached to the hull by struts. The foils produce lift in just the same way as an aircraft wing. Hydrofoil vessels have almost as long a history as planing hulls, the first experiments being carried out at the turn of the century by Forlanni in Italy, and later by Alexander Graham Bell in Canada. However, it was not until the second world war that a practical vessel was produced. These German patrol boats were later developed by Supramar A.G. in Switzerland and put into service as the world's first hydrofoil ferries. The latest Supramar design, the P.T. 150, is the largest seagoing passenger hydrofoil yet built. It can carry either 250 passengers, or 150 passengers and 8 cars, at speeds of up to 40 knots. This craft, which has a crew of 7, replaces a 17½-knot ferry carrying 1,000 passengers and 150 crew, cutting the journey time from 3½ to 1½ hours. Large numbers of hydrofoils are used in Russia on that country's extensive river system.

However, such relatively simple designs as these are not able to cope with heavy seas (wave heights greater than 7 feet), and this has limited their development as long-distance cargo carriers. Seakeeping can be improved by a different foil arrangement and by the provision of sensing and control equipment, but, at present, the cost is so great that such measures are commercially unacceptable.

Cavitation in the flow around the foils is another problem at speeds greater than 40 to 50 knots. Appropriate foil design is the solution here, but even so it appears that the size of commercial hydrofoils will be limited to about 1,000 tons.

The *air cushion vehicle,* or A.C.V. is a third more recent solution to the resistance problem in which the hull is lifted clear of the water on a trapped cushion of air. Air is supplied continuously by fans to the underside of the hull to replace the air which flows through the small gap between the vessel periphery and the water surface. Hydrodynamic drag is reduced to a very small proportion of the total drag, which is made up principally of aerodynamic drag and drag forces due to the momentum change of the air drawn in to supply the cushion. This principle was first given practical form by Christopher Cockerell in Britain in 1957. In 1959 the first large-scale research craft, weighing 4 tons and capable of 50 knots, became airborne. In the ten years since that time the A.C.V. has undergone tremendous development. The British Hovercraft Corporation's SR-N4, now in service as a cross-channel ferry between Britain and Europe, weighs 165 tons and can carry 60 passengers or a payload of 50 tons. Its maximum smooth water speed is 70 knots which reduces the time for the 80-mile channel crossing from 5½ to 1¼ hours. This craft's work capacity is about half that of the largest ocean liner. The work capacity of an A.C.V. increases with size so that a projected 700-ton craft would have a work capacity about the same as that of the Boeing 747 Jumbo jet.

Even larger A.C.V. are being considered. A study carried out by the United States Maritime Administration came to the conclusion that a 4,000-ton A.C.V. cruising at 80 knots was the best solution for a transoceanic cargo craft, taking into account the present state of knowledge. Unlike the SR-N4, which has a flexible skirt around the periphery of the hull, giving it an amphibious capabiilty, the U.S. craft has rigid parallel side walls running in the water. Flexible curtains at bow and stern close the gap between these walls. The study showed that, over long distances, this was the most economical solution. Despite the higher drag of the sidewall craft the total fuel requirement was less because of the reduced air leakage from beneath the hull.

For some applications hybrid craft, in which the air cushion support is augmented by the lift of hydrofoil or planing surfaces, may prove to be important. Research into a type of planing A.C.V. is being undertaken in the Mechanical Engineering Department. This is a sidewall vessel with a flexible curtain seal at the bows only. The stern of the flat-bottomed hull planes on the water, providing a large part of the lift. Some of the cushion air leaks away under the planing stern and appears to produce a marked reduction in the frictional resistance.

A.C.V. seem destined to play a very large part in the revitalization of sea transport, but in 20 years' time we can expect to see even greater changes taking place.

Two types of craft which seem to offer a potential far greater than that of the A.C.V. are the *Ground-Effect* and *Ram-wing* craft. Both concepts are now in the feasibility study and basic research stages. The ground-effect craft depends on the phenomenon that a wing section flying near to a solid or liquid surface experiences a greater lift force than if it were moving in an unbounded fluid. Large craft fly at speeds of 100 knots at about 25 ft. above the sea's surface. Clearly automatic control systems that can be produced economically will be required.

Still better prospects are offered by the ram-wing concept. Here the hull of the craft behaves as an aerodynamic lifting body, essentially a very thick wing, which will fly a few feet above the water surface. A peripheral curtain of air jets is envisaged to allow the craft to rise and hover. At speed only the longitudinal side curtains would be retained, to reduce lateral air flow from beneath the hull.

The forseeable developments in marine transport are enormous, but it must be remembered that the vehicle is only a part of a larger system and reduced travelling time will be of little significance unless there are radical changes in the loading and unloading arrangements in the ports. There are signs of significant changes here, with the introduction of containers and mechanical handling, and it seems that a new era of maritime transport is slowly beginning.

J. M. PICKLES.

A young lady who had been going out with a young man for more than a year was asked by her parents what she thought his intentions were.

"I'm not quite sure", she replied, "He's been keeping me pretty much in the dark."

STAFF-STUDENTS' GOLF DAY (continued from Page 42)

ballchatting) progressively decreased, and the now more pessimistic field began to stagger in for lunch. Score cards were compared, scores being proportional to the number of excuses available. All players agreed that they had made full use of the morning's round with due regard to their scores, amongst other things.

The barbecue lunch was a very tasty affair, the flavour being touched off well with the assistance of generous helpings of claret from the staff's No. 1 wine connoisseur, Concrete Crawley. A few anxious moments eventuated at lunch as one of the back of the field, I. Laing, unaccustomingly staggering and smoking was apparently attracted by the lunchtime festivities and aimed his ball at the merry throng, his shot, however, missing the claret and even the staff. Everyone reeked with confidence (as well as claret) after lunch, and all seemed certain that the earlier round was only a practice one, and the record of 14 strokes for a hole held by Messrs. Doble and Tyler seemed safe. Amazingly the field this time got off to a good start, with somebody actually finding the fairway on his first drive, the person involved being Mr. Doble whose milk diet was beginning to tell at that stage.

Soon after it was Concrete Crawley once again who hit one of the classic shots of the day. One of his drives dropped into a large bush, and he was determined to get it out using the "conventional" technique, i.e. by use of a golf club. Mathematically or otherwise I doubt whether even Mr. Sued could have helped at that stage. However, with high spirits, (from lunch) the golfer in question eagerly reconnoitred the shot. Sometime later a calamatory crushing, breaking noise followed from what must have been a furst-ing swing. The ball, together with flying twigs and dust gently sailed upward out of the rubble to be caught by Stayer Sandery at square leg, about 5 ft. from the bush. Stayer Sandery on the last hole proved by calculation or otherwise that by the "trial and error" method from previous standard and non-standard attempts, that a putter was the most reliable club in the bag, by clipping three strokes off his previous score for that hole when formerly using the "normal" range of clubs.

The party in dribs and drabs finally found the last green again, and so ended a most unforgettable and challenging day.

DEPARTMENT OF CHEMICAL ENGINEERING

Head of Department, Professor W. F. Tait

Current research projects in the Chemical Engineering Department cover a variety of subjects which have an important part to play in the understanding of certain engineering principles. Research interests include the process dynamics of packed bed reactors, the design and construction of an analogue-digital, digital-analogue conversion system and the high temperature deformation and internal friction characteristics of the metal Zirconium and zirconium alloys. Other current research interests include the fluid mechanics of gas-liquid flow in a closed channel, heat transfer to gas-liquid two phase flow, the practical aspects of trickle film cooling of buildings subjected to solar radiation and economic and location studies of the Australian chemical industry.

In the field of process dynamics of packed-bed reactors, theoretical models have been derived which describe the transient dispersion of heat in a packed reactor bed through which gas flows. These models are being tested by the application of a temperature pulse to the inflowing gas and the measurement of the resultant dispersion in the exit gas temperature. Analysis by a technique known as "moments analysis" was unsatisfactory and a new method of numerical Fourier transformations based on orthogonal functions has been developed. A similar problem in dispersion and mixing occurs when a pulse of salt solution is applied to a pipeline through which water is flowing. A theoretical solution for this case has been presented by Taylor but recent work has reported deviations for particular flows. It appears that deviations may be more a result of the method of data analysis than of the theoretical model. Experimental work is in progress to test this theory.

The analogue-digital, digital-analogue link with the CIRRUS computer is nearing completion. Such a system will be used to study digital control systems as well as for data logging of transient phenomena.

High temperature characteristics of zirconium alloys are of interest because zirconium canning tubes are subjected to high temperature in nuclear reactors. The development of techniques for investigating the high temperature deformation of zirconium has continued during the past year. In particular, a great deal of research has been done on the preparation of very thin foils of zirconium. Specimens with a thickness in the order of 1,000 Angstroms are required for examination in the electron microscope. To facilitate analysis of results, a large amount of work has been done on hexagonal crystallography and electron diffraction from hexagonal lattices.

A constant strain rate tensile apparatus has been constructed and controlled tests at temperatures in the range 200-400°C will be carried out.

Internal friction is also of interest as this is an experimental technique which enables the study of diffusion of alloying elements in a metal. Diffusion of alloying elements in zirconium at high temperatures is of importance because of the significant changes in the properties of the material which result. The internal friction apparatus has been constructed and commissioning trials on temperature control, calibration and recording procedure are being carried out. The first experiments on zirconium will begin shortly.

