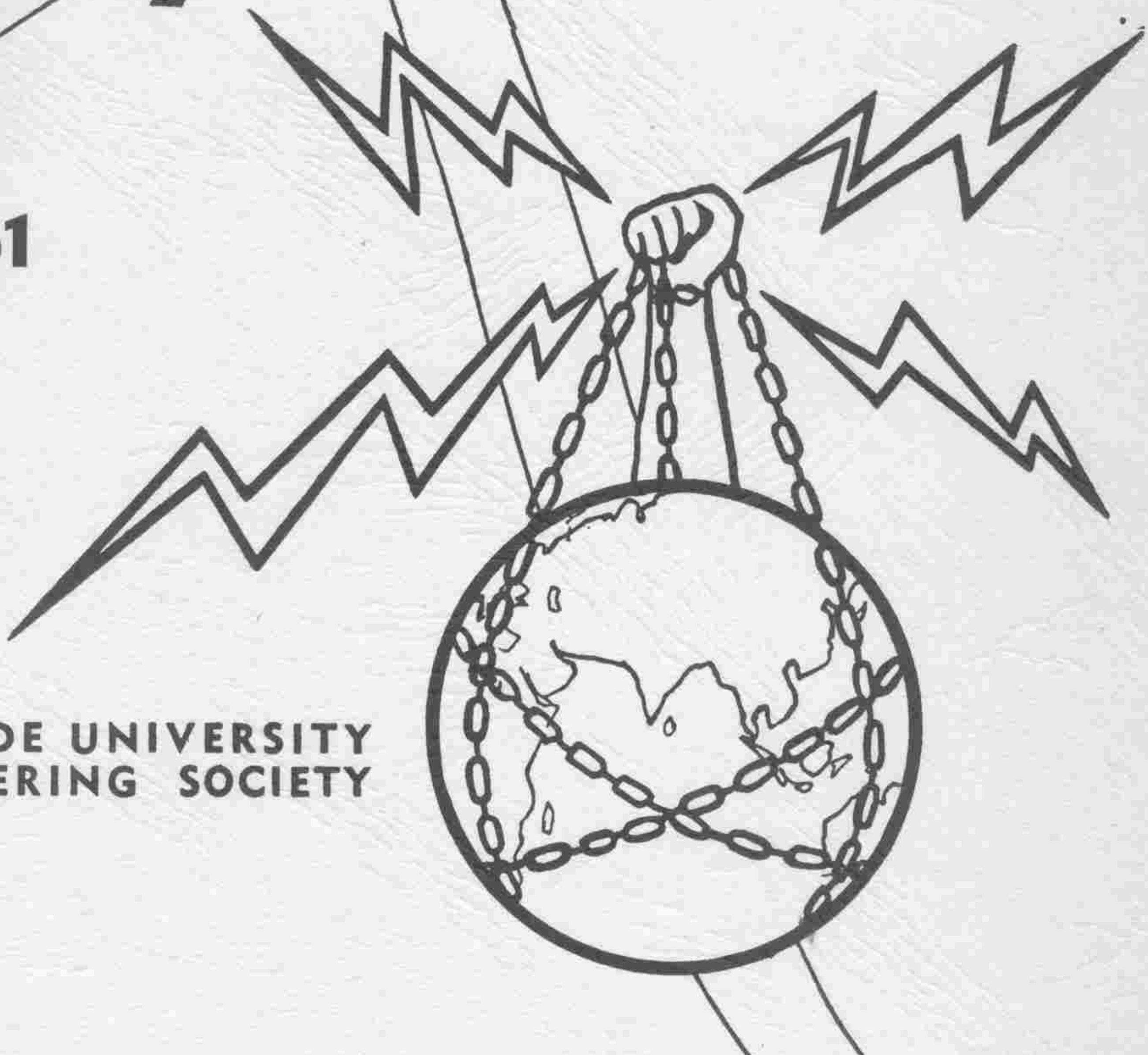
Hysteresis



1961

**ADELAIDE UNIVERSITY
ENGINEERING SOCIETY**

HYSTERESIS

1961

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EDITORS:
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EDITORIAL . . .

What happens when you double the number of engineers in a population? Do you double the scientific imagination at your disposal? The answer depends on how and for what purpose you double the workers.

With this question we come to the situation of Science and Engineering today. Since the beginning of this century, science, in the broad sense of the word, has become the hired servant of powerful states—the source from which their war potential has been built up and their industrial wealth increased.

The scientific imagination, however, is a personal thing. It is perhaps also a private one, a flower of the mind that opens only when solitary or when two or three are gathered together. What is happening to it now when ten engineers grow where one grew before, when the unit of research is the large highly organised team, when the pace of experimental work can only be maintained by feeding it with ever larger packets of energy, often at astronomical cost?

The prime mover in this expansion has been war. Aeronautical engineering has climbed into the air on the backs of two wars. The airliner is today, because the bomber succeeded in being what it was yesterday.

Perhaps the vital problem today is to ensure the effectiveness of the scientific effort. It has to be directed, and what may be good when the effort is small may grind its vital parts to a halt when it is large. The danger for large numbers of men at work is the appearance of large numbers to tell them what to do. We may suspect that Newton would have been much incommoded by the Director of Research with his programmes, deadlines, and his numerous committees and regulations. Many an engineer at work in a Civil Service is inclined to express his frustration at official channels

Engineer + Politician = 0

This goes too far, but leads us to ask whether our present system conserves much imaginative energy.

Another point that is worthy of mention is the colossal cost of some experimental work. Especially in fields subject to national prestige immense elaboration and expense is now the common approach. The real danger is that the strict thought that went with string and sealing wax experiments may become a memory just as these experiments have. The poor Australian engineer who reflects in this way may be only comforting himself. All the same, while the wealthy man never really wants to change places with his poor relation, the converse is not only true but a saving grace.

And what of space research—the new orbit for engineering? This project may cost the earth as we say, in which case the organization and resources should be on a global scale. This would happen in a well ordered world but it is not likely to happen in ours whose very anarchy has provided the means to launch the project. Martians will watch our rival gangs fight in Space Street, each spying on the other. It may be as we go farther out and learn the marvels of the universe we will be shocked into sanity. Who knows?

THE DEAN'S PAGE

I suppose that, to most Students at the University, the immediate task of passing examinations and graduation so completely fills the horizon that, for the time being at least, the problems of life after graduation must be left to look after themselves. Nevertheless, I imagine that all undergraduates in the Faculties of Engineering and Technology read with interest the recent announcement of the decision of the Commonwealth Conciliation and Arbitration Commission on the salaries of Professional Engineers. The decision of the Commission will mean higher starting salaries and a more rapid rise in salary in the early years of the graduate's professional career; a very welcome extra reward for all the years of study necessary to qualify as a professional engineer.

How did it come about that it was the ENGINEERS who had to go to the Arbitration Commission? Why not the Doctors, the Lawyers, or the Architects? The cynic might say that these latter professions get paid enough already, but the real reason lies in the way in which these professions are organised. Those practising medicine, the law, or architecture are for the most part self-employed, and to a large extent can influence their own rate of remuneration either individually or by their Profession Associations.

The professional Engineer, on the other hand, is much more likely to be an employee of either a Government Department or private organisation, the prime function of which may not be Engineering. It happens, therefore, that the working conditions of Engineers are greatly influenced by outsiders who, all too often, fail to recognise the hard training and professional responsibilities of the Engineer. It is good to know, therefore, that the Arbitration Commission, which studied the evidence at great length, has recognised the value of Engineers in making its recommendations.

The other professions, who tend to look after their own affairs, act in a responsible manner, so that the public is faithfully and honestly served, yet at the same time the professional man receives a fair reward for his services. We, as Engineers, must be careful to see that we also "play fair." One of the obviously undesirable by-products of a system which establishes legal minima is the temptation for a graduate to argue that there is no point in struggling to make himself more effective by post-graduate study or by serious reading; for on the face of it, he can get the legal minimum without any such effort. This could result in a general levelling down, thus accenting an existing feature of Australian life, which is summarised in the statement, "Tall poppies get their heads chopped off."

It is interesting to recall that it was an Engineer, some 1900 years ago, who first set down the story about the poppies. Sextus Julius Frontinus, chief engineer for the water supply of ancient Rome, tells the story in a book he wrote on Military Strategy (Frontinus was a soldier before he settled down to Engineering). He tells how Tarquin, one of the kings of Rome about 600 B.C., having decided to put to death the leading citizens of Gabii, and not wanting to let anyone know of his purpose, gave no response to the messenger sent to him by his son. Happening, however, to be walking in his garden in front of the messenger, he cut off the tallest poppy heads. The messenger returned without any answer, but reported to the son what Tarquin had done. The son immediately understood, and carried out his father's purpose on the leading citizens of Gabii.

It is unfortunate that the very policy of poppy head chopping tends to suppress the emergence of any tall poppies. For who could blame the remaining citizens of Gabii for declining civic office after witnessing the fate of their former leaders?

As Engineers, therefore, we have now a responsibility to make sure we do not shelter behind the new award, and use it as an excuse for not working hard to train ourselves to become as effective as possible.

Not only is there a need to succeed as well as possible in the undergraduate course, but there is a need to go on. For some it will be post-graduate research; for others it will be keeping up with engineering advances, or taking an active part in the affairs of our professional institutions.

Inevitably some tall poppies will emerge. I believe Australia must now recognise that she cannot afford to neglect these leaders of the next generation, and that in future her policy on tall poppies must be cultivation rather than decapitation.

PROF. F. B. BULL

PRESIDENT'S REPORT

The Engineering Society, following the pattern of the last four or five years, has emerged once again as one of the most successful and prosperous University societies. An encouraging aspect is the record number of financial members, totalling 260. This fact, together with the interest shown by a large number of students in all years, not only in just two or three years, as has been the case up until now, indicates that the Society will continue to forge ahead.

The committee members were elected in August, and took office in September, 1960. The First Year representatives were elected in April, 1961.

ANNUAL GENERAL MEETING

The last A.G.M. was held on September 7, 1960. The retiring President, Secretary, and Treasurer gave their reports, and handed over to the new committee for 1960-1961.

SMOKE-O

Your committee began work immediately after the exams. and, working against time, Wayne Murphy (Tech.), Dave Patterson (3rd Year), and myself organised a post-exam. smoke-o at the Memorial Drive grandstand.

FRESHERS' WELCOME

The opening activity of the Society for 1961 was the Freshers' Welcome, held in the Chapman Lecture Theatre. The staff were introduced to the students. Led by the Dean of the Faculty (Prof. Bull), the staff gave advice interspersed with witticisms—or vice versa—to the students. A film, "The Life of Fangis," was screened, after which the staff and students chatted informally over a "drawing office type" supper.

The success of the evening can be greatly attributed to the organisation by Mick Shearer (Tech.) and John Brook (Tech.).

CABARET

The Grange Hotel, on the Esplanade, was the site of a "burster" of a cabaret at the end of the second week of first term. The 120-odd guests enjoyed themselves to the full, or, rather, until they were full. Music was supplied by a band of fellow Engineers, the supper likewise. Little did the guests know that the tasty condiment on the home - made sandwiches was SAE90 from the hands of the "catering Engineers," and not Vegemite!

Thanks to the efforts of Peter Roberts (Final Year Elec.) and the "Catering Engineers," this show was the talk of the 'Varsity for days following.

COCKTAIL PARTY AND BALL

There was no doubt about the fact that the Cocktail Party, held in the Institution of Engineers' new building, far surpassed any similar function held to date by any University Society, including the A.U.E.S. Two hundred and fifty guests, including staff members, were admirably entertained, thanks to Nigel Barkham (Tech.) and Rick West (Final Year Mining). The help of Graeme Gentles and Stan Scarman was also greatly appreciated.

The Ball was attended by over 500 people, and was convened by Dave Patterson (3rd Year Civil) and Bernie Bent (4th Year Civil). Two bands, a floor show, and free drinks went together to make the 1961 Engineering Ball a great success. It would never have eventuated, however, had it not been for the fine efforts of the helpers, a number of whom found it necessary to work almost non-stop from Friday evening until early Sunday afternoon.

It is with hesitancy I ask this, but "Why is it that at least 150 Engineers, having enjoyed a very pleasant evening under the auspices of their Society, could be so thoughtless as to leave the cleaning up to four willing people?"

After all, this Society does exist for the benefit of every Engineering and Technology student, and it is not often, in fact, only on this one occasion, that of the Ball and Cocktail Party, that the committee appeals for the manual co-operation of the A.U.E.S. members.

SYMPOSIUM

Twenty-two Adelaide Engineers headed west to Perth for the Annual Symposium last May.

The Society subsidised the travellers to the extent of £2/10/- per capita.

Not only were many old friendships renewed, but many new ones were made. Everybody enjoyed themselves to the utmost. This was no doubt due to the fact that the hospitality afforded us by our Perth hosts was absolutely unsurpassable.

Four students, who prefer to remain anonymous, rowed the A.U.E.S. into a close second place in the Australian Engineering Students' Sculling Titles. A fine effort, considering the winners, W.A., were drinking their own brew. Paul O'Connor did a great job handling the Adelaide end of the arrangements.

Next years the Symposium will be held in Hobart, and my personal advice is, "Don't miss it. It will be a ripper!"

These Symposiums are organised annually by the Engineering Faculty Bureau (E.F.B.). This organisation co-ordinates the interstate activities of all Engineering clubs and societies. E.F.B. is affiliated with N.U.A.U.S., and is also responsible for the Indian Exchange Scheme and the publication of "Torque."

FILMS

Commencing in the first week of Second Term, films were shown every Tuesday, at 1.10 p.m., in Room 110 of the Mech. Eng. Building.

Bruce MacLeod did a great job in obtaining and screening these films. The success of this activity was also a result of the publicity of it, handled by Anne MacCuska and Peter Waters.

Attendances at the films have practically doubled in the last two years. This is a source of great encouragement indeed to those who spend so much time in arranging the programme.

TUG-OF-WAR

This year the S.C.I.I.A.E.S. shouldered the responsibility of the trans-Torrens pull. Unfortunately, it was nothing better than a disorganised brawl. For the first time in two years the Medicos had decided to take the contest seriously, and it was indeed a shame that the Engineers had not done likewise.

It is still not too late to restore this annual challenge to the level of sporting rivalry between the two Faculties, instead of a brawl between pseudo-intellectuals. If the students in both Faculties wish to pelt one another with flour, eggs, etc., surely this could be confined to a "flour fight" as such.

S.R.C.

The representation of Engineering students on the 1960-1961 S.R.C. rivalled that of the famous 1957-1958 S.R.C., which was literally "stacked" with Engineers.

Congratulations to the four Engineers on their election to the S.R.C., and to Bill Blandy (4th Year Chem.), the Vice-President, and to Roger Sawley (4th Year Mech.), who convened the 1961 Commencement Ball—the biggest and best ever. His great effort was much appreciated by the 2,000 odd guests. Never before have the Engineering students been represented by such dynamic personalities.

Congratulations also to Dean Patterson (4th Year Elec.) and Peter Waters (1st Year) on their election as Faculty Reps. to the 1961-1962 S.R.C.

TORQUE

The first edition, capably produced by George Meija (Final Year Med.) and Dean Patterson, "hit the streets" late in First Term. Without exception, the Engineers at the Symposium acclaimed it to be "the best Torque yet." This speaks for itself, as they represent a good cross-section of all Engineering students in Australia.

COMMITTEE

In past years it has been necessary to hold only one meeting a fortnight. However, the amount of business to be transacted has increased to such an extent that it was necessary to hold a meeting once a week. The work was well spread out, and did not fall upon the shoulders of a willing few, as it has done previously.

Energetic, reliable people, prepared to do a reasonable amount of work, are again needed for next year's committee.

YET TO COME

The Annual Dinner will be history when Hysteresis is distributed, but at this stage Mick Shearer is convening furiously. Dr. G. Sorby-Adams will be our guest speaker at the Hotel Finsbury. The increase in price for this function is regretted, but is unavoidable, and is still on a par with that of dinners held by other clubs and societies.

Dave Patterson and Ron Copeland are at this very moment organising a Barbecue to be held on the last Saturday of Second Term, somewhere in the scrub near Adelaide.

A challenge to debate against the Medicos early in Third Term has been accepted. If last year's form is any indication, the Medicos will again be the underdogs.

Don't miss the post-exam. Smoke-o this year!

HYSTERESIS

Editors Garry Brown and Wayne Phillips have been chasing people (especially the President for this report—Ed.) for weeks now. Congratulations to both of them for the tremendous job they have done in making this publication the success it is. Their job has been far from easy.

LAST, BUT NOT LEAST

In the foregoing report I have no doubt overlooked mentioning a number of Engineers, not necessarily committee members, who have so willingly assisted in and taken part in the year's activities.

I thank them one and all, especially the Hon. Treasurer, Graeme Evans, who so capably handled the financial affairs of the Society. This is also a fitting place to thank the staff, on behalf of all A.U.E.S. members, for the interest they have shown in our Society.

I hope that in the not too far distant future all students enrolled in the Faculty of Engineering will take an active interest in their Society, and become financial members.

In closing, I can only quote Prof. F. B. Bull (Dean's Page, Hysteresis, 1960): ". . . In supporting the work of the A.U.E.S. you show, while you are students, an interest in the whole field of Engineering, and I think that a lively and active Engineering Society is an essential complement to the formal work of instruction and teaching if we are to succeed at the University in fitting you to take your place in your chosen profession, Engineering."

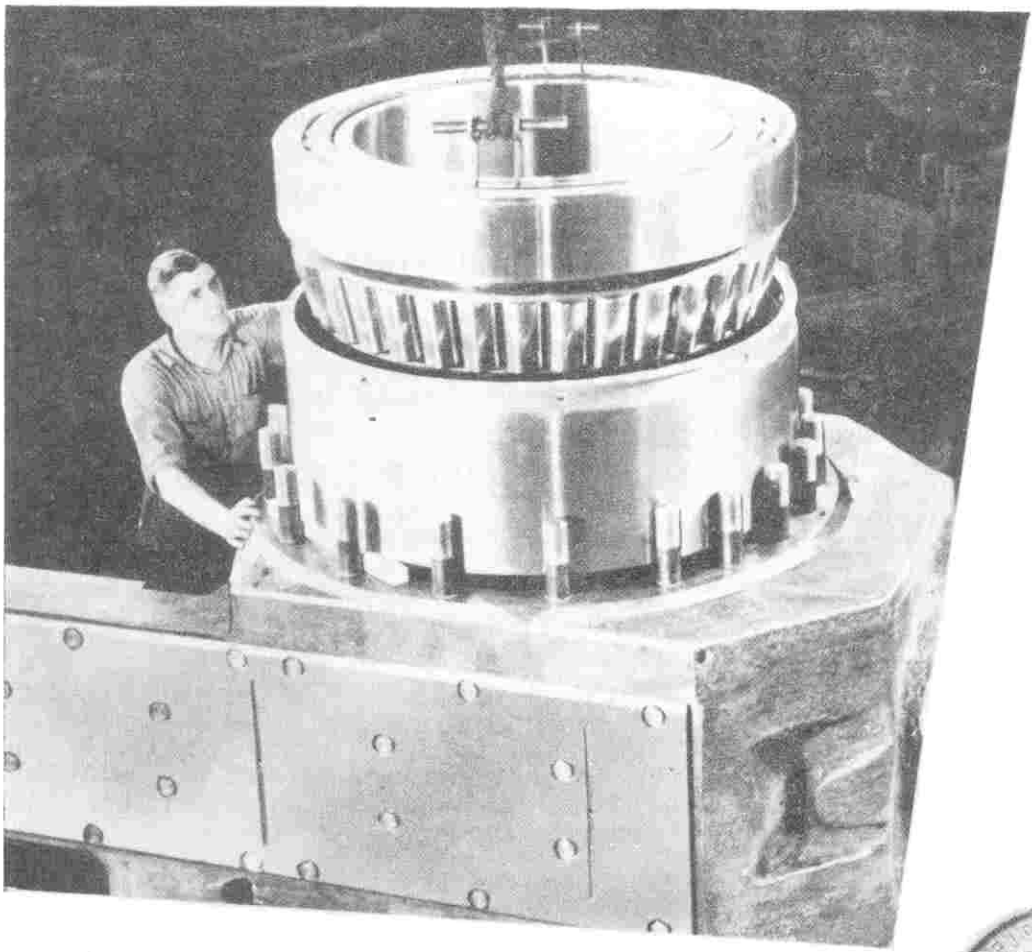
I feel honoured to have been associated with such a highly regarded Society.

PETER INGLETON.

Policeman (to an intoxicated engineer who was trying to fit his key into a lamp-post): "I'm afraid there is nobody home tonight."

"Mush be. Mush be. Theresh a light upstairs."

All women's clothes are merely variations of the never-ending battle between the admitted desire to dress and the unadmitted desire to undress.



CHANNEL CROSSING

By J. W. PARKIN

The question of a permanent cross-Channel link between France and England is one which has provided the world with interesting and novel ideas for many years. In these days of great engineering achievements it is not a matter of deciding whether or not a scheme is practicable, but rather whether it will be cheap enough for the use it affords. At present there are three proposals in the air:

1.—**A Channel Bridge**—to cross near the narrowest section, i.e., between Dover and Calais.

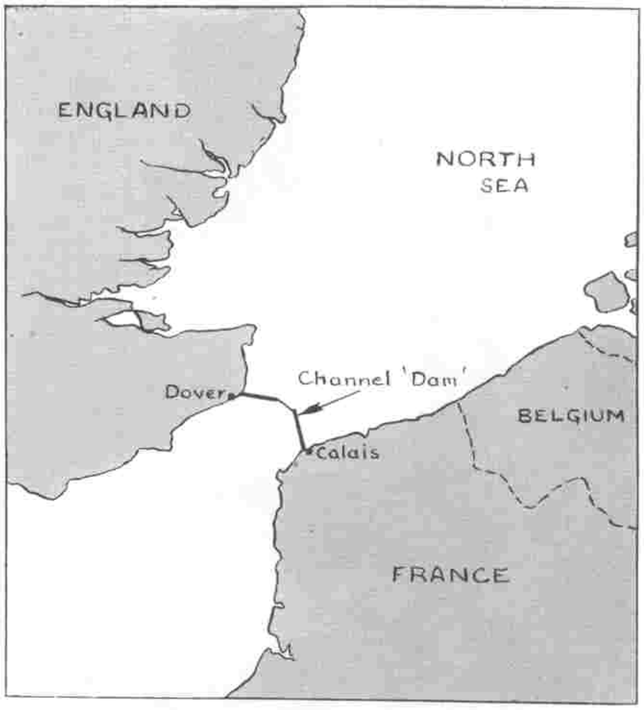
2.—**A Channel Tunnel**—the most publicised scheme.

3.—**A Channel Dam**—a revolutionary (and, of course, French) idea, which has much to commend it.

There is nothing brilliantly original in the Channel Bridge suggestion. Nobody would doubt the ability of modern engineers to construct a solid, storm-resistant steel bridge for the short distance of twenty-five miles in water no deeper than 140 feet. But in our time of American superlatives such things do not interest us. We all have a yearning for the sensational, and would be most disappointed if just an ordinary bridge were decided upon after so much dreaming by so many of the world's engineering optimists. We ignore the bridge as a conservative British idea which would be too expensive, anyway.

Being in this frame of mind, we are only mildly impressed by the Channel Tunnel scheme. For, after all, men have been building tunnels for centuries, and even under-water tunnels are commonplace. Yet there is something in a tunnel which appeals to the romantically-minded . . . and a tunnel under the sea like this is no small pipe. The most popular construction plan involves prefabricated sections floated out, sunk, and located on the sea floor, buried, and then pumped dry. A rate of progress of 540 metres per month is confidently predicted for this process. Arguments rage over the road versus rail contention—experts in economics, road traffic, and other associated departments are experiencing considerable difficulties in deciding this issue.

However, this French scheme has promise. The Channel Dam is not as fantastic as it sounds. for it is not, as one might expect, a huge wall holding back the mighty waters of the North Sea. In its simplest form it may be described as two training walls built out at an angle to the shores, and connected by a bridge. Underneath the bridge, in the centre of the Channel, sluice gates control the tidal movements. Quite apart from serving its original purpose as a link between France and Britain, such a "dam" would have some fascinating effects on climate and tide, and these alone almost justify its construction.



These are the principles. The quantity of heat introduced into a sea at 0° C. by a cubic metre of water at 10° C. is about 10,000 calories. To give this cubic metre a speed of about four knots, the equivalent of 0.5 calories is necessary. Even allowing for a factor of 10^4 for efficiency losses, the pumping of warm Atlantic water into the North Sea becomes a sensible proposition. The Atlantic's waters are warmed by the Gulf Stream, but the eastern half of the Channel and the southern part of the North Sea are almost stagnant, and cool down as the winter comes on. There is nevertheless a tidal current of 3 to 4 knots past Calais, but the tide coming up the Channel always meets the previous tide coming down the Channel from the north, and the net effect is a current of only 0.2 knots. It can be shown that barely half the volume of the stagnant North Sea is changed each winter. If the rate of renewal could be multiplied by 5 or 10 (i.e., the current speed increased to 1 or 2 knots), the warm Atlantic water would give two to four complete renewals per winter.

There are three suggestions to achieve this, namely, (a) a barrage of sluice gates and piers all the way across the Strait, which allow tides to pass to the east and debar their return; (b) two barrage arms extending from each side, but with a gap in the middle at the deepest part; this is cheaper, and solves navigational problems, and would have virtually the same effect; (c) the same as (a), but with the addition of a power unit in the centre with slowly rotating screws to oppose the westward flow, and to encourage the eastern flow; at certain times this could be used as a hydro-electric generator to return some of the power used.

The effects of these schemes on the climate can be summarised in the mean winter temperature along the Dutch and Belgian coasts of 2 to 3 degrees Centigrade, a corresponding increase of 1° C. in summer, and a prolongation of the autumn into the depths of the winter. The same would be apparent on the English coast. Direct benefits would include a saving of 10 to 20 million tons of coal per year in domestic heating, important agricultural changes, the generation of power from sea currents, and flood protection, as well as providing, of course, the foundations for a cross-Channel transport link. It is likely that the famous city "smog" would disappear entirely from large British cities.

A French engineer, M. Rougeron, who proposed this scheme about five years ago, writes of the power unit:

". . . The project, with artificially-induced current, produced by giant screws mounted perhaps at the bridge piers or under the bridge deck, has always seemed to me to be valid. I would increase their power beyond the 250 to 2000 MW I estimated to be necessary in 1956 for currents of 1 to 2 knots; I would go willingly to almost 3 knots and 5000 MW.

"Then I would combine the concepts of the articulated structure (sluice gates) and of artificially-induced current.

"Lastly, for amateurs of *récupération*, note that the electric-motor-screw sets would function as generators when the current, whether it be in the west-east or east-west direction, was between 3 and four knots. The French and British national grids would consume the energy produced, and would likewise supply the energy for pumping at around the slack water times. This is the same concept as is accepted by *Electricité de France* for the tidal power scheme which it has started to build on the Rance. Here is an example of twelve hours' working, from the moment current reverses from east-west to west-east:

1.—For 1½ hours, pumping to accelerate current in west-east direction.

2.—For three hours, generating, slowing the current and supplying energy.

3.—For 1½ hours, pumping as in stage 1.

4.—For 1½ hours, pumping to hinder the establishment of the current in the unwanted direction.

5.—For three hours, generating as in stage 2, which slows down the current, now in the unwanted direction.

6.—For 1½ hours, pumping as in stage 4."

Estimates of the cost of an exclusively railway tunnel are about 1475 million N.F. with returns growing from 180 million in 1965 to 283 million N.F. in 1980. Estimates of the cost of a bridge are 2500 N.F., with receipts growing from 181 million in 1965 to 568 million N.F. in 1980. Both of these seem economically possible solely from the income from traffic.

Now add to 180 million returns in 1965 from a dam and bridge scheme about 1200 million N.F. as a modest estimate of saving due to increased temperatures. Neither the production of tidal energy or benefits to agriculture or the effects of lack of smog are included in this estimate. It would not be difficult to imagine an annual return equal to the original cost of construction if one commenced with breakwaters extending from the coasts.