Flow of a gas and a liquid together is of great importance in many heat transfer and mass transfer operations. Research activities in this field are concerned with the mechanism associated with entrainment formation and deposition for the flow of gas and liquid in a closed circular channel. At low gas velocities, the liquid wets the channel walls and flows as waves which have been studied by cine photography. At higher gas velocities, the crests of the waves tend to break down into droplets which are entrained in the gas stream. If a long channel is used, equilibrium is attained between the liquid flow in the gas core and the liquid flow on the walls of the channel. The droplet mass flow rate is obtained by a sampling probe whereas the liquid film flow rate is obtained by removing the liquid through a porous section in the channel.

Several aspects of concurrent gas-liquid two phase flow in a closed channel are being studied. These conditions are

of interest since they occur in both conventional and nuclear steam raising equipment. A particular aspect of study is concerned with characteristics of heat transfer and momentum transfer of a particular geometry in a "climbing film evaporator". This system consists of a channel having annular cross section in which heat can be supplied on the inner, outer or both surfaces. Vapourization of the liquid in the liquid vapour mixture therefore occurs. The flow channel is fully instrumented to enable measurement of temperatures and pressures. High speed flash and cine photography are being used to study the flow regimes.

An extension of previous work on heat transfer to flowing liquid films has commenced. This project will investigate the possibility of trickle film cooling of buildings subjected to solar heat radiation. A mobile brick wall test rig which can be oriented in any desired direction in a vertical plane has been set up. This will be fully instrumented and it is intended that investigations on heat transfer, hydrodynamics, economics and practical possibilities of this method of offsetting solar heating of buildings will be carried out during the coming summer.

The economic and location studies of the Australian chemical industry are intended to analyse the factors which have determined the location of chemical plants at or within particular sites, to analyse the interflow of products within sites and between locations and to attempt to set up and analyse approximate input-output models for the industry. Concentration of investment and of technical manpower at particular sites and locations together with other aspects of the economic geography of the industry will also be considered.

Visitors to the Department, 1967-68

Prominent visitors to the Department included the following:

Professor J. D. Thornton, Chemical Engineering Department, the University of Newcastle upon Tyne, England.

Professor M. R. Tek, Petroleum Engineering Department, the University of Wisconsin, U.S.A.

Professor O. B. Volckman, Chemical Engineering Department, University of Witwatersrand, South Africa.

Professors J. Allen and I. McC. Stewart, University of Newcastle, N.S.W.

Professor R. G. H. Prince, Chemical Engineering Department, University of Queensland, Queensland.

Mr. L. S. Herbert, Chemical Engineering Division, C.S.I.R.O.

Publications

Dr. T. N. Smith—

"The Spatial Distribution of Spheres Falling in a Viscous Liquid."
J. Fluid. Mech. (1968), Vol. 32, Part 1, 203-207.

Dr. B. A. Hills—

"A Transparent Resin for Embedding Specimens".
Aust. Dental J., Vol. 13, 3 (1968), 213-218.

"Preparation of Polymer Films Displaying Some Basic Characteristics of Natural Membranes".
Trans. Amer. Soc. Artif. Int. Organs, Vol. XIV (1968) 1-4.

Mr. C. P. Jeffreson—

"Dynamics of Packed Beds with Intraphase Heat or Mass Transfer".
Chem. Engng. Sci., 23, 509 (1968).

"An Approximation Method for Fourier Transform Inversion Applied to Distributed Parameter Systems".
Proc. Int. Fed. Aut. Control Symposium, Sydney—26-30 Aug. 1968, p. 83-90.

"Application of an Approximation Procedure to Analysis of Pulse-Testing Experiments".
Proc. Circuit Theory Colloquium on Approximation Procedures—Sydney, 23 Aug. 1968, p. 40-44.

Dr. M. J. Story—

"Flow-cell Studies of Thermal Diffusion in Liquids".
Part 3—The $C.Cl_4$ + Cyclohexane System Trans Far. Soc., No. 536, Vol. 63 (1967), 1906-1912.

MATERIALS SCIENCE

Prof. D. R. Miller—

"Hexagonal Networks in Beta-Brass" (with R. C. Crawford).
Phil. Mag. Vol. 17, No. 146, 333-337, 1968.

"Standard Stereographic Projections for Hexagonal Lattices" (with M. E. Packer).
J. Aust. Inst. Metals, Vol. 12, No. 4, Nov. 1967, p. 299.

"Stress Induced Diffusion of Carbon and Oxygen in Titanium" (with K. M. Browne).
Proc. Internal Conf. on Titanium, London 1968, Inst. of Metals, London.

SURVEY CAMP 1968

by B. J. Williams

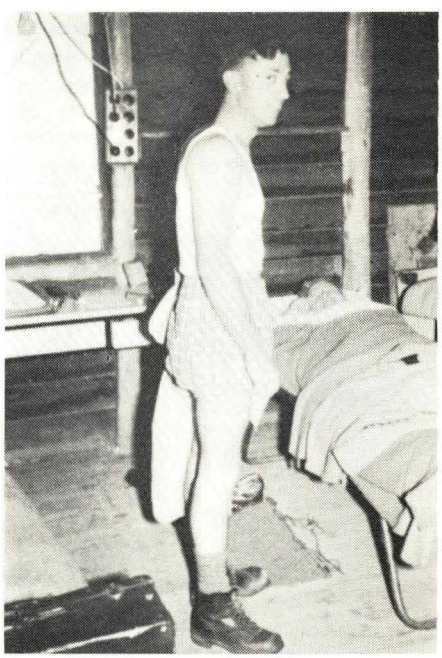
Until 1954 the Final Year Survey Camp had been held by the Civil Engineering Department at Kuitpo Forest or Mylor N.F.C. Camp in the September or Christmas vacations. For obvious reasons, both of these times have inherent difficulties in relation to the academic year. By coincidence, in 1954, Prof. Bull was discussing the problem with an E.T.S.A. executive and the Leigh Creek Survey Camp came into being. It was most noteworthy for its lack of rain and cloudless skies—both essential features for the camp, particularly since it was to be held in May. From the first camp at Leigh Creek until 1967, very little rain was experienced, but this year (1968), the 15 yearly six-inch dose was duly administered, blended with a variety of dust, clay, etc. and apparently deposited on every road, track, survey site etc. within 150 miles of Leigh Creek.

Normally the trip to Leigh Creek (Telford Station) is a comfortable, alcoholic (—er, sleepy, that is), nine-hour ride on the famous? Ghan, but this year that sturdy vehicle declined to make the trip. Fortune, however, was on our side, and although a day late, 25 of the crew of 29 boarded the "East-West" to Port Pirie where connection was to be made with a mixed train to Marree. (Three of the company preferring their own transport and one at that stage being . . . er . . . lost?)

The trip to Pirie was without notable incident although the preliminary bird scouting was done and the members of the party had partaken of a wide variety of biscuits, cheeses and liquids. At Pirie our lost member was found and a quick trip to the nearest public house was made where a new stock of lemonade was laid in.

At Port Augusta we were presented with our own carriage, along with two elderly aboriginal women and some pleasant friendly young people. We left Port Augusta after about half an hour—everybody seemed to be extraordinarily high in spirits — sorry — in extraordinarily high spirits, and those pleasant friendly young people were becoming more and more pleasant and friendly all the time. Our train it seemed was the supply wagon for the odd one or thirteen fettlers' camps on the line but the supply stoppages did little to hinder the speed of our journey (we were averaging an almost incredible 25 m.p.h. . . . between stops) and it seemed likely that the trip would be made well within the estimated 24 hours.

One or two most enjoyable lightning football carnivals were held during stops but it was decided that since the floodlighting from the train wasn't really as good as lightning, the football would be better replaced by a new form of entertainment known as "racing round the milk van". The refrigerated milk truck had a two-(perhaps three-) inch ledge around it on which races could quite easily be held. From the start, however, the winner was obvious. Already a certain winner in the marriage stakes, our sure-footed, starry-eyed lover, Fuller, won through with consumate ease.



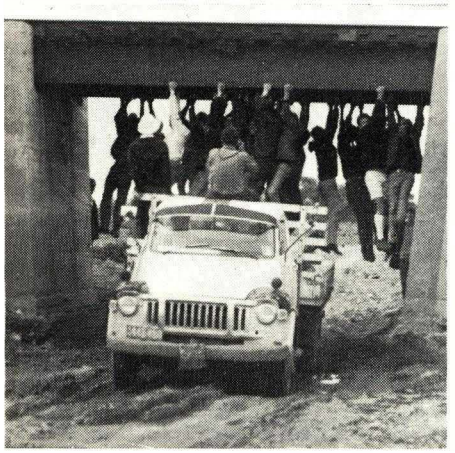
"Flash-Back"
(Don wearing typical surveyor's apparel)

Perhaps the only thing which marred this last part of the journey was the unaccountable illness of a large section of the group. Most held it to be due to some form of food poisoning or travel sickness, although a few contended that excessive

lemonade can most certainly cause the sickness of which so many complained. (Of course the suggestion that any member of our party would drink excessive quantities of lemonade was quite ludicrous, so this contention was generally derided by those present.)