ANSWERS TO WIT TESTERS

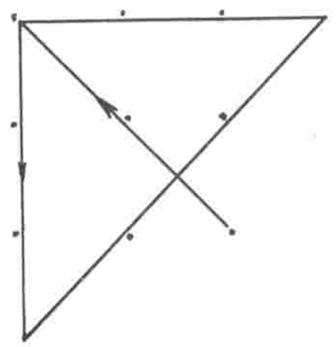
SEE PAGE 39 FOR QUESTIONS

1.—Time to collision $= \dfrac{120}{25 + 15} = 3$ hours.

Hence the fly flew 300 miles.

2.—D=5, T=0, E=9, A=4, R=7, L=8, G=1, N=6, B=3, O=2. This is the order in which the letters can be evaluated.

3.-



4.—White.

5.—2 7 6
9 5 1
4 3 8

6.—The prince could not do anything unless he broke his own decree, because if the culprit were hanged his statement would be true and, according to the decree, he should be beheaded. If he were beheaded his statement, "I shall be hanged," would be false, and he should be hanged.

7.—There are a number of strategic positions, namely, 1, 12, 23, 34, 45, 56, 67, 78, 89. If A makes sure that B never occupies these positions, A will always win.

HEALEY HUNT

By JOHN CAMPBELL

Somewhere in an English motor magazine of ten years ago, I believe there was published a photograph of a car travelling sideways around Madgwick Corner during a minor event at the Goodwood motor-racing circuit. This car, a Healey Elliott saloon, was at the time the daily transport of a friend of mine, who has never ceased to praise its merits. When he emigrated to Australia he decided reluctantly against bringing it with him, fearing that a land of kangaroos, aborigines, and bone-headed politicians would be unable to provide adequate supplies of spare parts and facilities for maintenance.

In May last year, he seized on my grudging admission that a car might suit me as well as my faithful but rather tired motor-cycle.

"You know," he said, "if we were in England the Healey would be the only car I'd recommend. But I'll bet there's not one anywhere in Australia. Probably nobody's ever heard of the thing, or if someone has, he thinks it's an Austin-Healey. Hell!"

I was not so sure. One Sunday afternoon in 1954 I had come out of the Public Library after reading a most complimentary road test of the Healey in a bound volume of "The Motor," to be confronted immediately with a life-sized specimen parked just across the road. At least, that is what I seemed to remember in 1960. Being prepared to back the accuracy of my memory in this respect, I took him up on his bet, and returned to Adelaide determined to find the car.

For some time I studied magazine photographs of the Healey, and my elderly motor cycle was frequently urged into startled pursuit of likely-looking cars on the roads. I can recall being ten minutes late for a Physics III lecture after one fruitless chase, which took me out to Kensington from near the Botanic Gardens before I managed to overhaul a bodgie driving a battered grey Peugeot. Similarly, Rundle Street was thrown into chaos at 11.30 on one Saturday morning when I spotted another "possible" in heavy traffic near Gawler Place. I have never seen so many annoyed bus drivers within such a small distance since that morning, and the policeman on point duty at Gawler Place, who had just held up traffic flowing along Rundle Street by a magisterial gesture with the right hand, had the narrowest escape of his life as I continued to press on, swerving to the centre of the road to avoid the first cars turning out of Gawler Place. However, the chase stopped abruptly when I had my first clear view of the tail of the "possible." It was, I am ashamed to admit, a Volkswagen!

My first success came unexpectedly. I was showing some of the magazine photographs to a non-motoring acquaintance when he surprised me with the emphatic remark: "I saw one of those yesterday." Moreover, he remembered the place. "It came into Delamere Avenue from Fullarton Road up at Netherby, went past me, and turned off to the right." Strange to say, he lived about five miles from Netherby, and he refused to tell me what he was doing so far from home. Later I heard a sinful explanation of his movements from a friend, but that is another story.

FROM THIS . . .

The only possible right-hand turn off Delamere Avenue which fitted the information was Springfield Avenue, the one real outlet for a small area of Springfield, as you may see from a street directory. On the following Saturday morning, armed with numerous photographs, I ventured into the district, prepared for almost any eventuality short of a house-to-house search.

As it happened, however, the job took just twenty minutes. A cultured gentleman digging weeds out of his front drive looked blankly at the photographs when I produced them, shrugged unconcernedly, and suggested: "You might try that feudal castle-type establishment up the road. They've got about half a dozen exotic cars in there."

"Feudal" was the correct word if size was any justification of the word. The driveway seemed half a mile long as I toiled up it. But the labour was rewarded. There was the car, parked neatly across one of the numerous back doors of the establishment.

Technically there was not much to be learned on the spot. The establishment's car maintenance gentleman, Jack by name, repeated that it was a "good car," although possibly a little more temperamental than their collection of Jaguars. Finally he announced that he was leaving for Unley Oval to lend moral support to Sturt in the big game, and could not waste time in trivialities. I thought of offering him a lift on the back of the motor cycle, but took one more look at the magnificence of the establishment and decided against it, for fear that it would be received as an insult.

Within an hour I had telephoned John, the ex-Healey owner, in Melbourne, but he was out, and I had to satisfy myself with leaving a message. On Monday I received the telegram: "IT'S ALL IN THE MIND U KNOW." Apparently further proof was required before he would concede the bet!

Further proof was forthcoming immediately. A friend at G.M.H., with "extensive connections in the automotive industry," rang on Monday night to say that the grapevine had reported the presence of a blue Healey at a garage somewhere in Kent Town. The car I had seen on the Saturday was a two-tone grey. It never rains but it pours!

Out came the magazine photographs again for the benefit of every garage owner in that district. Again the job was over quickly—in fact, I needed to go no further than the bottom end of Rundle Street this time.

The blue car still bore Victorian plates, and the owner explained that he had bought it as a result of seeing an advertisement in "The Age." Off went a telegram to John: "TRY READING AGE CAR ADS JUNE 4 CLOT BABOON SWINDLER."

John responded by letter in an unusual tone. He passed over the bet in a few words, and remarked that, if I should present myself at a certain address in North Balwyn at 1430 hours on the following Tuesday (this, by the way, was in the August vacation—even I can't escape from Adelaide as readily as I wish to do) I would hear something to my advantage.

Promptly at 1430 I entered through the main gate at the given address, to be awakened rudely at 1430.01 by the sound of a car horn and a squeal of tyres directly behind me. John had arrived, inside a dark red Healey.

This car had come from New Zealand, no less, in the hands of Paul, one of John's "old mates from Manchester," and its arrival in Melbourne had had absolutely no connection with the original bet. But the most surprising information of all was that I had been booked aboard, so to speak, as a passenger for Sydney on the same evening—provided, of course, that I wanted to go!

Paul drove as far as Euroa, but it was obvious that he was tired. I hesitated to offer my services as conductor, being a polite young man, but the question was settled for me.

"Here, you drive," he said, pulling over to the side of the road. "I'm going to get some sleep in the back seat." He pointed to a large intimidating switch on the left of the steering column. "Don't use that unless somebody baulks you when you're trying to pass. Don't go much over ninety, and I'll murder you if you make me wake up."

I began cautiously, wondering whether I was in charge of the car or whether the car was driving me, but by the time we had reached Benalla I was enjoying the drive fully as much as I had done with any other car. We stopped briefly in Albury for fuel and refreshment of the inner man, but Paul slept on. I looked at him, decided that he was in no condition to argue points of geography, and resolved to go the long way around, through Bathurst, on the Olympic Highway, merely to see how the Healey would behave on the road through the Blue Mountains.

Outside Wagga a fly appeared in the ointment in the form of a cow-cocky in a Vanguard, who accelerated a little whenever I essayed to pass him. After two miles of frustration I remembered Paul's advice, and turned the switch on the steering column as a last resort. Immediately the scenery was illuminated as in broad daylight. It seemed that a magnesium flare had gone off inside the Vanguard, and I had a momentary vision of the cow-cocky struggling to cover his driving mirror to avoid being blinded as the Healey's ammeter needle swung back from a discharge reading of about 25 amps. I had seen a single extra spotlight on the front of the car in Melbourne, but I had no idea that it was as efficient as an aircraft's landing lights. In fact, that was what it was! A small aircraft, obviously, but I had no complaints about that.

Of the remainder of the trip it is sufficient to say only that probably we established a new unofficial record time between Bathurst and Penrith. At eight minutes to nine I emerged from the driver's seat in front of the Sydney Town Hall, having just driven five hundred miles without sleep, but feeling none the worse. Paul yawned, engaged first gear, and was off at once in the direction of Newcastle. I directed my steps to the office of the "Sports Car World" magazine.

Doug Blain, editor of S.C.W., mentioned that a Healey Elliott lived out beyond Parramatta, and directed me to a garage there. Back I went to Parramatta, to the garage operated by John Schroeder, owner of the only Silverstone Healey in Australia. Yes, he could tell me about the car I was pursuing. It lived at a junk yard (!) near Westmead, and had been having a hard life, but it was worth examining.

On a blisteringly hot afternoon I set out to retrace my morning's route along the Great Western Highway, but on this occasion I had to use my own legs and carry a kitbag, sleeping bag, and overcoat into the bargain. There appeared to be a wrecker's yard at each bend on the highway, but I had no success with any of these, and I was directed to keep going. Between frequent visits to stores for gallons of cool drinks, I looked into the future and imagined myself still tramping on beyond Bourke towards the mirage of the next bend in the road, pursued by the mocking laughter of an army of car wreckers.

However, my efforts were at last rewarded, at the price of two feet in which all sensations of feeling had been lost. After waiting for an hour for the relevant keys to be sent up from Sydney, I was driven to an innocent suburban house about a mile away, and its garage was unlocked with due solemnity.

I looked inside, but there was no car. Instead,

. . . TO THIS

(Spare pair of trousers not included)

I was confronted with a maze built from pipes, boxes, oil drums, and a bath. Removing some of the boxes, I found a fossilised espresso coffee machine and the decaying remains of what must have been a triple bed (I wonder if evil-minded Engineers can think of a use for it?). Behind this was a large cream-colored, cobweb-covered object with windows, through which I could see a guitar case, a small lawn mower, and a steering wheel. A steering wheel? Eureka—it was the Healey!

Here, to all intents and purposes, the hunt ended. Last November a certain sum of money changed hands, and the Healey was back on the road, no doubt appreciative of being rescued from its last place of residence. It is now being restored slowly to its original condition, and should reappear "as new" within a few months.

To those of you who contemplate hunting, I refuse to recommend that you should hunt kangaroos, elephants, or even women (a favourite Engineering pastime, I understand), for maximum satisfaction. Try car hunting—there's nothing like it!

Women's styles may change, but their designs remain the same.—Wilde.

THE AMERICAN AUTOMOBILE

By A. L. COBIAC

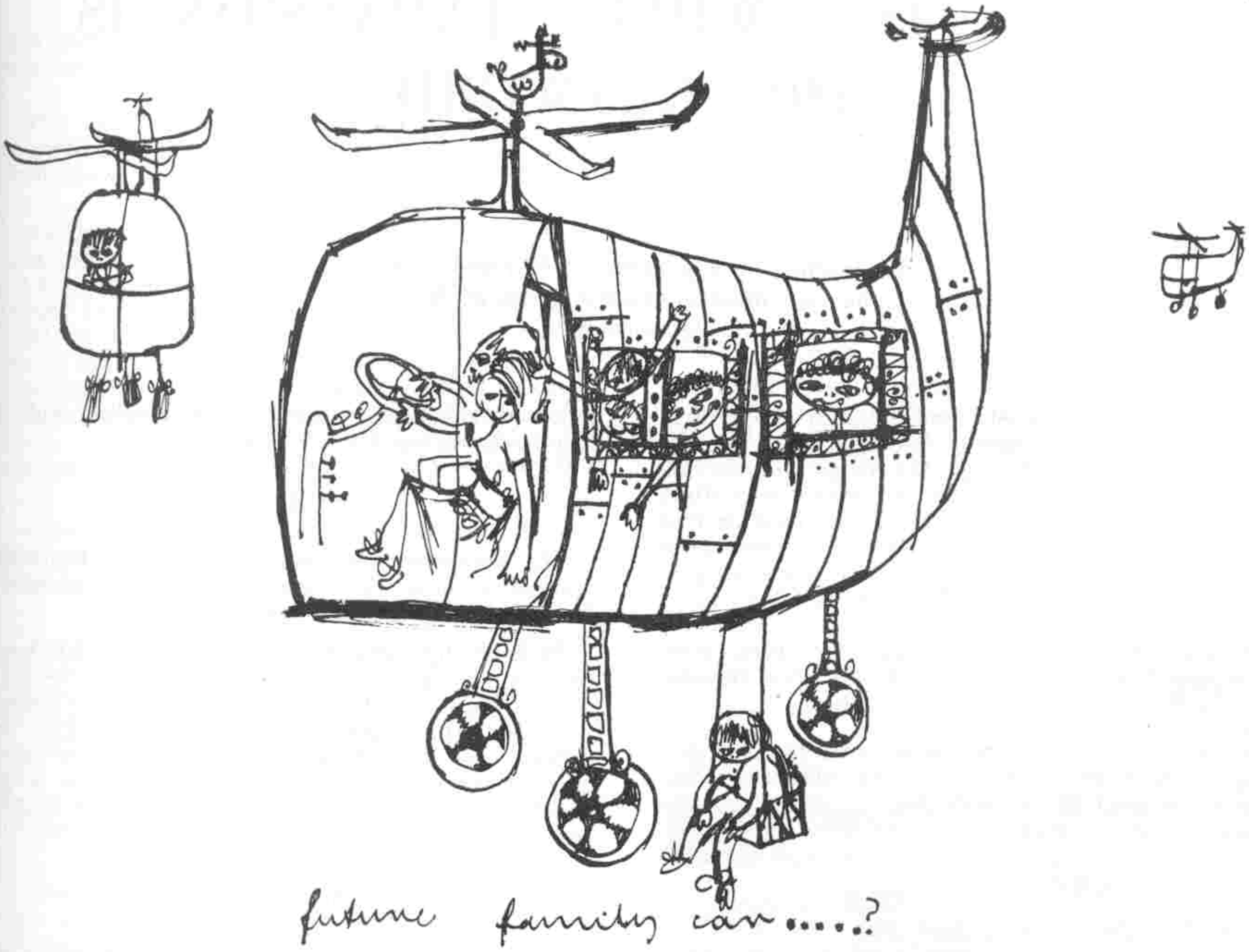
To the American public an automobile is a home away from home, and one is bound to admit that it does seem to closely resemble a house on wheels. Its nominal size is 18 ft. x 6 ft. x $4\frac{1}{2}$ ft., and it arrives in assorted shapes and colours.

Gadgetry reigns supreme, with power windows, seats, aerials, and steering, automatic light dimmers, mirror adjusters, and ash disposal, etc. Incidentals include a speedometer, generator, and oil pressure lights, and a fuel gauge. The kitchen sink, however, must remain a novelty until such time as a lightweight mobile septic system has been developed.

From outward appearances, the plating business is currently booming, but a recession may be in sight following the introduction of a substance called paint, popularised by cosmetics manufacturers. Any bright ideas will be gratefully received. Two objects which receive much attention from platers and panel-beaters alike are the bumpers or, more commonly, the front and rear ends (the order is debatable). They perform several important functions: to support a badge bar and a licence plate, to deflect pedestrians from the armament encrusted bonnet towards the peaked headlight cowls, and last, but not least, to support the grille. This latter article did wonderful service as a drain cover until a talent scout spotted it, and used it to restrain insects and air from reaching the radiator.

But beneath those acres of embellishment lie some truly amazing examples of American ingenuity, undoubtedly the greatest being the V-8 engine. This truly magnificent article was created by Henry Ford before the invention of the horse, and in time proved to be the largest consumer of oil, petrol, and tyres. Around it sprouted a whole industry, widely known as petrol stations, so that no vehicle need be more than a few hose lengths away from its life-giving liquid diet.

The suspension system is similarly unique. The front features fencing wire, coil springs, with direct-acting sponge-rubber shocks, while at the



More for less . . . or, more probably . . . less for more.

rear end five foot long leaf springs positively located with respect to the chassis via various elastic media. The end result is bound to be interesting when thrown into an average corner. From outside, the whole vehicle resembles a jelly with St. Vitus' dance, while inside, the passengers beneath the dashboard can hear a banshee wail as the driver vigorously unwinds the steering wheel, pushes the cogs around with a big rubber stick, and attempts to gain control with the loud pedal which, as on all good American cars, produces the same result. On occasions like these one wishes for flaps, parachutes, or, as a last resort, ejection seats, which would all certainly be in keeping with the aircraft-derived fins.

Seriously, though, this phase of development has come to a timely end, as "compacts" take the scene. This year the Big Three are all selling canned heat, cars which come closer to the European school of thought.

In the meantime anyone wishing to sell his bucket of SAE bolts cheaply . . .

Among the acres of electronic brains that are the centre of activity at the U.S. rocket-launching centre at Cape Canaveral, Fla., is an ancient Chinese abacus encased in a glass cabinet. On the cabinet is the legend: "Break Glass in Case of Emergency."

"What are you smoking in your pipe?"

"That's my business."

"That's what I thought. But how do you keep it alight?"

She who hesitates is won.—Wilde.

MOUNT ISA: WHERE EXPANSION IS THE KEYWORD

P. L. ROGERS

Highlights of the recent celebrated trip to the rich mineral-bearing areas of North Queensland.

Two days, five hotels, and a hundred and fifty bridge games after leaving Adelaide, Alice Springs was reached, and although the 'Ghan was partially dismembered en route, all were peacefully sleeping when the train came to its final resting place. Time was just sufficient to glimpse some of the scenic grandeur, and grasp something of the potential great "red heart of Australia," before the group of 25 chemical engineering students, ably assisted by two lecturers, were winging their way towards Mount Isa and the A.I.M.M. Conference to be held there.

They say first impressions are lasting, and right from the outset the organisation would have flattered the British Army. It was obvious that expense, grog, and anything else except women were no object to a company as almighty as Mount Isa Mines.

Technically, a good deal was absorbed in a stay of just under a week, and each day trips over the mine, smelters, or the new power station were scheduled.

The ore produced from the mine consists of copper ore (3.7% Cu), associated with silver lead zinc ore (8.3% Pb, 6.8 oz. Ag, 5.3% Zn), and the company's expansion programme has reached an immediate production target of 8,000 tons/day. And in order to locate new ore bodies, and to obtain further information about the grade and extent of known ore bodies, diamond drilling exploration is carried on from surface and underground sites. The surface diamond drilling machines are capable of driving to depths of 5,000 feet, while holes drilled from underground locations vary in depth from 50 feet to 2,500 feet.

MINING

Using the blast hole percussion drill, stoping now extends over two levels (380 ft.), and several different methods of stoping (e.g., sub-level stoping, shrink stoping, long hole benching, and cut and fill stoping) are employed. Stopes are filled, when finished, with open cut overburden, deslimed mill tailings, and granulated copper slag.

An interesting feature at the mine is the primary jaw crusher beneath the lowest haulage levels. The primary crusher is the largest single piece of machinery built in Australia, and it began operating late in 1959.

MILLING

The concentrating plant treats both lead-zinc and copper ores. The ores are treated separately, but treatment methods are similar.

Present throughput of the plant is 53,000 long tons per week of seven operating days. Several grinding units and one fine ore bin are so equipped that they can handle either lead-zinc or copper ore, depending on the demand for each on the world markets. Normal practice is to treat 15,500 tons of lead per week, and 37,500 tons of copper ore per week.

SMELTING

In the lead smelter, the charge components of mill concentrate, fluxes, baghouse dust, and return sinter are delivered to the main mixer. From there the charge is conveyed on to machines, and passes under an oil-fired stove which ignites the sulphur in it. As it moves along the machine, a down draught through the bed maintains the burning, so that the sulphur leaves the charge as gaseous sulphur dioxide. Thus, by the time the machine discharges, all the material has been sintered, and the lead is present as lead oxide.

In the blast furnace section the coke and sinter are automatically weighed and charged to the furnace, where the coke burns to form carbon monoxide, which reduces the lead oxide in the sinter to metallic lead. All other materials present melt to form a slag. The bullion and slag are continuously tapped from the furnace into a forehearth, and the bullion is then tapped from the bottom of the forehearth into five-ton ladles, and taken by overhead crane to the drossing section. Drossing effects further refining, and the drossed bullion is heated to 700° F., and cast.

In the copper smelter the charge for roasting consists of concentrate, purchased ore, miscellaneous copper-bearing material, Black Rock oxidised ore, and limestone. Roasting is almost autogenous, with make up heat supplied by oil burners, and any sulphur is removed preferentially from iron sulphide, leaving all the copper sulphide unoxidised.

The calcines, converter, and boiler dusts are charged into the reverberatory furnace, which is fired through four pulverised coal burners.

As the charge smelts, separation of matte and slag takes place, and as the matte is required by the converter section, it is tapped through a copper tapping block with a magnesite core. The matte is then transferred to the converter section, where silica flux is added, to form a slag during the slag blows. Slag from each blow is skimmed into ladles and returned to the reverberatory furnace. The converting is a cyclic operation consisting of three slag blows and one copper blow.

Finally, the blister copper is cast by pouring from the ladles, by crane, into one-ton copper moulds.

Besides spending a good deal of time inspecting the mine, mill, and smelter, two other tours proved of special interest, and both were indicative of the increasing expansion occurring in and around Mount Isa. This expansion is warranted, as it is claimed there remains sufficient ore to last for at least 50 years, and research is continuing to unearth more mineral wealth.

The Mica Creek Power Station and transmission lines, which will ultimately cost more than £7 million, marks a big advance in itself. The first 30MW turbo-alternator began operating last year, another has begun operation this year, and there is provision for a third. The station supplies power for the mine, its leases, and the town of Mount Isa. The site provides sufficient area for expansion in the event of a nuclear station being built in the future. In actual fact, the station is claimed to be the first outdoor type to be built outside America.

The water supply for Mount Isa is drawn from the Leichhardt River and Rifle Creek Dams, the former being a rock fill dam 12 miles down stream from Mount Isa. It was completed in 1957, and is now the main source of supply, with catchment area of 430 square miles and a capacity of 17,389 million gallons. Its principal uses are for fishing, water ski-ing, and boating or yachting, and it is a popular spot at week-ends.

Well, such was the technical data that was absorbed, and after such a high-powered, packed morning session, it was not unusual to find the students relaxing in the afternoon—relaxing in the luxurious pool, and with thoughts many miles away. As was found by one and all, it was a definite necessity to be really fit for the evening's entertainment. This was really something to be marvelled at—sumptuous food, upon which numerous sorties by students made little impression, the chance to become as blind as an owl each night, dances where the ratio $\frac{\text{males}}{\text{females}} = \frac{100}{1}$, but nonetheless, all provided without charge by the good grace of the company. Adelaide distinguished itself by challenging all-comers to a boat race, and was narrowly defeated by a more practised crew of lemonade drinkers. However, "the Blacks" emerged victorious in a hotly contested football match on the following afternoon.

In the tightly packed schedule, squeezed in between technical sessions, a trip across to Mary Kathleen was programmed, and once again the students made the most of all opportunities. The township itself is very modern and well planned, having been built up entirely by the Rio Tinto Company. This company, in March, 1956, signed a contract with the British Government for £40 million, agreeing to supply uranium concentrate to the United Kingdom Atomic Energy Authority.

"THOSE GLORIOUS TECHNICAL SESSIONS"

Open cut mining is practised, and the chemical plant, which, incidentally, has an ion exchange section, is one of the most modern in Australia. A quick plant trip was followed by a magnificent barbecue on the lawns of the manager's residence.

Well, as always, it was a case of "all good things coming to an end," and although the copper refinery at Townsville, and a short stay at Mount Morgan, still lay ahead, one had the impression that history wouldn't repeat itself, or at any rate, not to the same extent. So it was with bloodshot eyed nostalgia that the Adelaide students, aboard the Institute Train, watched the black slag dumps of Mount Isa disappear into the distance, realising that a week of magnificent hospitality had come to an end.

Me: "If angular momentum cannot be created, where did it come from?"

Prof.: "Why, the torque brought it."

A-BOMB SURVIVAL

By DON ROYAL

To the ordinary man in the street the most important thing is his own safety and well-being. He stands some risk of being killed or injured every day, either in his working time or in his leisure hours. In war time he stands a much greater chance of meeting violent death or serious injury, so he builds shelters and takes other precautions for his own safety. During the last World War many advancements were made in armaments, and men had to go to greater trouble to make themselves as safe from these new weapons as possible. It was the engineer's job to design safe shelters, in addition to supplying the fighting forces with the best equipment for their needs. There was an acute shortage of building material for defence construction because as much material as possible was being used to supply the fighting forces.

The shelters used during the last war saved the lives of very many people, but they also caused some deaths when they were poorly designed or constructed. Some people took refuge in reinforced basements, where they could escape from the noise of the war, because there they felt safe. When the Anderson surface shelter was first introduced, many people did not use them because their semi-circular arch construction did not look safe. In actual fact, these shelters were among the best types used in the war, as they withstood bomb blasts very well, and they were comfortable and dry inside, with no danger of being flooded.

From the mistakes others have made, and from the engineering advances that have been made since the last World War, our knowledge of protection in war times has increased considerably, but so have the forces which our structures may have to withstand in another war. The atomic and hydrogen bombs have been developed to such an extent that there are relatively few people who have specific knowledge of the devastating forces which these bombs can unleash. The whole world was shocked at the results of the atomic explosions over Hiroshima and Nagasaki. Since then the power and destruction forces of the atomic bomb have been increased many times over. The man in the street today has no idea of what an atomic war would involve, yet the threat of war is always with him. If an atomic or hydrogen bomb should be exploded somewhere near Adelaide, would the ordinary person have any idea of how to use any available protection? There would be practically no hope for people close to the ground, zero point, or point on the ground practically under the bomb, but in the outer fringe areas a person, by taking some protective action, may be able to save himself. It is true to say that he would be fighting great odds, and that we do not know how strong our enemies may be, but we can get some idea of what to expect from the terrible results from the bombs exploded over Japan. Saving lives would be our primary concern if we were attacked, but we should also maintain essential services such as hospitals and communication systems, so that the country could recover quickly from one attack.

For the most effective results from atomic and hydrogen bombs, they are exploded in the air at a height of 2,000 to 3,000 feet. Within ten seconds of the detonation of an atomic bomb the maximum temperature of about 300,000° C. is reached. This is followed by a secondary heat wave, generated by by-products of the chemical and nuclear reactions. This wave is principally made up of ultra-violet and infra-red rays. The heat from these waves charred doors and other surfaces except where sharp shadows of unaffected areas were left by objects shielding surfaces from the direct rays of the bomb. In Japan the heat was sufficient to cause roof tiles to boil and bubble. The colour of objects greatly affects the heat they absorb, and this was obvious on people in Japan, who had patterns burnt on their bodies by the dark and light patterns on their clothes. The effect of heat flash is most severe within a radius of 2,000 feet, but its effect extends to about 4,000 feet. People in the shadows of buildings would escape the direct effects of the heat flash.

The gamma radiation wave follows close on the heels of the heat waves. Radiation sickness caused by exposure to gamma rays may extend up to 10,000 feet from the point of the explosion. There is normally no shadow protection by shield-

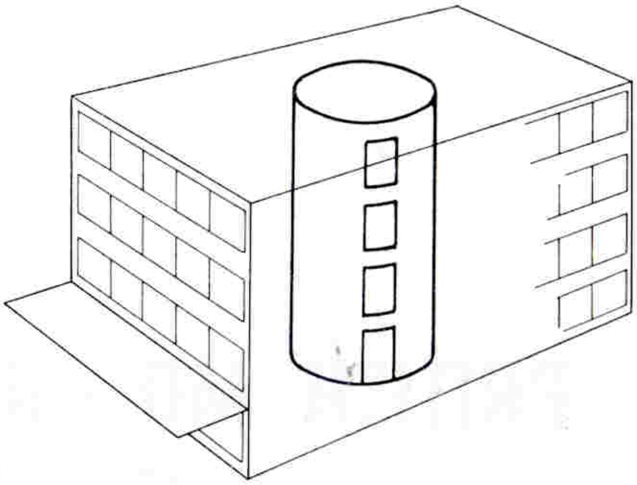


Fig. 1.—BLAST-PROOF SHELTER TOWER

ing against gamma rays. Shielding is effected either by a thick layer or layers of material which has a high molecular weight. Thirty inches of concrete would be the thickness required to offer effective protection against the gamma rays, or a thinner layer of lead or "heavy water" would produce the same effect. At a distance of several miles a normal concrete wall would offer suffilent protection from these deadly unseen rays.