We arrived in Leigh Creek early Saturday morning after travelling for some 20 hours and were shown our quarters. We were to sleep in what had been a mess hut, and although somewhat cramped, lacking fresh air, roused at 4 a.m. by kitchen noise and having catenarian beds, we were reasonably comfortable (i.e. dry). We were not able to start work on the Saturday because of the muddy conditions and Mr. Robinson suggested that we rest and recover in preparation for a hard fortnight's work. (The illness of those on the train had developed into nasty headaches.)

On Monday morning, refreshed, we started work in the field, where we were supervised by Mr. Robinson, with Dr. Arnold and Mr. Ewers in able assistance. The area in which our work was conducted was almost two miles from the town proper on a property belonging to Mr. J. C. Hirsch. We are indebted to Mr. Hirsch for allowing us to use his property and more particularly for the hospitality afforded to us by he and his wife when we visited their homestead on the second Sunday.



The Record "Hang"—19 Bodies

The trip to the site was made each day on the back of a dilapidated old truck which was kindly provided for our use by the E.T.S.A. at very small cost. Seats were bolted to the tray of the truck with room for about twenty-five or six persons. The remainder (three or four unfortunate wretches) sat or lay where the sitters allowed them to sit or lie. The trip was always cold, sometimes wet, never without interest (and bumpy too). At one stage the truck passed under a small girder bridge beneath which there was a large mud puddle. On the first trip it was noticed that (a) the truck slowed when passing under the bridge and (b) the distance from the top of the seat to the bottom of the girder beneath the bridge was something less than eight feet. It was reckoned by one or two speculative types (as in previous years) that a mighty fine athlete or gymnast could leap gracefully from his seat on the truck and attach himself to the girder, there to swing quite prettily until the momento applied by his fingers and air resistance damped his motion to nought, whereupon having suspended his person for a further second he might drop to the ground like a gazelle (oh, luvvly!).

Let it be noted herewith "that nineteen well proportioned and truly handsome engineers of the Final Year Class in Civil Engineering (1968) did suspend their bodies from the railway bridge at Leigh Creek on May in that year".

Work was conducted with the usual honesty, dignity and aplomb of the engineer in the field. As always, no mistakes were recorded, although it is understood that a scant number of small flaws were detected but these were immediately adjusted with all the ingenuity of any chef. Generally, conditions were exceedingly difficult and it is a credit to us that we did so well. In fact, a bloody great hooray for us. (If you'll excuse the enthusiasm). Of work, enough said.

As usual a considerable amount of time was devoted to that age old final year custom of card playing. For the most part, the standard was high and the game played fairly. To our utter shame and degradation, however, we discovered, hidden in our midst that lowest of all earth's creatures—the card cheat (no names). The beast was smartly cleansed of his sins by a baptism (by naked immersion) in a convenient mud puddle. He has not since been caught cheating but hell, if he doesn't stop talking . . .!

The evenings were spent in a variety of ways—the least forceful members of the group being banished to the computations room, the remainder indulged in a variety of tasks including prayers for more rain,

pounding of pillows into a comfortable shape, letter writing or shuffling of cards (for the slick, intelligent ones). Incidentally, the winner of the prize for the "mushiest and most letters received" was Ian Laing. Our congratulations to Ian and Wendy, too, and may she be just as prolific in everything she does. Pete Moorfield won the prize for most varied letters by a broad margin.

Mick Hardy drove his Mini up after attending a wedding on the first Saturday and we were pleased to note that there was an inch to spare on either side when we pushed, carried etc. it into the "dormitory". It looked much better in the hut in place of his bed—gave the place a touch of class somehow. Mick was impressed, too, when he came back from the wet mess and found it there.

Interior Decoration

The big social event during our two-week stay was the Saturday night dance. This was a six-monthly type country dance with the locals out in force—young ones, middle-aged ones, white ones, dusky ones, black ones, spinsters, married ones, engaged ones, all types in both sexes—in fact anything your heart could desire. It seems that after a week in the bush some blokes' hearts desire anything. Anyway, those whose hearts weren't desiring found their way to the lemonade and proved beyond doubt that this was the cause of their ills.

By the end of the fortnight the Commonwealth Railways had managed to organize a strike for us and there was much rejoicing at the thought of an extended stay in Leigh Creek. Like a flash the young lovers in the group chartered a plane and flew to heaven (Port Augusta thence by car to Adelaide at great speed) and the remainder found their way home in various conveyances (semi-trailers, trucks, etc.).

Conclusion: How big is big?—Thank you Mr. Robbie.

FOURTH YEAR CHEMICAL CLASS NOTES

Chemical Engineers have this year maintained their high standing in the engineering department. We are still on the top floor, and now are alone in this exalted place. We have finally eliminated the architects and gained an expanse of vast but dirty rooms. Now under planning, we students envisage extensive recreation facilities and common-room accommodation. Alas, the Administration, with the effrontery of not consulting us, has more academic plans.

This year saw an all-time high in 4th year, with the numbers swelled to no less than 20.

We gained a new lecturer in Dr. Storey, fresh from Cambridge. After anxious waiting we found him to be interested in us, when teaching a dull subject, and also a pretty good mate. (Sock it to me!)
Upon entering this height of learning, informality and conviviality is the keynote, almost; if you attend tutorials that is. It was not unknown for a lecturer to step back and gently drop a mystified oath, when he viewed as a whole the confusion he had created in chalk.

One student's exasperated, sighing pharque ended P.E.IIC lectures for two weeks. Mumps, we were told.

Some of the 4th years have, for better or for worse, made an impression.

Peter Davey—
Historian with brown-arms?

Foo Toon Hing—
Has been speaking English for less than three years. The Union's curse and employer's dream (perhaps) in vacation employment. The class idiosyncrasy.

Khoo Bhoo Lip—
Malaysian with an Australian accent!?

Artie Kontofoulos—
"I've got 27 superfluous questions."

Dick MacMahon—
Protects us from the wogs—he catches them all.

Werner Mobius—
Formerly just Mo, now Fluff-face.

Continued Page 69

DEPARTMENT OF ELECTRICAL ENGINEERING

Prof. R. L. Woodward
(Head of Department)

The steady growth in undergraduate numbers has put the staff, facilities and space of the Department under heavy pressure during the past year. The numbers enrolled in Electrical Engineering I, II and III in 1968 were 52, 44 and 29 respectively.

There will be some easing in space restrictions in 1969, when an additional 4,000 square feet on the second floor of the Main Engineering Building will become available, following the transfer of some sections of the Department of Architecture to the first stage of the Barr Smith Library extensions. This will provide a suitably-appointed laboratory for research and project work in the Microwaves and Electrical Materials field, a medium-sized lecture room, and a small research laboratory. In addition a seminar-cum-tea room will be provided for postgraduate students, an amenity which they have not previously enjoyed. The additional laboratory space will be particularly welcome in view of the large increase expected in final year numbers in 1969.

Academic Staff:

Dr. P. H. Cole joined the staff as a Senior Lecturer in November, 1967. He holds the B.E. (Hons.), B.Sc., and Ph.D. degrees of the University of Sydney, and during the period 1964-67 was a Research Associate in the Department of Electrical Engineering at M.I.T.

Mr. G. Karolyi has been overseas throughout 1968, and has been working with Brown Boveri in Zurich, and Siemens in West Germany.

Dr. D. W. Griffin is at present on study leave in the United States, where he holds Post-Doctoral research appointments at Cornell University and at the Rome Air Development Centre.

Visitors to the Department:

Professor J. H. Westcott of the Centre for Computing and Automation, Imperial College, London, spent two days in the Department during September, lecturing to undergraduate and postgraduate students, and discussing research projects.

We were also fortunate to have a visit from Professor Brian Anderson of the University of Newcastle.

Research Activities:

The Department conducts an active research programme which relies on financial support from the Australian Research Grants Committee, Electrical Research Board, Radio Research Board, P.M.G. Department, and Department of Supply, as well as internal University sources. There are twelve full-time research students working towards higher degrees.

Current projects may be grouped under five main headings:

Antennas and Propogation

(a) Navigational Aids.

A complete re-evaluation of the methods used for radio navigation by ships and aircraft. This has involved the development of suitable systems and their associated antennas.

(b) Overwater Propagation.

A study of the factors affecting the propagation of surface waves over sea water at high to very high frequencies. Suitable antennae have been developed and evaluation of the effect of meteorological conditions on propagation is of current interest.

(c) Tropospheric Propagation.

A study of propagation at frequencies from 2-10 GHz. The particular problem of interest concerns microwave repeater links used for telecommunications over long distances. Due to meteorological conditions peculiar to certain regions, fades of up to 90db have been observed. This effect is being studied with a view to possible improvement.

(d) Adaptive Active Arrays.

Antennae problems relevant to microwave communication link operation in remote areas are being investigated, particular attention being paid to the application of microwave transistors to adaptive active arrays.

Communications

(a) Transmission of Information.

Study of the design and implementation of systems for transferring digital information over available channels in an optimum manner according to criteria of speed and accuracy. Modulation-demodulation methods which make efficient use of the channel are being investigated, as well as the use of sequential decoding as a method of greatly reducing error rates. Synthesis techniques for such codes are of interest at present.

(b) Delta Modulation.

The improvement of the efficiency of delta modulation systems by the reduction of redundancy is being studied. The simplicity of delta modulation compared with pulse code modulation makes it an attractive alternative if its efficiency can be improved by relatively simple techniques.

(c) Pseudo-random Noise.

Study of the application of binary pseudo-random noise to the measurement of the parameters of communication systems. In particular the measurement of intermodulation distortion in frequency multiplex radio telephone channels is of interest. This has involved a theoretical and experimental study of the properties of pseudo-random noise, and the development of generators operating at clock rates of 100MHz.

Control and Power Systems

(a) Adaptive Control in Brain Mechanisms.

The olfactory system of animals is being investigated in conjunction with the Department of Physiology. It is desired to define the neuronal pathways associated with the olfactory system and study their properties. The project has involved development of electrical and mechanical methods of stimulation and means of data acquisition. Numerical processing of data will be done by computer, probably directly on-line.

(b) Power System Modelling.

An investigation aimed at improving the dynamic representation of hydraulic prime movers and associated generators together with their speed governors. Refined models for turbine and governor have been shown to be desirable for a proper understanding of system behaviour under certain conditions.

(c) Asynchronous Power System Operation.

A study of the feasibility of temporary, short lived non-synchronous operation of a power network as a useful operating mode under certain fault conditions. Digital simulation has been used, necessitating the development of synchronous machine models valid under pole-slipping conditions as well as under normal synchronous operation. The influence of governor and voltage regulator settings on loss of synchronism and re-synchronisation is of current interest.

(d) Speed Control of A.C. Motors.

An investigation into simple and economic methods of speed variation in A.C. motors. A brushless machine having two independent sets of stator windings and a single short circuited rotor winding which runs at a speed proportional to the difference of the excitation frequencies applied to the two stator windings is being studied. Another study involves the use of ferro-resonance in the realisation of variable speed motors. The principle may also be used to obtain linear reciprocating motion.

(e) Static Converters.

Particular interest is in the minimisation of cost and components associated with three phase to three phase static converters, following successful development of a very simple and reliable bilateral variable ratio D.C. pulse converter which acts as a D.C. transformer.

Digital Techniques

(a) Digital Techniques and Systems.

A general study of interfacing equipment and of the methods used in implementing the logic requirements of these systems. With the increasing use of the digital computer as a control element, there is an increasing need for the allied hardware and software to keep pace with the rapid advances in computing techniques.

(b) Optimal Control Using a Digital Computer.

This project involves studies of the problems associated with the theory and software, as well as the development of suitable transducers and interfacing equipment, for a system which uses on-line digital computation in the control loop.

(c) Computer Aided Circuit Design.

The analysis and synthesis of electrical circuits using a digital computer. The studies involve the user being "on-line" to the computer, using graphical methods of communication.

Microwaves and Material

(a) Semiconductor Properties at Microwave Frequencies.

In conjunction with the Department of Physics, techniques have been developed for the measurement of resistivity and carrier mobility over such wide ranges as to include dielectrics and metals as extreme cases. Studies of helicon waves and microwave emission in high mobility semiconductors are of current interest.

(b) Antiferromagnetic Resonance.

A study of the influence of the internal disorder on the linear and non-linear properties of the antiferromagnet rubidium manganese fluoride, with the aim of evaluating the use of this material in a wide range of device applications.

(c) Surface Acoustic Waves.

A study of the potential applications of surface acoustic waves in communication systems at microwave frequencies. Detailed studies of the launching, propagation and scattering characteristics of these waves in a variety of media are needed as a foundation for the design of information storage systems and the acoustic analogues of microwave circuit components.

PUBLICATIONS

Cole, P. H.—"The interpretation of parallel pumping experiments near the magnetoelastic interaction region", I.E.E.E. Transactions of Magnetics, 1968. Vol. MAG-4, No. 2, June, 1968.

Cole, P. H.—"Antiferromagnetic spin wave instability calculations in the flopped state", Electronics Letters, 3, p.363, 1967.

Davis, B. R. and Willoughby, E. O.—"Effect of tapered illumination on fresnel zone patterns", Proc. I.R.E.E. (Aust.) 28, pp.435-442, November, 1967.

Griffin, D. W.—"Wideband balancing of bimodal cavities used for microwave measurements on gyrotropic media", Brit. J. of App. Phys. 18, 1967.

Smith, B. H.—"Synchronous behaviour of doubly fed twin stator induction machine", I.E.E.E. Transactions on Power Apparatus and Systems PAS-86, No. 10, p.1227, October, 1967.

Smith, B. H.—"Asynchronous reluctance motor using ferroresonance, Proc. I.E.E. 114, No. 11, p.1707, November, 1967.

Smith, B. H. and Seymour, B.—"A lesion generator for controlled radio frequency lesions in stereotaxic surgery", Med. and Biol. Engineering 5, pp.571-578, Pergamon, 1967.

Smith, B. M.—"Some experimental results concerning cycle-slipping in a phase-controlled loop", I.R.E.E. Proc. Vol. 29, No. 8, pp.294-299, August, 1968.

Willoughby, E. O.—"An omnidirectional standard aerial system for aircraft", Australian Electronics Communications, in I.R.E.E., Proc. Vol. 29, No. 7, pp.273-275, July, 1968.

Willoughby, E. O.—"Plan position indicator display for beacons or aircraft with headings attached to the bearing radials", Aust. Electronics Communications, in I.R.E.E. Proc. Vol. 29, No. 7, pp.275-277, July, 1968.

Woodward, J. L.—"The dynamic behaviour of a hydrogenerating set", A.S.M.E. Publication 67-WA/FE-41, November, 1967.

Woodward, J. L.—"Hydraulic turbine transfer function for use in governing studies", Proc. I.E.E., 115, March, 1968, (No. 3).

CAR TRIAL, 1968

Being rather tricky blokes, we decided to have the Car Trial early in first term to take advantage of the weather—it poured!

This reduced the field to about thirty cars, but with true A.U.E.S. type spirit we pressed on regardless, and after some ninety miles all but one car arrived at the cow paddock, which was supposed to be the Cherry Gardens Oval.

The M.G. type brewery vehicle finally arrived with the goodies, and the real trial of the day began with one, P. Moorfield, appearing to take the honours.

In general, the trial was fairly easy, the idea being to have a good time with any unnecessary car customising, but things were made easier still when one of the secret checkpoints got lost (past the Corkscrew Phil, not down it).

After much computing, it was decided that T. Thompson (Holden) and P. McSkimming (Falcon) had tied for first place.

Apart from the weather, the day was a success—so shine up your slide rules for 1969. "ARMPITTS".

FINAL YEAR STUDENTS, 1968

ELECTRICAL ENGINEERING

J. LIM

A Colombo Plan student who completed his secondary schooling at St. Michael's College and then obtained a B.Sc. He is one of the few Asian students we can call by his Christian name—would you believe J for John?

T. McPHARLIN

Rejoined the engineering ranks after spending a year obtaining his B.Sc. He was educated through secondary at Norwood High School and is presently holding a Commonwealth Scholarship and a cadetship with E.T.S.A. His form really stood out during the football match against the fourth years—take that which ever way you want to.

N. HUNG

Colombo Plan student from South Vietnam. He is a very quiet person and is well liked by all the students.

A. CUFFLEY

Has spent the last five years at this establishment after attending Findon High School. He also obtained a cadetship with the PMG last year. Although his initials are J. C. we have not as yet seen him walking on water! Rumour also has it that he is Prof. Willoughby's protege.

D. CLELAND

An old Saint's boy, and is going through on a Commonwealth Scholarship. He was one of the few to become engaged throughout the year. He thought he was umpiring a football match at Neil Smith's place after the dinner. He persisted in blowing a whistle! General opinion is that he had had a few.

W. HARROD

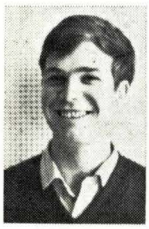
An old Prince's boy also and who, like A.D., has a cadetship with E.T.S.A. and a Commonwealth Scholarship. He is noted for his courage or drunken stupour when he drove around with P.K. after the dinner. Neither was of much help to the other.

J. VASSOS

Jim the Greek—was surely, casanova of the year. His talents were discovered in Tasmania this year. Yet this was not enough. It was rumoured that he arranged to get free meals from the Refectory, after being seen with the Refec. birds on several occasions. Must be the beard!!

D. CLARKE

"Clucky"—After attending Brighton High School, he obtained a B.Sc. and a cadetship with the Department of Supply. He is now trying to obtain a much higher goal of a B.E. (Hons.). He is usually seen going around on one of his three Harley Davidsons or the magnificent "Square Four".



P. S. KEANE

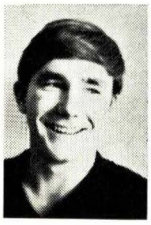
Until five years ago he attended Sacred Heart College, then obtained a cadetship with B.T.M. which allowed him to retain his Commonwealth Scholarship. He showed us all how to get "plastered" by mixing your drinks after the A.U.E.S. dinner.

A. J. JENNER

Another of the older students hovering about 30-year old mark. He attended Port Pirie High School in his younger days and now has a cadetship with the Department of Works. He is one of our more active political demonstrators and had a commonly heard interjection of "Crap" during Management lectures.