If we manage to escape the heat flash and the gamma rays, our troubles are not over. The slower moving shock wave will follow as a high pressure surge through the air. This produces the blast force which causes buildings to crack and crumble. The human body is naturally capable of withstanding mild pressure changes, and the sudden increase in air pressure would feel most unpleasant, but the most it is likely to do is burst our eardrums, and even this is unlikely. The pressure wave quickly wraps itself around small or thin objects, which will remain standing because the pressure distribution around them is quickly and evenly distributed. A large body or a whole building offers a big resistance to the travelling pressure wave, and the momentary pressure between opposite sides of a large body may result in its collapse. The danger to humans from the blast wave is similar to the blast from an incendiary bomb, causing casualties from flying glass and wood splinters, or falling masonry. Following all these effects of a bomb blast is the additional hazard of a radio-active fall-out, which may travel distances up to 80 miles if caught up by air currents.

These are the principal dangers of atomic war, and these are the forces against which the engineer may be asked to cope in the future. There is one considerable difference between atomic shelters and the shelters we are familiar with. This is because there would be very little warning time in an atomic air attack. Our shelters would have to be very close to us so that we could reach them in a minimum of time.

The maximum warning time of an approaching attack might be 15 minutes, but this warning time may be only a few seconds, or there might be no warning at all. In a city building we would require some form of shelter on every floor of the building, so that people could reach them in one minute, or preferably less time. The need for a strong shelter many stories high could be met by having a strong part in the building, preferably in the centre, where it could be accessible to all occupants in the building. The strong central part would remain standing if the rest of the building collapsed. For maximum strength, a circular central part would be best, but its circular walls would result in wasted floor space. In an existing building a separately constructed central shelter would be very costly, as it would involve building a stronger building, with stronger foundations, within a weaker one. The most practical way to provide protection right where the people work would be to strengthen some part of the building already existing. A suitable place would be a corridor or fire escape inside the building.

Casualties caused in the modern multi-story building could occur even if it suffered no structural damage. These would be caused by flying glass fragments hurled through the air as the windows burst under the blast wave pressure. If there is not time to rush to a prepared shelter, the safest thing to do is to get away from the windows. The person who shelters under his desk or drops to the floor when he sees an atomic flash or the light from it, which is brighter than the sun, has taken a considerable step in his personal safety. If he acts wisely in the few seconds he has before the blast hits his locality, he may save himself. If time permitted he could run into the corridor, and if this was strengthened he would be as safe as he could be in those circumstances. A reinforced corridor or passage would be handy for most of the building's occupants. Another place, although probably not so centrally convenient, would be the fire escape well, which would then only require the top ceiling to be strengthened and blast-proof doors fitted to make it effective as a shelter.

The matter of cost comes into all engineering problems. If a building is built in a locality subject to earthquakes, the designer will make a costlier building, which will resist an earthquake. If we intend building in times when an atomic attack might occur, it might be worth while spending a little extra money in designing a building capable of resisting to some degree the effect of an atomic war. The extra money spent in initial cost may be a good investment if it leaves a building structurally sound after an attack, instead of a liability in a building which has to be demolished due to excessive distortions. The blast wave passing through a building has its severest effect on the top floor or roof, and the ground floor, because of the time lag for the pressure on top and bottom sides of these surfaces to become equal. Intermediate floors of similar construction are less likely to suffer damage. To escape the danger of flying glass, it would be desirable to have windows away from the areas where people work, or have the windows shielded by metal screens, or some other device.

In the last World War there were people who lived in shelters because they would not venture out and expose themselves. The proportion of people like this in an atomic war would probably be higher, because of the greater danger of surprise attack. There are buildings in existence today that are completely bomb-proof against blast and gamma radiation. These are thick concrete windowless structures with shapes chosen to resist a surrounding high pressure surge. The best design for smaller buildings of this type have dome-shaped exterior walls. Larger buildings are similar to silos in shape, or they have a group of these buildings with tube-like connecting corridors running between them at every three floors or so.

The tall, relatively thin buildings are enveloped

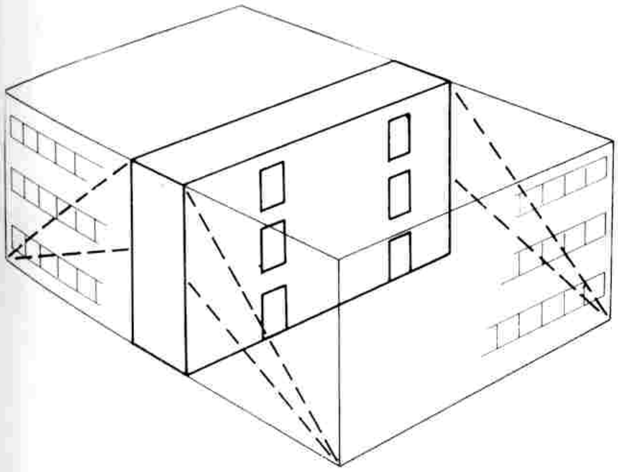


Fig. 2—BLAST-PROOF REINFORCED CORRIDOR, WITH OR WITHOUT SUPPORTING CABLES

by the high pressure shock wave before out-of-balance pressures become excessive. These buildings must be artificially illuminated and air-conditioned inside. Although the buildings themselves are very functional, they have an adverse effect on some people. Living in an artificial atmosphere all day, and having no windows to look through to the outside, has a similar effect to being cooped up in a submarine or in an underground chamber all day.

A windowless building will withstand the outside pressures due to the shock wave, but this would not be the only building left standing after an atomic bomb had exploded near by. The steel framework of a building under construction would not be affected by the blast wave, because there is little resistance to the pressure front. If a steel-framed building has intermediate masonry panels, these panels would most likely be blown out, and the framework be left standing. Thus the principal part of the construction would remain undamaged, in contrast to the reinforced concrete building, which may have to be demolished. In Japan some reinforced concrete buildings had to be demolished, although they did not appear

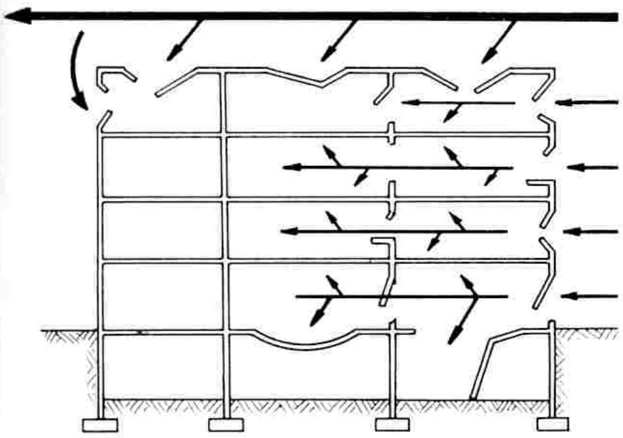


Fig. 3—PATH OF SHOCK WAVE THROUGH A BUILDING

excessively damaged, because the beams and columns were fractured and distorted badly.

An alternative to building blast-proof structures would be to erect buildings with strong steel frameworks with panels that would offer little resistance to a blast wave. In this way the wall panels would have to be designed so they would not injure the occupants when they were blown out. Very light material, such as caneite, which was held in place on a steel framework, would solve the problem if it could be deflected upwards, away from the people inside. This could be done by using a louvre type of wall framework with V-shaped louvres, so that the soft padding material between them would be deflected upwards if blown out from either side. This safety panel could be a feature of new multi-story bulidings without substantially increasing costs.

Much of the information we have on atomic bomb effects comes from scientific tests and the data gained by the U.S. Strategic Bomb Surveys of Hiroshima and Nagasaki. A much more powerful weapon, the H bomb, has been developed and tested since then. It seems that an even deadlier bomb is being developed, and many people are anxious to test the effects of this new device—the N bomb. These weapons available today may never be used because of the disastrous effects they may have on mankind. In the case of another world war, even if atomic weapons were not used at first, a military power with its back to the wall is bound to bring atomic weapons into use.

Protective designs in buildings would be the most practical way to offer protection to the public. The people must be educated so that they will know what to do instinctively in case of attack. In this way be can safely look to the future.

CHEMICAL ANALYSIS OF A WOMAN

Symbol: Woo.

Thought to be a member of the human family.

Atomic Weight:

Accepted as 120, though known isotopes vary from 100 to 200.

Physical Properties:

Surface usually covered with a film of paint or oxide. Boils at nothing, and freezes without reason. Unpolished specimens tend to turn green in the presence of a highly polished one. All varieties melt with proper treatment. Very bitter if used incorrectly. Density not as great as usually supposed. Exhibits magnetic properties in the presence of noble metals.

Uses:

Chiefly ornamental. Acts as a positive or negative catalyst in production of fevers. Probably the most powerful (bank account) reducing agent known. It is illegal in most countries to possess more than one specimen. A certain amount of exchange is permissible.

(We acknowledge Perth Engineers' Club.)

RESEARCH: ELECTRICAL ENGINEERING DEPARTMENT

SYSTEM STIMULATION

The growing complexity of modern day systems, whether they be scientific or commercial, has made imperative the use of machine aids for their successful operation. These aids may be used for two distinct purposes, either to perform routine tasks and relieve human operators, or for the much more complex duties of predicting future trends or behaviour, and making the correct decisions for the guidance of future operations.

For the former, the principal requirement is speed, and this is being gradually improved with better performance of electronic equipment. The latter, however, is much more difficult, as it requires that the machine aid have a thorough knowledge of the system built into it, so that it can predict its behaviour under certain conditions. This means that for each unique system there is only one possible machine, and henceforth its construction will invariably prove uneconomical.

Another approach to this problem is to use an already existing machine and, with alterations to its structure, enable it to represent (or simulate) another machine (or system) not physically but logically similar. If this alteration can be achieved at little cost, an economic simulator may then be feasible.

A digital computer could well be used for this purpose, as it can be programmed to operate in any logical fashion with no change to its physical structure. As most systems fortunately always obey certain particular rules, some of which may not be outwardly apparent, but are nevertheless well mathematically and logically defined, the digital computer could well be considered as an ideal tool for the purpose of simulation. However, the lack of speed of electronic digital techniques has meant that the programming of complex systems on machines has been restrictive, and only the recent advent of faster machines has opened up what may be a completely new field.

With the construction of a new fast digital computer in the Electrical Engineering Department, incorporating a fast access store and micro-programming facilities, it is thought that a simulator of any system may be inbuilt into the machine order code. This simulator could be particularly fast, as through the micro-programming facility the interpretation of orders particular only to a single outside system can be very quickly achieved.

At present the investigation has been confined to simulating a differential analyser, and the problems encountered are typical of any simulation attempt on a digital machine. These may be broadly divided into firstly, research to find suitable mathematical representation for the system's operations, and secondly, the logical arrangement of the simulator in the general machine structure. The solution will probably be to break the simulated system into well-defined sections, and to allot a block of micro-orders to each, a principle that could be adopted for any other proposed simulation.

The ultimate aim, of course, is to achieve very simple logical blocks, the inter-connection of which can simulate any required system, scientific or commercial, and its attainment is yet for the future to decide.

IGOR T. HAWRYSZKIEWYCZ.

Research Supervisor: Dr. M. W. Allen.

DIGITAL TECHNIQUES AT MICROWAVE FREQUENCIES

The computing speeds attainable today seem to be adequate for most realisable problems known to man, yet a computer with speeds an order faster than those of today's machines would immediately find use in simulation problems, dynamic programming, and real time problems, and in space vehicle computations where the accuracy required to hit a distant planet can only be obtained by more frequent monitoring, so that many more perturbation effects can be considered. In the business field, faster computers would be used to do the work more efficiently, and in the construction of large-scale economic models.

The world's fastest computer, the I.B.M. Stretch, built for the American Atomic Energy Commission at a cost of $15,000,000, can add in 1.5/usecs., and multiply in 2.7/usecs. (400,000 average operations per second), and is one of the most complex digital projects ever undertaken. Its 200,000 transistors present a formidable reliability hazard alone, without considering its other units, which are run at limiting speeds.

To achieve speeds which are orders faster than present machines, investigations are being made in new fields, since the transistor art is not likely to improve to the required level for some time if it continues at its present rate of improvement. Experiments have been carried out at X-band (9–12 KMc/s) by pulse amplitude modulating this carrier, and by using "phase-script" representation of the binary information, a continuation of the ideas in a patent by the late Prof. J. Von Neumann describing the use of "Phase-locked Subharmonic Oscillators in Digital Computing," published in 1957.

At microwave frequencies the interconnection of the logical elements cannot be made using conventional waveguide components, because of the complexity required, and because of the cost and size of these components. Probably higher frequencies than X-band will be used to reduce the size of the components (at 10 KMc/s the wavelength is 3 cms), since the free space propagation speed of a signal is approximately 1 millimicrosecond per foot, hence logical operations carried out 1 foot apart will need a delay of at least this figure to allow the signal to travel between the elements.

The department will carry out investigations into aspects of microwave computing techniques. In particular, study will be directed towards the determination of useful configurations for the logical elements using photo-etched strip waveguides, strip transmission lines, and other microwave devices. The conventional logical designs and methods of level restoration are not necessarily applicable at these higher frequencies, and investigation will be made on the methods available to achieve these operations in the microwave region.

PETER R. WALLACE.
Supervisor: Dr. M. W. Allen.

THIN FERROMAGNETIC FILMS

In the coming generation of ultra high-speed computers, several new techniques appear to be of importance. They are:

(a) Microwave computing.

(b) Thin ferromagnetic films.

(c) Cryogentic elements.

The thin magnetic film has been proposed to enable large-scale high-speed random access memories to be fabricated. Basically, an individual binary storage element consists of a thin film (100 — 3000 angstrom units thick) of either Permalloy or Gyralloy I which exhibits a preferred axis of magnetisation. This film, which acts as a single domain, due to its high length-thickness ratio, thus has two stable states, the magnetisation being either parallel or anti-parallel to this "easy" axis. By suitable methods of driving and sensing flux changes, a binary bit may be stored on the film.

Thin films have several advantages over ferrite cores:

(a) They are faster, switching times of 1 microsecond having been observed.

(b) Their magnetically effective fields lie in the plane of the film, thus allowing driving conductors to lie on them and not through them, as in cores.

(c) Etched strip line wiring techniques are possible.

(d) Multi-layer elements offer unique applications, such as non-destructive read-out.

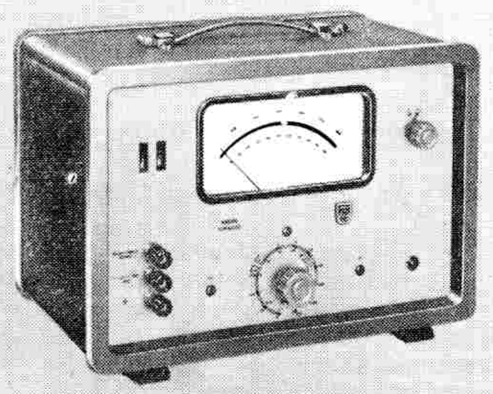
(e) They are potentially very much cheaper per bit stored than ferrite core memories.

Thin films have the basic disadvantage of small output signals. Since driving currents are of the same order for films and cores, this imposes a severe noise problem on their utilisation. Signals of 1 –4 millivolts are usual for drive rise times of 50 microseconds to 200 mA.

The scope of the project to be undertaken in this department depends on the amount of time available after the basic plant has been set up. Since the films are obtained by vacuum evaporation of the metal at 10^{-5} millimetres of mercury, rather extensive vacuum plant and test facilities are necessary. Manufacture of these components is now being undertaken, and preliminary investigations may be under way this year.

ROBERT J. POTTER.

Supervisor: Dr. M. W. Allen.

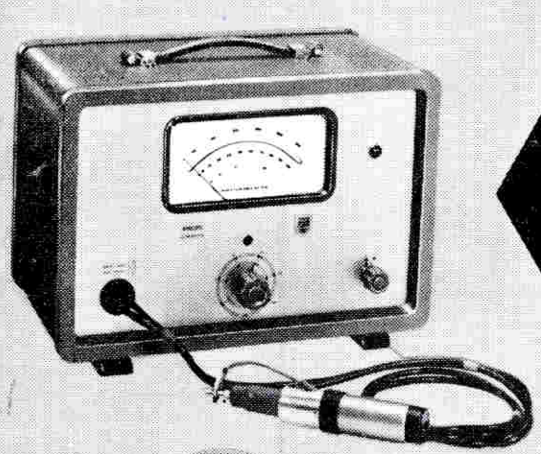


D.C. MICROVOLTMETER

GM6020

- 11 voltage ranges 100 μV-10 V (full scale) with an input resistance 1 MΩ
- 11 voltage ranges 10 mV-1,000 V (full scale) with an input resistance 100 MΩ
- 22 current ranges 100 μμA-10 μA (full scale)
- Calibration voltage accuracy ±0.5%
- Automatic polarity indication
- Full overload protection
- Mains operated 110 V to 245 V, 50 c/s to 100 c/s

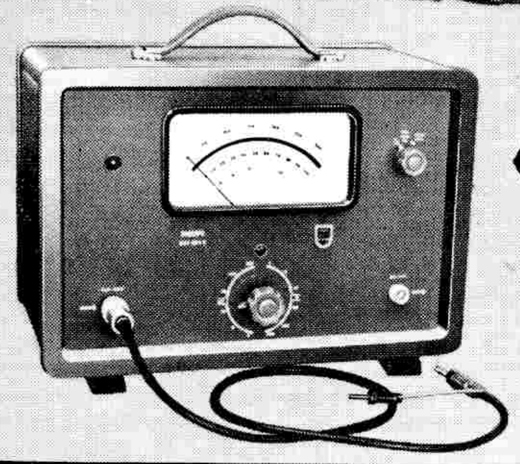
PHILIPS Millivoltmeters



BROADBAND HF MILLIVOLTMETER
(1 kc/s-30 mc/s)

GM6014

- High sensitivity: 1 mV . . . 30 V (full scale)
- Frequency range: 1 kc/s . . . 30 mc/s
- Cathode follower probe input
- High input resistance and low input capacitance
- Printed circuitry
- Independent of mains variations
- Built-in calibrating voltages
- Overload protection
- Mains supply 110 V to 245 V, 40 c/s to 100 c/s



BROADBAND—MILLIVOLTMETER
(2 c/s-1 mc/s)

GM6012

- High sensitivity: 1 mV . . . 300 V (full scale)
- dB range—80 to +52 dB (0 dB 1 mW 600Ω)
- Frequency range: 2 c/s . . . 1 mc/s
- High input resistance and low input capacitance
- Independent of mains variations
- Built-in calibrating voltages
- Can be used as amplifier
- Overload protection

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WHAT IS THE M.K.S. SYSTEM?

By GIORGI PORGI

So you don't know what a weber is? You ignoramus, you! You ought to be ashamed of yourself. How do you expect to get anything out of a transformer if you don't have any webers there? You've to put 'em into the iron, take 'em out again, put 'em in, take 'em out, and so on. That's what old Weber[1] found out in between sending out the "Invitation to the Waltz" and writing "Der Frieschutz," which last, for your benefit, is pretty Low German for "the penalty kick," old Carl being a great soccer man, with strong views on the permissible charge. (In his day, of course, the game was played with a pith ball.)

What about lines? Well, what about them? They used to have them, of course, before Carl came along, but he didn't care much for linesmen (you should have heard his language about referees, too!), so he disinvented lines, and now we have webers to do all the work.

That disposes of the weber. Next question, please.

What about gauss? Oh, well, I suppose we can't get rid of Carl that easy. Carl was all for economy—in fact, some used to call him stingy, downright stingy; used to say he never even meant to hold the dance he issued the invitations for—didn't specify a time, or place, or anything. Be that as it may, Carl found that he was doing pretty well if he could get so much as one of his units into a square metre of iron, where old Gauss[2] was shooting literally ten thousand lines to the square centimetre. Imagine, to the square CENTIMETRE. The prodigality of the man. These are hard times, gentlemen, and we're getting rid of Gauss.

You ought to know something about the joule, even if you don't know whether to pronounce it like an affair of honour or like the thing cheek goes by. You do know something about it? Good! Then I think I can explain what a newton is. Let's see, now. A newton is a joule acting for a second. No, a joule is a secton acting for a newcond; a newle is a joucond acting for a sec—a newt is a Jew acting for a sexton. No. Let's start again. I think I took the wrong thing first.

A joule is a newton acting for a second. Still something wrong—Newton[3] was a dead serious type. Ah, I have it. Seconds don't come into it. Gentlemen, Einstein[4] has abolished time, so it must be space. Yes, a joule of work is done when a force of one newton moves its point of application one metre. This, of course, was the subject of Joule's famous experiment, in which he got Newton to paddle in a bucket of water while he bombarded him with apples. This naturally gave Newton the pip (Isaac was a pretty crabbed old fellow, anyway, without much esprit de core!), in fact, he was fairly boiling with rage, so Joule measured the heat transferred to the water in the bucket, divided this by the number of applications, and hey, presto! the joule.

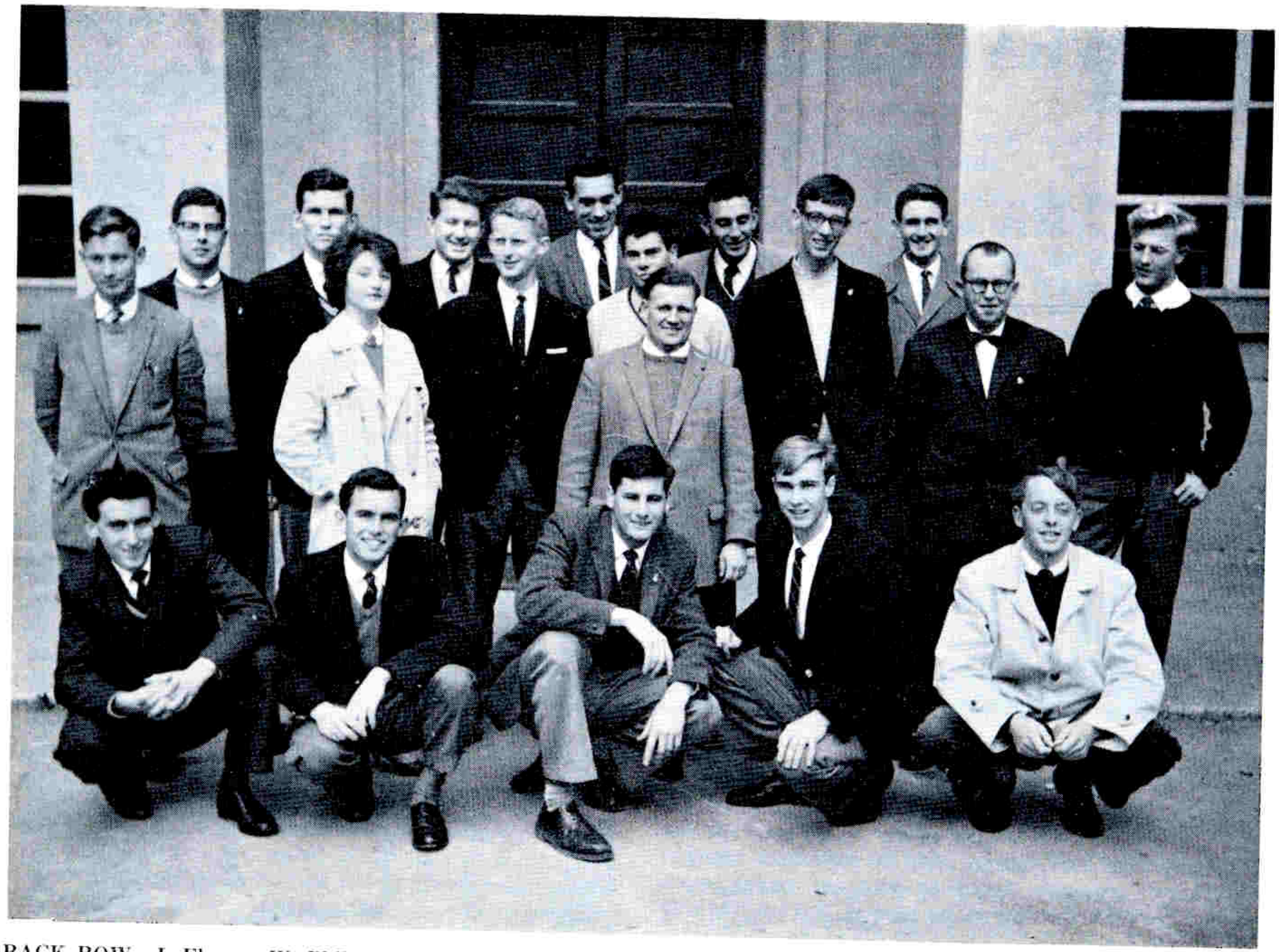
Where does the metre come in? Well, I was just coming to that when I was so rudely interrupted. The metre, gentlemen, is necessary to define the unit of magetic field intensity, which in the M.K.S. System is the ampere per metre, commonly abbreviated to ammeter following the practice of the great Viennese engineer Gram, the man who first discovered that the pound weight could be divided into the four hundred and fifty-four more or less equal parts which now bear his name. Gram[5], who also invented the Gram Ring, a game often used to wind up the proceedings at a party (also known as the Gram Old Duke of York). Gram adopted this abbreviation on the analogy of his own name, which had been shortened from Grampere by his grandfather. This old man was very fond of four-letter words, and said he couldn't stand his own name any longer.

All this is by the way. However, to return to our magnetic field intensity. I think I hear someone bewailing the fact that in the new system the oersted has been ousted. Believe me, no one is sorrier than I that the Great Dane should thus be hounded out of our technical vocabulary, but no less an authority than de Bunque[6] has given it as his opinion that Oersted was so honoured because, it was thought, on the ground that no one could spell his name correctly, that he was the first magnetic Pole—a title, of course, that properly belongs to Copernicus. Besides, Oersted is in good company. Gilbert (the filbert, the knut with the K) no more lends his mighty name to magneto-motive force, and Maxwell, it seems, is no longer on the right lines. O celebrated shades, weep for your fame. No more shall learned lips lisp lovingly your name . . .

Indeed, gentlemen, I feel overwhelmed with my own rhetoric. You must excuse me. I had meant, after expounding the M.K.S. System, to apply by didactic powers to rationalised units, but I fear that must wait. Another day, perhaps. Till then, adieu.

FOOTNOTES:

1—Weber, C. M. von—"Aufforderung Zum Wechsels—tromtechnik." Augberg, A. Durer, 1573.
2—Caussius—"De Mensuratione Virium Magneticorum." MS 7352, Koln Archives ca. 1213.
3—Newton, I.—"Dissertation on the Imperturbabilitie of Matter," Oxford, at the Asse and Astrobabe, 1635.
4—Einstein, A.—"General Particularity of Absolute Relativity," Ladies' Home Journal, Vols. 61–63, New York, 1919.
5—Gram, P. A.—"Hochspannumgsfreileitungsfestigkeitsuntersuchungs theorie," Der Lustig Ingenieur, Vol. 2, Wien, 1988.
6—de Bunque, R. de st-A.—"Des Grands Ingenieurs Inspires par L'Amour," La Vie Parisienne, Paris, 1912.



BACK ROW: I. Flower, W. Phillips, D. Waters, Miss A. McCusker, N. Barkham, D. Reilly, D. Patterson, R. Copeland, R. West, B. Bent, P. O'Connor, R. Sawley, B. Macleed, K. Lightburn.
FRONT ROW: I. Sandow, G. Evans, P. Ingleton, G. Brown, M. Shearer.
ABSENT: P. Roberts, A. Isaacson.