G. J. LAWNSLEY

He is guaranteed to become an ardent gambler in the near future after his efforts in the third term. Around the time of the dinner, he was slightly broke and several fellow students "dobbed in" to pay for his ticket about three hours beforehand. I don't think he can say he had a bad time.



J. OZOL

Somehow he got through Woodville High School without being expelled and now has his B.Sc. Because of his hot Morris 1100S, he got picked up and fined for speeding going to a card game. He was one of the three that stayed on 'til 7.30 a.m. that night (morning??)—and boy did he lose some money.

T. S. KHOO

He impressed many students during a Management lecture by showing his prowess in getting a number of sticks in about 40 holes in just over 60 seconds—whew!! He must have lost a lot of money betting one weekend because he was evicted from his flat the following Tuesday for not having paid his rent.

N. SMITH

His noteworthy incident of the year was when he was booked for "obstructing the footpath". Somehow I can't think of N.S. as being a rabbler, or provoker of riots. By now you probably know that he had a party for the class one Saturday night and we also had the post-dinner party at his place.

N. BRYENS

After attending Swinburne Tech. College, he eventually became an acting class two engineer with WRE and is now going through as a cadet for the Department of Supply. He is one of several students who are married and is regarded as one of the "barbarous" types.

B. DAVID

The Barmy type. He is one of the older members of the class and has a cadetship with the P.M.G. He and Gordon Dick both got married before the commencement of their final year studies.

B. PURDEY

Did his secondary schooling at Marion High School and is another one of those rare FEW that hold a P.M.G. cadetship. For some reason, he didn't remember much of the party at Neil Smith's place one night—he was also a bit crook—doesn't remember that either.

A. QUAN

Alex—did his secondary schooling at the Victoria Institution in Malaya and is here as a private student. He showed his great adaptability to Aussie Rules, by kicking the first goal against the fourth years in which we eventually went down 8-14 to 9-15. He is also a very keen photographic student.

R. F. H. HOLLAMS

He last attended Findon High School about six years ago and is also one of the many holding a cadetship with the P.M.G. He became well known for his non-technical questions during the Philips Spec. . . . Lectures. They were mainly about "mum's TV set!". He also took the initial plunge during the third term and became engaged.

K. K. WANG

Originally comes from Formosa and already has a B.Sc. Even though he says he never has any money he has more assets than any other students. He also provided a matrimonial service for the ball and the party at Neil Smith's place. His two famous quotes are "Don't be like that" and "What are you?"

G. KRIEVS

He turned out to be the . . . of the year by not attending any of the A.U.E.S. functions or the party for final year students at Neil Smith's place. He also had a funny habit of starting a bit late on his projects during the year. It is always interesting to listen to his argument on how to pass exams and get a degree.

M. SCHEMETZKO

For some reason, he had Prof. Willoughby always looking for him, but in the end the Prof. seemed quite pleased with his project. He is also another of the married gentlemen in the class.

A. T. KONG

A Colombo Plan student who did his secondary schooling at Sarawak Methodist High School. He was very quiet during the year and is also said to be rapidly approaching 30-years old.

I. A. McAULEY

He is our other political demonstrator and was the instigator of a certain stunt on Prosh Day. He also went to Tasmania during the May vacation. Except for the first night there, when he slept in the same room as P.K., he was apparently never sober.

A. DOWNING

After attending the famed Unley High School he obtained his B.Sc. and now has a cadetship with E.T.S.A. which also allows him to use his Commonwealth Scholarship. Having been married several years, he is the only father in the class. He is usually seen driving around in a sky blue British car—a 1948 Vauxhall.

D. G. GRIGG

Another one who attended Unley High School and who is now in possession of a cadetship with the P.M.G. He is not expected to last much longer as a bachelor; not after going to his bird's place after the dinner, then later turning up at Neil Smith's place with a big grin across his face.

G. DICK

Bog Duck—also one of the older members of the class, going senile, I think. He came down from Whyalla after attending the Whyalla Technical School and a few years with B.H.P. A present he is on a cadetship with the PMG. You've probably heard of Nuclear Fission, but I bet you haven't heard of Dick's SCR Fission!

S. MAK

Another who attended that school—Unley High School. He ran out of steam during the football match against the fourth years and is steadily becoming unfit. He was one of the three students who played pontoon all night one Friday through to 7.30 a.m. the next morning. He needed the money to pay for his new car.

MR. BAGHURST

An old Prince's boy who is going through on a Commonwealth Scholarship. He is a man of many interests which range from newly acquired Mark V Jaguar to organ playing, for which he has won two scholarships.

MECHANICAL ENGINEERING

J. C. CONNOLLY

John seems to spend most of his time in the Computing Dept. and it is rumoured that he occasionally goes home for weekends. He has shown an unhealthy interest for natural convection cooling but this will no doubt disappear when the Department of Works grab their man next year.

CHEMICAL ENGINEERING

BRENTON RUDD

Brenton, thanks to his limitless reservoir of coarse yarns at the MMCES dinner/elections, became 1967-68 president. He is headed towards certain business success—at dinners and conferences, with his vocal assets. Marriage is a long, happy way from Brenton, as Alison will testify, and he should make a good graduate.

HIA CHEK PHIANG

An average Chemical Engineer, this one from Singapore, Hia last year had a bad year. For the first time he failed to get all distinctions, but it was a lousy mech. eng. subject, anyway. Assuming governments are agreeable, he will stay in Australia to attempt his Ph.D., after graduation.

SZTO, CHENG KOVI

Melville, as he is commonly known, is from the same Singapore school as Hia and Lee. Melville hopes to remain in Australia next year to gain practical experience as a chem. engineer. He finds it memorable that he has passed all subjects, except that foreigner, Mech. Eng. 5, which he passed in a supp.

C. S. LEE

Mr. Personality, C.S. is a Colombo Plan student from Singapore. Another exceptional student, he and Hia were classmates at school in Singapore, where C. S. Lee claims he was then the better. The computing science centre is considering programming their machine for C. S. Lee himself. He carries his programmes in two arms. He is single in Australia—enough said.

GRAEME MITCHELL

This lad from Bathurst commenced university in Sydney in 1963. Graeme plays Rugby with uni. A's and has played inter-varsity in 1967 and 1968, and in 1968 playing against the State team, but next year he retires into marriage. He is at present kept under lock and key by a good woman (who shall remain anonymous to worry Christine).

BRIAN PAGE

A keen golfer, he is a member of the Mount Gambier Golf Club, his home town (handicap 20). Often referred to as P.F., Brian has an unusual talent which is most prominent after he has had eggs for breakfast. He is famous for nothing else, including brilliant card play.

JEFF FISHER

Also a Commonwealth Scho'arship holder, Jeff has been at uni. only four years. His ability with the tennis racket gave victory to the students in a grudge match against the staff. It is a fortunate thing, for he was just about the only student who could stand up for the finals.

TAN CHENG YAM

Like his classmates, Tan would like to stay in Australia after graduation. in order to gain experience. He has no sporting interests but "last Prosh was memorable" he says, "as were the newspaper comments". Perhaps he means immemorable.

TONY CHEW

Final year exams just completed, Tony is a little dazed. He rather liked final year and was considering doing it again but decided no. Much of this year Tony turned Adelaide bookmakers' hair grey. Tony has no definite plans for his graduate life, but does want a rest from engineering for a while.

RICHARD CLARK

A Commonwealth Scholarship holder, Richard graduates after five years. There is no doubt that if a Final Year Chemical Engineering Mr. Smooth award was made, Rick Clark would win hands down (but look at the competition!).
Following last summer vacation when Richard discovered life, he now has negative marital plans.

JOHN FOULIS

John knows little about lots, and has an infallible exam passing technique. His tenure as treasurer of MMCES is still being spoken of—desperately. As for sporting interests, he is under the delusion that he is Royce Hart (ace Richmond centre-half-forward).

MECHANICAL ENGINEERING

C. A. TYLER

The class stirrer and always ready for an argument on anything, especially with R.S.F. Chris is least known for his redesign of the Standard 10 motor and best known for his marriage early in the year. Chris will probably be a military man next year but should do well in the future.

E. Y. F. FUNG

Ed hails from Borneo but has set up camp at Belair where he keeps a selection of spare parts for anything resembling a car. Ed returns to the land of the headhunter next year and will probably own Borneo's first used car yard.

C. Y. P. CHEE

A very studious lad from Malaysia who has had little or no trouble with exams. Seems determined to show us that study does have a place at Uni. but apart from this is a pleasant friendly bloke.

L. C. SEE

Always smiling, even during Fluids lectures when a page or two behind. Regularly takes us for tutorials in the correct pronunciation of Chinese swear words and maintains that Australia will eventually become a Malaysian State if he has anything to do with it.

R. J. PRESNAIL

'Mr. Unperturbable"—Dick has the casual approach to just about everything but has managed to breeze through effortlessly each year. He is a cadet with the Department of Supply and will be off to Melbourne next year to maintain a steady supply of dud ammo. to our boys in Vietnam.

J. P. PITTS

Jeff has been called the class ratbag. He is known to the lecturers by many names since whenever in trouble always has an alias at hand, generally Presnail or Tyler. He spent most of first term sleeping but had a lapse and was engaged during the second. Has been a model student ever since.

A. J. BLAKE

Adrian must earn the title "Mr. Used Car" as he has owned more cars than Rick Hosking. However, he has minimised his chances of passing Mech. 2B by owning a better Rover than W.D.D. The lad is currently on an E.T.S.A. cadetship but could finish up anywhere.

C. Y. D. LAM

Dennis arrived form Sarawak in 1965 and has become a great mate. Has a pretty good eye for the birds but was heard trying to swap a Malaysian bird he knew for Jeff's fiancee—not sure how the deal went. He has promised everyone a beer when they visit Sarawak next.

R. E. I. HALL

Introducing our own Andrew Jones. Ian has fanatical views on everything non-Engineering and keeps the crowd cheering for more when he gets wound up. Ian will unfortunately disappear into industry next year but, will be easily recognised by his cry of "Swing axles forever!".

S. G. LIM

Arrived from Singapore in 1965 and has rewritten the record book result-wise ever since. A quiet likeable bloke who is always willing to help the not so bright remainder of us. As yet undecided whether to go home in 1969 or do post-graduate work—should stay, the country needs brains like these.

CIVIL ENGINEERING

WANG

Wang was born in Malacca, Malaysia. He attended a Chinese school and spent one year at Nanyang University before admission to Adelaide. Although not extremely fluent in English, he presented one of the best Seminars. He is an active member of the Malaysian Student Association.

RICHARD HORN

One of the hard workers who sit in the front row at lectures, trying to look interested and intelligent as a cover up for the rows behind. Hobbies indicate he likes to live dangerously; sailing the high seas or mountaineering—he'll climb anything in sight.

ADRIAN ("TEDDY") REDDEN

Adrian is one of the old school. He is well known for his friendly disposition. So friendly is he that he borrowed his fiancee from a friend and forgot to return her, yet still remained on good terms, to be groomsman at the said friend's wedding. Who needs enemies?

LARP CHITNUYANONDH

Arrived in Aust. from Thailand in 1965. For the first two years he boarded at St. Mark's College, but since then has been "flatting". He is a very likeable person, a conscientious student, and is bound to get on. Interests include Thai-boxing, hockey, and judo.

PETER BATTYE

Peter is one of the hard workers of the class. He actually wrote up his lectures each night and arrived for lectures five minutes early each day. Has a unique, friendly laugh—an adaptable gentleman, a non-dancing gourmet. Interests include painting and tennis.

DAVE COWAN

Dave is the quiet, hard working type. Was one of the few to arrive at Leigh Creek sober and one of the few to actually complete the Astronomy programme. As well as being a conscientious student, Dave is a keen footballer who keeps fit by riding a bicycle to school in preference to his M.G.B. every second day.

JACK FORREST

One of the well-dressed members of the class. A reflective type with a reflective type pipe to match. Jack is an ardent golfing fan and rumour has it that he is an accomplished musician—plays the sax.

ROGER BUDARICK

"Roger-the-Slogger" Renowned for his "excellent" designs and inarticulate drawings ("Hey Rog., I'll give you $4 an hour for doing mine"). No one deserves to pass more than Rog.—I mean who else has done all the exam papers for the last ten years? A keen footballer, bridge hanger and pillow fighter.

MARK REHN

"How's Things" Mark gets the prize for the most irrelevant questions asked in lectures this year. Also received look of the century from G.S. He is getting married next March and hopes to do a Ph.D. in Canada.

JOHN GILLETT

Another of the "almost marrieds". John's cadetship wage is divided between this, keeping his M.G. on the road, and building an M.G. special. Wins the annual staff-stopper prize for asking most questions in lectures. Is currently debating whether to cut his hair or cut his collar down.

IAN LANG

The baby of the class but one of the first to get under the thumb. Enjoys smoking (particularly at Jack Forrest's expense). Won himself the distinction of being the only person ever to be disqualified from the drinking horn. Despite his many vices Ian studies and stays up longer than anybody else.

GRAHAM TEMPLER

"Didja hear the one about the . . .?"
"Gees, if I only get through this year things will be all right."
"Seriously, don't you think women are all the same?"
"I'm not helping with the calculations because I'll only bugger them up."

K. LAI

Kam, 27 years old, was raised on a rubber plantation. He joined the class in fourth year after completing a Diploma in Civil Engineering at R.M.I.T. His favourite bird is Sue and his ambition is to programme a Canadian computer in Mandarin.

RHYS ROBERTS

Has been active in student affairs, including five years on the S.R.C. and a director of A.B.S.C.O.L. Despite eye trouble Rhys has accredited himself well during his course although certain people at surveying camp reckoned he only worked when Robie was around.

K. MG. LEWIN

Came to Adelaide with a degree in Civil Engineering from Rangoon. He is studying under the Colombo Plan and hopes to proceed to an M.E. in 1969. He is a married man with three children and his other interests include table tennis, tennis and swimming.

TREVOR FULLER

Trev. has been a star performer for the final year class. His best episodes were the train trip to Leigh Creek, the "barndance" thereat and his own buck show before "D"-day. We got the impression that he was always making the most of his pre-marital freedom.

VIC. TOKMAKOFF

30-year old Vic, is the most "experienced" member of the '68 class. Vic. came back to Uni. after working for some years for Chrysler Aust. He is one of the five married members of the class and as yet has no kids—but he is working on it.

BRIAN WILLIAMS

Brian started out as a Chemical Engineer but saw the light and changed over to the more laudable Civil Eng. early in his course. An old Saints boy, Brian is a "steady" student and a keen sportsman—the javelin being his specialty. We're all dying to meet the Sydney attraction!

IAN HORGAN

Ian has the distinction of sporting the only beard to survive survey camp. Besides being a regular escort of a certain staff member's daughter, his interests include basketball and music. Ian is an E.T.S.A. Cadet but will spend the next two years working for the National Interest (willingly of course).

DENNIS N. SANDERY

This year Dennis probably made his worst mistake, apart from getting engaged, he gave up football to play basketball. Dennis, a smoker/drinker from way back seems to have indulged only in drinking since T.F.'s New Year's Eve Party. This may have been due to violent memories of cigar smoking that night.

MICHAEL HARDY

"Yellow-boy" Mick. Was bred in Broken Hill and spends most of his spare time playing with the stock market. Has some of the strangest habits—or do you take your car to bed too. His ambition—to become managing director of B.H.P. by the time he is 30.

BRUCE TUNCKS

He smiles when he speaks. Bruce always did like the wild life of Australia and quite often goes looking for heather in the hills. Building a house for Cathy takes up most of his time but he still manages to find the half-hour for his hobby, engineering! Probable destiny: understudy for Smiley.

PETER MOORFIELD

Unbeknown to most of the class Peter has spent some time on the stage. Appeared in "Volpone" during the first Festival of Arts and other plays with the Adelaide Theatre Group at the Sheridan Theatre. Peter has an abhorrance for cards and preferred to spend his lunch hours at political type meetings.

ROB FRAZER

Never mind about G.S. Rob—he really loves you underneath it all. This "talkative" gent is not only a brilliant scholar but the best and fairest player for the "A" basketball team and was awarded a full Blue in 1967. Rob was one of the three originals to "hang" at Leigh Creek.

WERNER PADARIN

A country boy who has done well. Came from Leigh Creek as an inquisitive student in 1964. He has always been the mathematical expert of the class and causes quite a stir whenever his hand goes up in dispute or disbelief. A diligent worker—A Commonwealth Cadet.

MECHANICAL ENGINEERING

R. S. FREEMAN

Bob is the class monitor and slide projectionist and keeps the troops happy with his constant ravings about the Holden abortion. He upholds our sporting image very successfully as a water skier of some talent and could enter motor sport with his Goggo, affectionately named "The Galloping Maggot".

PROTEST

Who says us engineers are boors?
To them what closes arty doors,
I say to them, where would you be
Without your electricity?

IAN DICK (Elec. IV.)

ZED PORTS

A connoisseur of wines and spirits. Has the build to absorb many gallons of choice ports. Zed has been known to drink one of our members into oblivion while remaining sober himself. This is quite a feat, considering that this member was G.T.

MARK RODNEY WILLIAMS

A quite, friendly and affable guy who surprised us all by taking on the marriage game on the 12th of July. Interests include cricket, mowing lawns, and washing dishes. We all love you, Mark.

BART VAN DE WEL

"Maverick" Bart has become a wizard with computer programming and an authority on Highway Engineering. If you think you can beat him at cards then you've got "Buckley's chance". His classical dead-pan humour won him the Parsons Prize. Well done.

HUGH LUCKHURST-SMITH

A colourful veteran of the Civil Eng. Dept., he is one-eyed black and white, drives a green, 4-wheeled contraption and bombs out on "red" (a family weakness): S.R.C. sports rep., basketball club president and ex-treasurer (he now has enough to retire on). Destination—unknown; probably Alberton.

FOURTH YEAR CHEM. CLASS NOTES

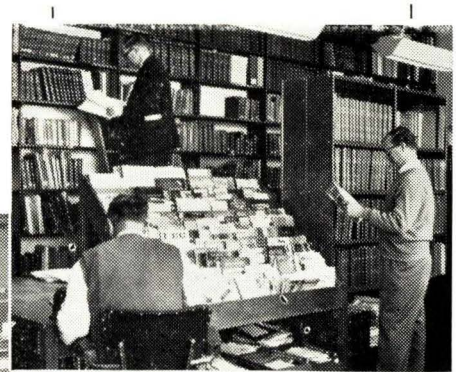
(continued from Page 59)

Mok Siew Cher—
Birds are better than beaches.
Hugh Ness—
Seminar Party Poopet.
Lewis Owens—
"Look at my fossilized organs."
Dennis Southam—
The first to plight his troth.
Michael Wright—
A.C.C.'s best educated garbo.
Geoff Matthews—
Has a word for everything, with some left-overs.