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ADELAIDE UNIVERSITY ENGINEERING SOCIETY

GENERAL ACCOUNT

RECEIPTS

	£	s.	d.
Bank Balance (12/8/60) -- --	222	11	4
Subscriptions -- -- -- --	68	15	0
Badge Sales -- -- -- --	37	10	0
S.R.C. Grant -- -- -- --	60	0	0
1960 Dinner -- -- -- --	25	0	0
Hop and Social Functions -- --	57	7	11
Ball Receipts -- -- -- --	255	10	0
Tie Sales -- -- -- -- --	23	2	6
Transferred from Magazine Account	86	14	5
Magazine Sales -- -- -- --	52	6	6
Magazine Advertisements -- --	314	18	8
Symposium -- -- -- --	347	8	0
Donations -- -- -- --	9	17	0
Miscellaneous -- -- -- --	7	12	10
	£1568	14	2

PAYMENTS

	£	s.	d.
Cost of Badges -- -- -- --	32	10	0
Cost of Ball -- -- -- --	191	12	3
1960 Dinner -- -- -- --	7	11	11
Hop and Social Functions -- --	66	1	4
Postage -- -- -- -- --	20	0	0
Cost of Ties -- -- -- --	31	4	0
Petty Cash -- -- -- --	10	0	0
Magazine Administration Expenses	7	5	0
Magazine Printing -- -- --	475	4	11
Transferred to Special Purposes Account -- -- -- --	50	0	0
Symposium -- -- -- --	393	4	8
Miscellaneous -- -- -- --	3	5	5
Bank Balance as at 12/7/61 -- --	280	14	8
	£1568	14	2

This Statement is not complete, due to the fact that the 1961 Dinner has not been taken into account.

G. R. EVANS, Treasurer.

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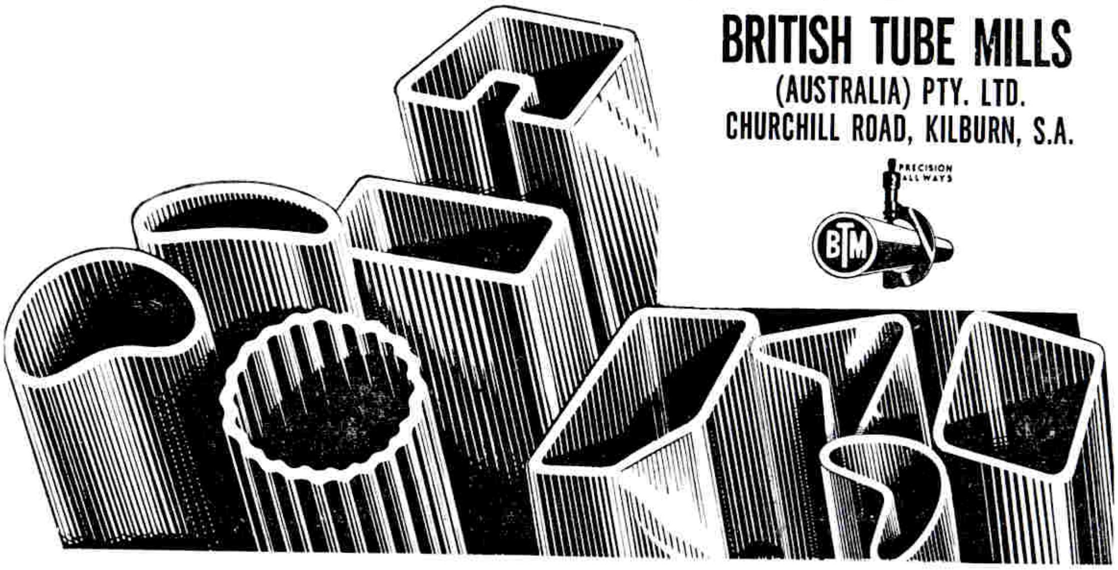

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THE BAILEY BRIDGE

By P. J. SCALES

"The most remarkable bridge in the history of military operations" is a fitting tribute to the Bailey Bridge, a weapon born of necessity in war time, and now, having exceeded all expectations in the theatre of war, proving its worth under peace-time conditions. Without doubt it is true to say that to the Bailey Bridge, as much as to any other single piece of equipment, we owe our success in the last World War. For these reasons it is interesting to trace the development of this bridge, and what better place to begin than with its creator.

Sir Donald Coleman Bailey was born in Yorkshire on September 15, 1901, but later moved to Cambridge, where he received his first technical education at Lays School. From an early age he possessed a "water complex," showing a distinct fascination for dams, reservoirs and bridges. On this basis an engineering friend of his father recommended Sheffield University, where he took his Engineering Degree.

In the late twenties he was engineer for Sheffield city's new reservoir, after which he tried railroad engineering for a short time. In 1929 he joined the civilian staff of the Experimental Bridging Establishment, where he was later promoted to Assistant Superintendent.

Up until 1940 the Army's standard bridging equipment was the Box Girder Bridge, designed to carry the existing tanks. However, its capacity was being severely taxed by the rapid increase in tank weights. Up until 1937 the heaviest class of bridge was 19 tons. By 1939 the "Matilda" tank was in service, weighing between 23 and 26 tons. A complete re-design of the Box Girder Bridge permitted the bridge to just carry a load of 26 tons—and to carry a "Matilda" tank on a transporter the spans had to be made inefficiently short. When the 50-ton "Churchill" tank arrived something had to be done.

For some years previous to this Bailey had been dissatisfied with many aspects of the Box Girder Bridge—it was difficult to manufacture, hard to handle, and its transport involved the transport of a large volume of air. As a possible solution, he had toyed with the somewhat nebulous idea of making the bridge girder out of panels, but the pressure of higher priority work had prevented any definite development of this idea. British disasters at the Battle of France and Dunkirk in June, 1940, made plain the need for bridging equipment to handle the 50-ton "Churchill" tanks. As this necessitated the complete re-design of all existing equipment in any case, the time seemed ripe for Bailey's new proposal to be investigated.

Planning from scratch, it was decided to make the following demands on the new equipment:

(1) The girder and deck system to be capable of being strengthened at all, preferably in position. This would take care of increases in weight of the tank, and of any reasonable transporter.

(2) All parts to be made of readily available materials, and to be welded; special steels are almost impossible to obtain in war time.

(3) Parts to be capable of manufacture by almost any firm. All previous bridging equipment had been difficult to produce, as only limited numbers of firms could make it.

(4) All parts to fit into a G.S. 3-ton lorry.

(5) Nothing to be heavier than a six-man load.

(6) Under side of girders to be kept smooth for rolling on launching rollers.

(7) A properly designed jacking system to be incorporated, since this operation can cause untold delays in the field.

(8) Adequate bearings and bankseats to be provided. No previous system had these, despite rapidly increasing loads.

(9) Close manufacturing tolerances to be avoided. (Previous systems were difficult, due to this.)

Thus, in late 1940, Bailey sketched the bridge system that was to be named after him, the idea that he had held in "embryo" for some time. From this rough sketch he was authorised to design his new bridge—a strong, comparatively light prefabricated steel, sectional span that could be erected easily, quickly, and quietly (under fire, if necessary), and whose interchangeable parts would simplify repair, and permit variation in length and strength.

The actual design was by D. C. Bailey and H. A. T. Jarrett-Kerr, with much advice from R. Freeman, the designer of Sydney Harbour Bridge. Various forms of construction were considered for the panel, but after examining different forms of truss (M.N.K., etc.), it was decided that existing rolled steel sections fitted most economically into the present design.

Completed in only six weeks, this was a truly amazing design feat. Working long hours each day, the team tried out all their ideas, discussed, adopted, modified, or rejected numerous proposals for the best utilisation of the basic idea of panel construction. Each night they returned home to ponder the results of the day's intensive planning, and to return the following morning with fresh ideas or variations to be thoroughly and critically examined, until the end product was as near perfect as the team could make it. That their planning was both thorough and adequate has been borne out by subsequent events, which have immortalised the Bailey Bridge as a lasting testimony to British ingenuity and thoroughness.

By February, 1941, work had started on a 70-foot knockdown bridge. Within another three months the structure was ready for its first test. In loading this bridge with three tanks, one on top of the other two, one of the tanks veered into two of the main steel struts, and thus weakened, the bridge slowly collapsed.

Spare parts were immediately procured, and soon the bridge was repaired, and successfully withstood the load. Here was an unscheduled practical demonstration of quick repair and easy replaceability of parts. With this and a series of other exhaustive tests successfully completed, mass production began in four months.

Structurally, the Bailey Bridge is most interesting. As originally designed, the panel appeared as in Figure 1, the chords being each 2 at 4 in. x 2 in. ⊏ back to back, and all bracing being 3 in. x $1\frac{1}{2}$ in. H.

In this form $m = 24$ $j = 13$ $(2j - 3) = 23$,

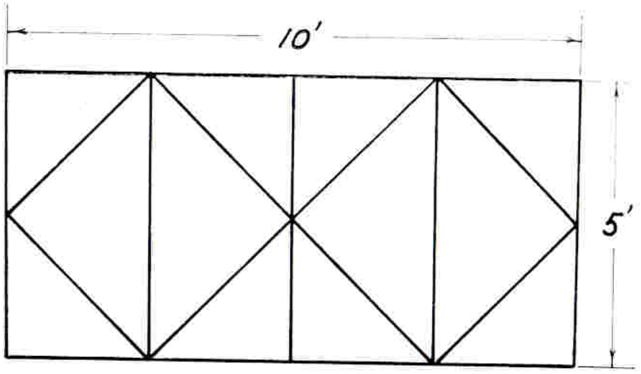


Fig. 1.

so the structure is once redundant. Later however, as a result of tests, the two unbraced verticals were removed. This was an advantage, not only because of the saving in weight, but also because the extra verticals made it extremely difficult to climb through the panel.

The final panel is shown in Figure 2.

$m = 22$ $j = 13$
$(2j - 3) = 23$

This structure is now once deficient, and the immediate thought is that reliance is placed on the stiffness of the chords at the mechanism hinges. This is not so, however, as the Bailey Bridge panel is loaded in such a way that it is subjected only to a condition that leaves it stable, despite its deficiency.

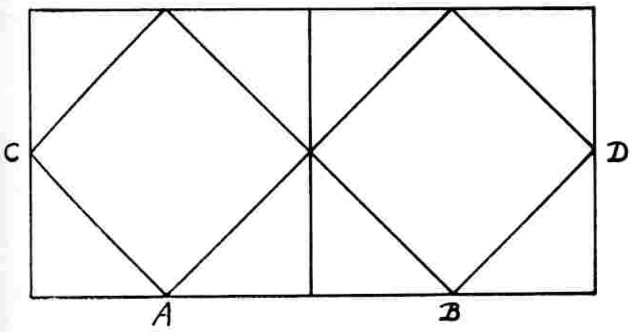


Fig. 2.

Reference to Figure 2 will show that if the panel was loaded at A or B this would not be so, nor would it be stable for compression across C–D, but as none of these conditions can occur in normal use, the panel is not affected by the possible mechanism it constitutes.

This can be seen by reference to Figure 3, which shows the way in which a Bailey panel is loaded, and also Figure 4, which shows that the mechanism does not cause any load to move in the direction of its application, and hence no work is done. In fact, this means that any position of the mechanism is stable under the loading conditions employed in the bridge.

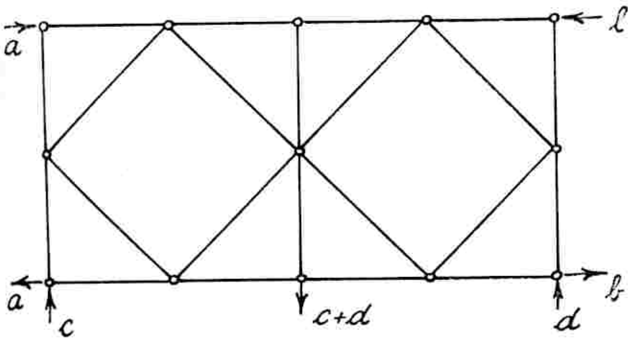


Fig. 3.

Owing to the indeterminate nature of the structure, all joints in each panel being fully rigid, more than usually exhaustive tests were carried out, and as an added precaution, all tests were carried to destruction.

To save weight, a vital factor, the factor of safety on loads is only 1.5 for a well-made bridge, this being naturally lessened under field conditions. In addition, all recommended load tables have been verified by actual loading to destruction.

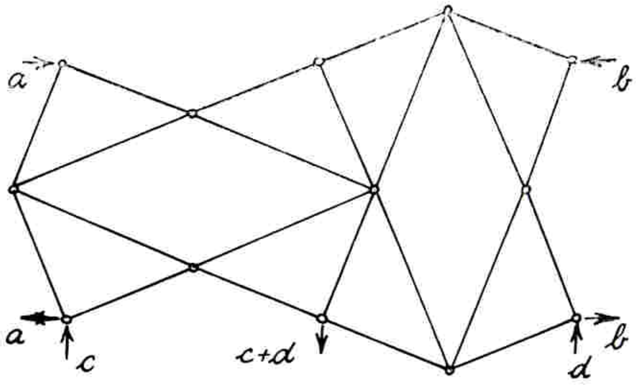


Fig. 4.

It is interesting to note the mode of failure. In bending, the top chord failed as a strut between bracing frames near the centre of the bridge; in shear, the end upper diagonals in the end panels failed by buckling. In each case the stress at the moment of failure was approximately equal to the theoretical yield stress, which showed the bracing to be adequate.

The actual construction of the bridge is simple, and lends itself to rapid, ordered construction in the manner of things military.

The ten foot long panels are connected by pins to form the through trusses. On the lower chord of these are laid the transoms, then the longitudinal stringers, and finally, the transverse decking chesses. The strength may be increased by adding a second, and even a third panel truss alongside the original, and making this arrangement single, double, or triple storied. With an increase in load class of the trusses, more transoms are added in each panel to strengthen the decking.

The simplicity of launching is notable. The whole structure is assembled on the home bank, its forward end equipped with an elevated false launching nose.