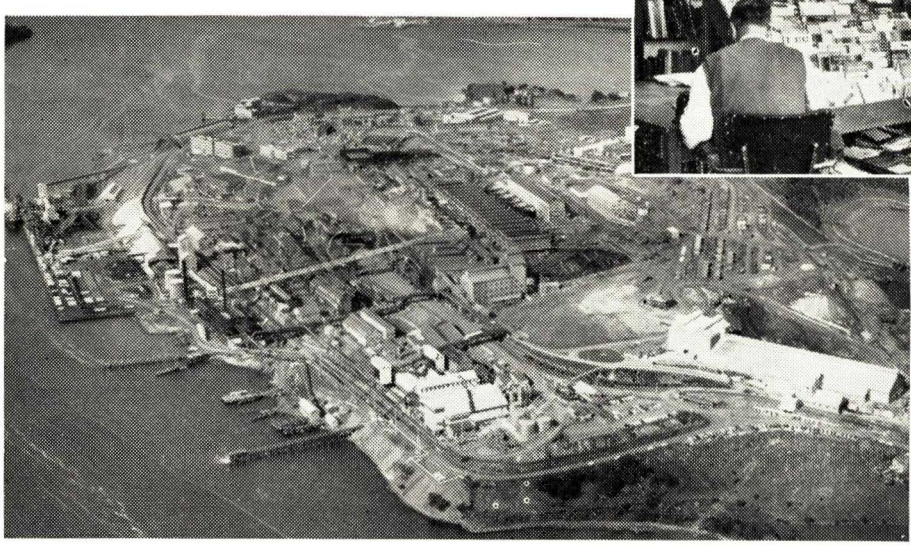
ELECTROLYTIC ZINC COMPANY
OF AUSTRALASIA LIMITED

Graduates (or prospective graduates) in Science, Metallurgy, Geology, and in all branches of Engineering, including Mining Engineering, are invited to consider employment with this Company in the research, plant operation, geological, engineering, or product application fields.

Zinc and Fertiliser Producers



One of the Company's technical libraries



Aerial view of the Risdon Plant on the Derwent River, Tasmania.

Electrolytic Zinc Company operates mines and ore dressing plants at Rosebery, on the West Coast of Tasmania, while the zinc plant and its associated sulphuric acid and sulphate of ammonia units are situated at Risdon, near Hobart. The Company, the largest producer of zinc and sulphate of ammonia in Australia, is at present engaged in an active programme of exploration, development and research which offers a challenging future to new graduates.

The Company offers practical and comprehensive training while paying competitive salaries which are augmented by a twice yearly bonus. A liberal superannuation scheme and complete medical benefit scheme are in operation for all staff.

Further information may be obtained from the Company's Offices at Risdon or Rosebery, Tasmania.

Head Office:
390 Lonsdale Street,
MELBOURNE, C.1.

M6

FOURTH YEAR ELEC. CLASS NOTES

This year the Science Faculty found out just what was meant by the new B.E.-B.Sc. course as it staggered from the onslaught of nine brash engineers fresh from the last Vac. Laboratory Course in Elec. Eng.

Despite moves by the Physics department to trap these bright young men into a possible Science career the group opted to spend this "foreign-year" (place the stress on the "y" and say it fast) in doing Physics III and Applied Maths. III in order to (hopefully) complete their ordinary B.Sc. degrees.

PHYSICS III

Dr. Bevan found that he had no trouble in keeping the students quiet throughout his course of Electricity and Magnetism. Having exhausted themselves in copying the two black-boards full of endless, randomly scattered equations and multi-coloured diagrams which the keen gentleman had put up before the lecture, the students either dozed or just sagged quietly, pondering on the principles of relativity (e.g., what might seem one hour to one person could seem two hours to another, both being in widely differing frames of reference).

It's a good thing that the Doc. is an expert on waveguides, otherwise the students would have been even further up the T-junction in trying to cope with his back-to-front method of notation (especially "Maximum S.W.R. is unity—this book says so"), and all this dealt with phenomena which, according to him, did not exist anyway. Those who managed to stay awake and/or conscious found the Doc. to be a careful painstaking lecturer whose chief handicap was the incredible dullness of the subject matter.

Dr. Lawrence—the Physics Department's walking, talking Eisberg. Can't say much about this gentleman; except that he sees filter networks in the most unexpected places; he must have been trying to make Quantum Mechanics palatable to the Engees; and that he must be a most conscientious worker. He did his homework well in copying reams of Eisberg into his notes, and from these on to the black-board. ("Yes, I know the diagram's rough, but take it out of the text-book anyway"); all this for the entertainment of the drowsing group which woke only to record the relevant page numbers.

Dr. (Speed) McCoy—Relatively lecturers are known to be fast talkers and this one must be the fastest of the lot. His lecturing method found general acceptance —he just gave out great wads of notes and spent his lectures rattling the students' ears with convincing-sounding arguments. This gentleman certainly knows his stuff and these seminar-type lectures, although on Friday afternoons, were quite bearable. He would, however, be about the only lecturer who, for light vacation reading could give out 72 pages of "Physics and Perception", a large part of which dealt with the acquisition of experience or real world knowledge by the young child. (Did this reflect his opinion of the students?). This booklet found many strange and unintended uses thereby satisfying another tenet (?) of this subject, viz. what is important to one person may be unimportant to another, both being in widely differing frames of reference.

PHYSICS PRAC.

The one big thing, which although occasionally very frustrating made this year bearable. The privilege of having, in effect an Engineer's room, and having separate "developmental" projects, which were far more interesting than the ordinary Physics III practs., occasionally made the work a pleasure. Some factors which contributed to this feeling were the attitudes of the supervisors who did not bother the group more than necessary, and (Elec. Dept., take note), the ready availability of components for electronic-type projects.

The projects themselves appeared to be left-overs from post-grad. projects, such as Atmospheric Electric Fields, Electron Spin Resonance, Transmission Lines and a vibrating rubber mat (to solve standing wave equations). Second term projects were a little better, being concerned with the designing and putting into operation multipliers and function generators for an electronic analogue computer being built by the Physics Dept.

The main student activities were: Mondays and Fridays at the Botanic, golf or squash on Wednesdays and Physics prac. the rest of the time.

The hardest worker in the first and third categories was Roman OLESNICKY, who initially thought so much of Science that he actually gave up his E.T.S.A. cadetship for the privilege. Apparently he has since

modified his views. Roman's big causes for celebration this year was the anniversary of his enforced pedestrian state (see last year's Hysteresis). Ably assisting in both celebrations and prac. work was Roger ROBERT who after a swinging first term became noticeably quieter after his surprise engagement. What an early end to a promising career.

If you want to know what a Falcon V8 will do in second, how many m.p.g., how many pints of oil per 1,000 miles, etc. etc., just ask Ross DALY, who, still glowing with pride over his big acquisition is only too willing to tell you all. Ross is one of the group's hard workers although his studies suffered a little because of his attention being diverted to a certain young lady.

Helping Ross with his prac. work was Clive WINKLER, who specialized in creating mazes of rat's-nest-type wiring and in continuing to startle the lecturers with his upside-down glasses. Can't say that I'd look forward to that sight in the mornings. Clive is also our local capitalist, playing the share market and going into the strobe-lighting business.

Nick DEMYTKO ("just call me Nick") is another hard worker who tried to baffle the Physics lecturers with his aggressive-type questions with an occasional success. He is a budding golfer, a keen celebration man, and, off duty, is an expert at blowing any handy power supply.

Jim MOLE is another good celebrations man, who persisted in claiming that he could do better than the computer in calculating his Numerical Analysis papers. It's a pity that no marks were awarded for trying.

In the same prac. group as Nick and Jim was our keen social activities man, Peter BALAN, who tried hard to keep up with his studies as well as to do Economics I (as an interest subject), to be a member of the Prosh Film Unit as well as many other clubs, and to be elected as a General Rep. to the S.R.C. A pity for him that they don't award exam marks for extra-curricular activities.

Providing much entertainment in the first term was Phil. WILLIAMSON with his activated, rebounding rubber mat on which he spent hours playing with his ball-bearings. Keeping Phil company was our keen Physics IIH man John (Red Waistcoat) HURST, who sadly saw the high life end when his father returned from study leave. He and Phil spent most of second term testing their co-ordination in playing the follow-the-maze on the department plotter although they called it "developing a function generator".

If, after reading this article, you decide to take the plunge, good luck to you, and enjoy yourselves.

FINAL YEAR ELEC. NOTES

(continued from Page 38)

to some fine lecturing on Digital Computer Techniques and Reliability. Still needs initiation into attending the AUES Ball and dinner—maybe next year!!

Mr. Davis—B.R.D. Noted as being easily the user of the most chalk per hour for the whole year. It was good to see him at the golf day, and it is hoped other social events will attract him next year.

Mr. Smith—B.H.S.—Many students got to know him a lot better this year and found out that he doesn't only talk about machines, but other things as well. He frustrated some students with his three-phase diagrams during the year, but overall he's not a bad bloke! He also went to the golf day and to the dinner. He was noted as sinking a few on the golf day—a few what??

Dr. Schweitzke—Congratulations go to this man for giving us the greatest lecture performance throughout our years of learning. We know that "zee electrons moof" with a swish of the hand, and the right knee getting cocked up and passed in front of the left leg.

Mr. Olesnicki—a most unusual personality. He is a walking, talking, breathing demonstration of the Doppler Effect—with a very wide range.

Dr. Mannan—one of the boys from that little know Mech. Dept. He really put the heat on during the first term. You know!! —conduct . . . . , convections, rad. . . . . , that sort of goings on. He seems to have lost his familiar smirk.

Mr. Dyer—Management was supposed to have been combined for final year Electricals and Mechanicals. The attendance rate of Elecs. would have been about 90%, and that of Mechs. about 20%. What's wrong? Do they think they can manage without him! Oh! How very subtle.

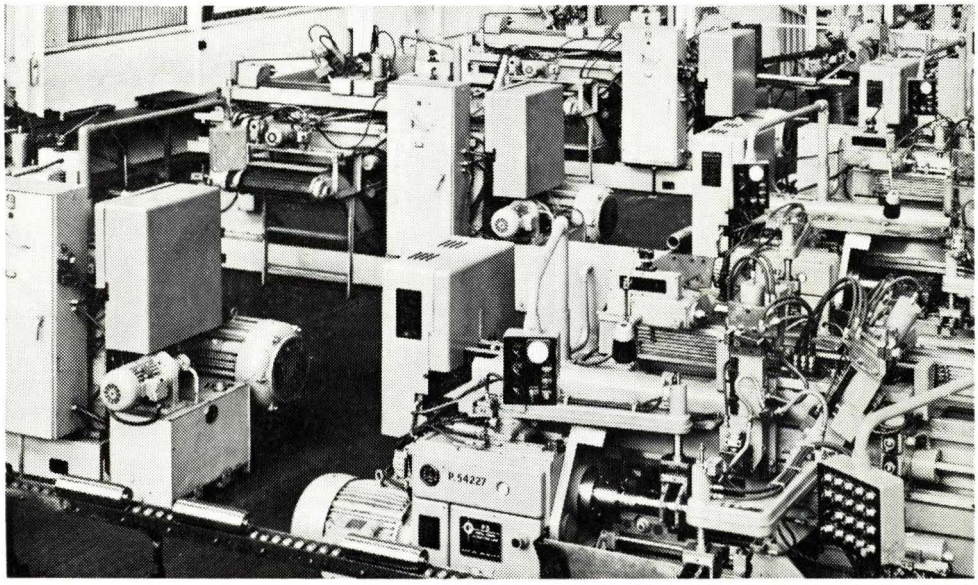
ENGINEERS

• WE PRODUCE
- Explosives
- Ammunition
- Small Arms
- Aircraft
- Guided Missiles

• WE OPERATE
- Over 20 Factories, Laboratories and Research Establishments in Victoria, South Australia and New South Wales

• WE RESEARCH INTO
- Explosives
- Ammunition
- Structural Design
- Aerodynamics
- Weapons Systems

DEPARTMENT OF SUPPLY

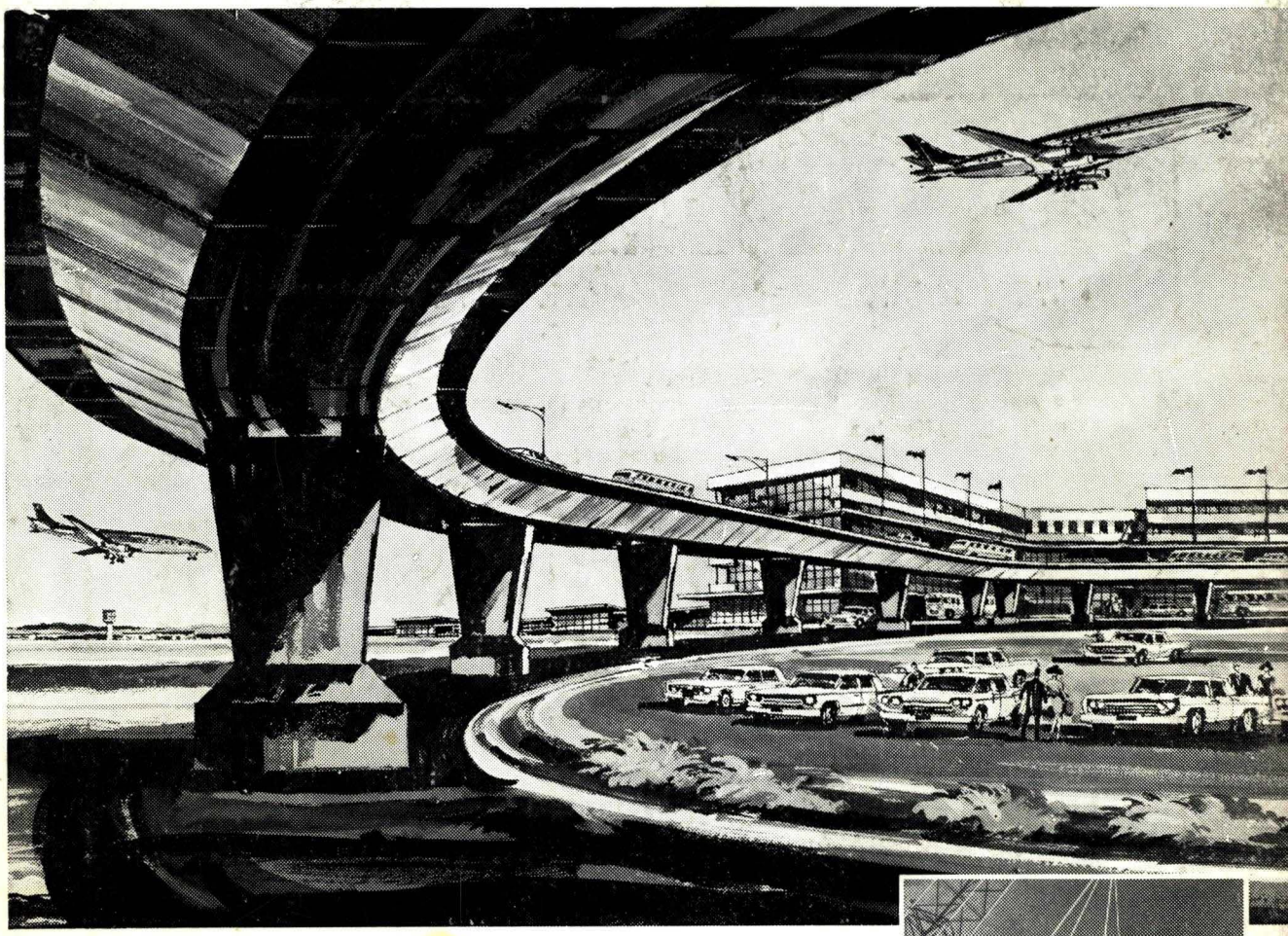


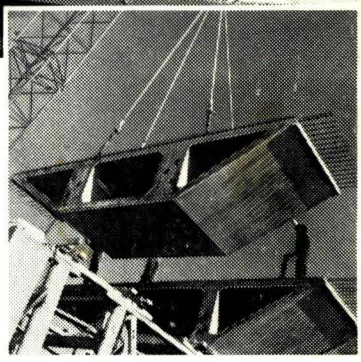
Machining Line for Medium Calibre Shells

Supply employs 20,000 people including more than 600 Engineers. Scope for promotion is excellent and depends on ability alone. The work is demanding but guidance is given by senior staff. Our Engineers are expected to develop their technical skills, to produce ideas and to develop management ability as they progress in the organization.

If you are interested in a professional position with us and want further information why not call in and see us, the Department of Supply, 68 Grenfell Street, Adelaide, S.A., 5000 (Telephone 23 9911)

We will be pleased to advise you.





FUNCTIONAL ELEGANCE AT DOWN-TO-EARTH COST

The Tullamarine elevated roadway to Melbourne's modern new air terminal featuring Humes precast box girder segments

This is a fine example of the numerous projects where precast concrete is ideally suited to meet the design engineer's demand for accuracy and functional elegance . . . and also to satisfy the contractor's need to keep costs down. All units were manufactured to a tolerance of $\pm \frac{1}{4}''$ on overall dimensions; factory controlled casting and curing conditions made this accuracy possible. Further advantages —

● The units are delivered to exactly meet your construction programme's timing ● No delays once the units are in position ● No expensive formwork.

This unique roadway is formed by 192 concrete segments post-tensioned together. Each segment measures approximately 27-6″ wide by 9-0″ long by 5-0″ deep, weighs up to 35 tons. Precast in one of our concrete factories to a design by **Maunsell & Partners** for the **Department of Works,** built by **Lewis Constructions.**

HUMES **HUMES** **Pipemakers to Australia**

MELBOURNE ● SYDNEY ● ADELAIDE ● BRISBANE ● PERTH ● HOBART

HC33X