The structure is then pushed across the gap on rollers, and after the false nose has been removed, the whole bridge is lowered on to supports, and access ramps are added.

This method is suitable for construction of simply supported spans from 50 foot single-single construction up to 200 feet in triple-triple construction.

In addition to this, many other modes of construction are used, which will be mentioned later.

Once the War Office officially adopted the structure as standard equipment, its use spread far and wide, and in application it exceeded all expectations. By the end of 1944 an average of two bridges a day were being erected. The U.S.A. had adopted the bridge as standard equipment, and plans had even been given to the Russian

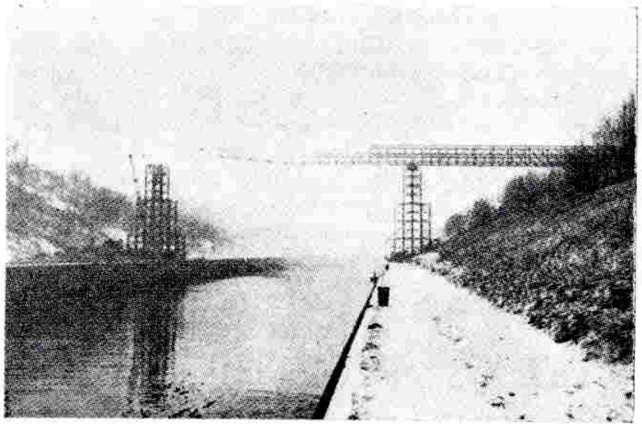
Army. Outspoken in his praise for the new equipment, Field Marshal Montgomery said: "This bridge is quite the best thing in that line we have ever had; it does everything we want."

The bridges could be thrown across rivers in a short time, and as an example we had a team of four hundred in Burma working day and night for 48 hours to build history's first bridge over the 1,000 ft. wide Chindwin River.

Because of standardised parts and erection methods, field calculations are reduced to a minimum. If necessary, bridges could be strengthened in position, and if damaged, only the damaged parts need be replaced.

Although originally designed for double-double construction over simply supported spans, it soon became obvious that it was not limited to such structures.

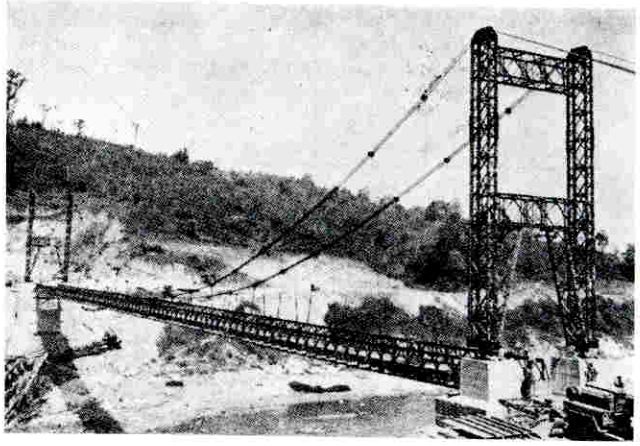
Continuous span bridges were the first extension to the basic, simply-supported span. By placing intermediate supports under the bridge, the length could be extended almost indefinlteiy, and a greater economy of parts achieved than if each span were simply supported. For example, see the span over the Albert Canal (Figure 5).



LAUNCHING A BAILEY BRIDGE over the Albert Canal in Belgium, where the pier supports were provided by assemblies of Bailey truss panels. Spans are 151, 152, and 121 ft., while the piers are 52 ft. high. Note that the temporary launching nose is so long as to require double trussing in the last three bays.

A variation of the continuous span on piers was the pontoon bridge. This was a natural development for the long bridges required across relatively calm waterways. A good example of this construction was a pontoon bridge built across the flooded Mass in Holland, with a length of 4,000 feet. Even longer bridges were later built across the Rhine, and due to the appreciable current, these were anchored against drift by means of heavy horizontal suspension cable on the upstream side.

Suspension Bailey Bridges also found wide application, especially for lighter-load class bridges on difficult crossings. An excellent example is afforded by the 420 ft. bridge built to replace the Shweli River suspension bridge.



THIS 420 FT. BAILEY BRIDGE carries the Stilwell Highway across the Shiveli River, near the China-Burma border.

Miscellaneous uses performed by the Bailey Bridge panels include grillages for distributing the bridge loads on to the pontoons; the towers for suspension bridges; buried anchorages for the suspension cables; retaining walls; and sheet piling supports.

This, then, is a brief survey of the Bailey Bridge—standard bridging equipment for the armies of the free world—of "meccano" type construction, which comes in sets, each having 34,607 separate pieces, enough to build a double-double bridge of 150 ft. span. Named after its designer, Sir Donald Coleman Bailey, whose ingenuity in the field of military bridging has earned him the honor and respect of people the world over.

The bridge has become a familiar peace-time sight, especially as temporary bridging while permanent bridges are made or repaired, and as semi-permanent bridging in many of the under-developed Asian countries.

Truly the whole world has benefited from this brain-child of the Engineer.

Everybody brings us happiness—

Some as they arrive . . .

Others as they leave.

WIT TESTERS

The following are genuine questions and have sensible solutions:

1.—Stations A and B are 120 miles apart, on a single-track railroad. At the same instant that a train leaves A for B, at 25 m.p.h., a train leaves B for A, at 15 m.p.h. Just as the first train leaves A a fly flies from the front of the engine straight toward the other train, at 100 m.p.h. On meeting the other train it immediately turns back and flies straight for the first train. So it continues to fly back and forth with undiminished speed until it is crushed in the eventual collision. How far had this marvellous fly flown before it met its glorious end?

2.—The following is a sum, as in arithmetic. Given D = 5, can you find the integers which the other letters represent?

D O N A L D
G E R A L D
―――――――
R O B E R T

3.—Join the nine points by FOUR straight lines without taking the pencil off the paper.

. . .
. . .
. . .

4.—A man walks five miles due south from a point "A," and shoots a bear. He then walks due east, and is still five miles from "A." What is the colour of the bear?

5.—Arrange the numbers 1–9 on the dots so that each row and each column and each of the two diagonals adds up to 15.

. . .
. . .
. . .

6.—Poaching on the hunting reserves of a powerful prince was punishable by death, but the prince further decreed that anyone caught poaching was to be given the dubious privilege of deciding whether he should be hanged or beheaded. The culprit was permitted to make a statement. If it were false, he was to be hanged; if true, beheaded. One rogue very cunningly said: "I shall be hanged." How should the prince deal with him?

7.—A and B are to add a number greater than zero and less than ten to the previous score in turn, starting from zero. The winner is the one who reaches 100. If A starts, he can always win. How does he do this?

8.—Work this one out:

Here lies the son, here lies the mother;
Here lies the daughter, here lies the father;
Here lies the sister, here lies the brother;
Here lies the wife and the husband.
Still there are only three people here.

ANSWERS ON PAGE 13

THE WINNERS! The Final Year Mechanical Engineers defeated the Final Year Electrical Engineers.

SLIP-STICK SNIGGERS

The turtle lives 'twixt plated decks
Which practically conceal its sex;
I think it clever of the turtle
In such a fix to be so fertile.

—Ogden Nash.

A University Professor (I wonder who) was awakened by his telephone at 2 a.m. The caller enquired:

"Is that one, one, one, one?"

"No," replied the Prof. "This is eleven, eleven."

"Wrong number. Sorry if I disturbed you."

"Oh, that's all right. I had to get up to answer the 'phone, anyway."

Beneath this stone lies Murphy,
They buried him today.
He lived the life of Riley
While Riley was away.

SWOT

Grandma does nothing these days but read her Bible;

I guess she's cramming for her final.

Her dress was tight,
She scarce could breathe.
She sneezed aloud,
And there stood Eve.

A Scout troop hiking in the backblocks came across a parked car in darkness. The Scoutmaster, showing some concern, tip-toed up to the car and gently tapped on the frosted windows.

A bleary-eyed fellow peered out sullenly at the anxious Scoutmaster.

"Eer . . . having trouble?" the latter enquired.

"Nuh."

"Broken down?"

"Nuh."

"Tyre down?"

"Didn't have to."

A neurotic is a person who builds castles in the air.

A psychotic is a person who lives in one.

A psychiatrist is a person who collects rent from both.

Don't worry if your grades are low,
And your rewards are few.
Remember that the mighty oak
Was once a nut like you.

All women are good—good for something or good for nothing.—Cervantes.

We hear of the aboriginal who was dissatisfied with marital status. He therefore changed his lubratorium, and now he is getting Ampol.

Origin of the Charleston: A Scotsman trying to pick the lock on a pay toilet.

Chaplain (to prisoner in electric chair): "Can I do anything for you?"
Prisoner: Yes. Hold my hand."

"My father was a good conductor—in fact, too good a conductor."
"Orchestra, tram, or train?"
"No, none of those. He was struck by lightning."

"Daddy, can I go outside and play ball with the other little boys?"

"Shut up and deal."

A young doctor and a young dentist shared the services of a receptionist. The eternal triangle soon developed. The dentist was called away on business, so he rang the receptionist and said:

"I am going to be away for ten days. If you look in your office you will find a little present."
She did—and found ten apples!

Now go back and read the rest of the magazine.

HOW ABOUT A STUDENT REPORT?

It seems a pity we cannot have reports modelled on the present systems used in schools. These would undoubtedly be invaluable to future employers of graduates. There are, roughly, four possible styles that could be used, namely:

The Horticultural Style:

"Coming on nicely."

"Maturing well."

"Needs forcing."

As if the boy were a prize vegetable pumpkin.

The Puppy-training Style:

"Intelligent."

"Responding well to correction."

The Blunt Style:

Used long ago, I believe.

"A real devil."

The Modern Psycho-analytical Style:

"His listlessness is a natural protective armour against brain fag."

"His constant failure at Latin Translation is probably due to a suppressed fear of his Italian grandmother's verbal violence."

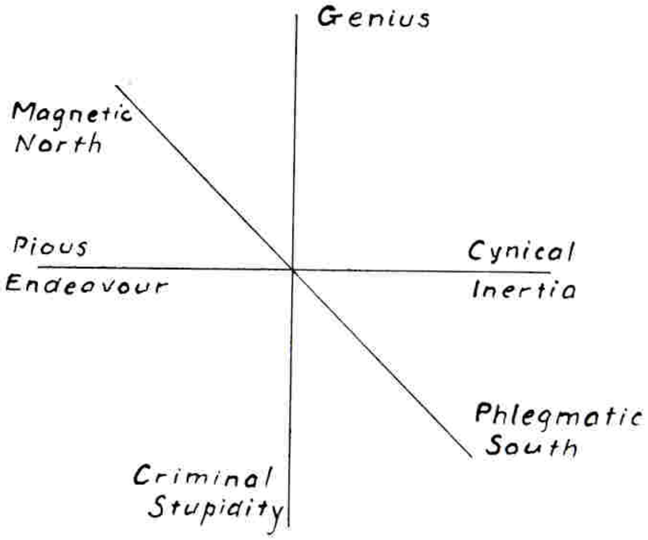
"Weakness in French Grammar suggests he was dropped in infancy by a French nurse."

"An interesting boy."

SOMETHING NEW

But why have stereotyped recognised styles? May we not brighten up reports or enlarge their scope, as in the U.S., by including such subjects as "Sanitary Plumbing" and "Flower Arranging"?

It has also been suggested that to save schoolmasters a lot of literary effort, and to enable parents to size up the situation at a glance, cards be printed on which the points of the compass are clearly stamped.



The NORTH will represent GENIUS.

The WEST will represent PIOUS ENDEAVOUR.

Between the two will be MAGNETIC NORTH, which may represent you. To carry on the analogy, there will be an Easterly point of CYNICAL INERTIA, and an extreme South point of CRIMINAL STUPIDITY. And opposite Magnetic North there will be PHLEGMATIC SOUTH. Then all we need to do is plot the pupil's position, and perhaps add a word or two, e.g.:

Smith Minor: "Keeps a steady North-West course."

Jones: "Last seen heading for the Phlegmatic South, reported becalmed."

Bloggin: "Believed, amid strong wind, to have reached the South Pole."

SYMPOSIUM

"A DRINKING PARTY"

By RON McKITTRICK

Late afternoon, Wednesday, 17th May, found a party of Adelaide Engineers aboard the Commonwealth Railways' Transcontinental, bound for Perth, fair city of the Swan.

In the air-conditioned, stifling atmosphere of this smooth-running train we settled in for the long haul over the Nullarbor. Early evening, and vigorous poker games were under way in compartments of all shapes and sizes. The clink of glasses, the rattle of pennies, and occasional bursts of muffled swearing echoed down the corridors all through the night. Bleary-eyed the next morning, we sampled in full the cuisine, and found it excellent.

A two-hour stop in Kalgoorlie that night gave our contingent a chance to test the local product. After the first dozen pubs, capacity, if not enthusiasm, waned, and new pleasures were sought. The train from Kalgoorlie to Perth is filled with raging air currents and that feeling that "We're off the rails for sure this time, Rodney!"

Forty-eight hours after leaving Adelaide we were greeted at Perth station by a party of Perth Engineers, who organised transport, and eventually we were all lodged in St. Thomas More, a Roman Catholic University College, or in private homes.

The theme of the Symposium was: "Space—A new Orbit in Engineering."

In the week that followed our arrival daily talks were delivered on this general topic by men whose experience and first-hand knowledge enabled them to deal with their subjects in an informative and interesting manner.

A close study of a subject like this, new in every way, puts the engineering side of space research in a new light to those privileged to take part in it.

Quickly we established ourselves in the "University 'Pub'," which overlooks the Swan, and in the quiet and cool of the evening we relaxed with our new friends from other States, and discussed things of interest to all of us. I don't think any of us from Adelaide had ever realised before that "'Growl' is good."

On the Monday night a smoke social was held to start the week off in the right mood. Eighty gallons and several hours later the party broke up into small groups, which roamed all night.

In the "Boat Race" S.A. came a close second, showing good times, though one of the team didn't last till the actual race owing to excess training during the evening.

SEVERAL OF OUR PARTY "CELEBRATE"

THE NEW PERTH ENGINEERING BUILDING OPENED AT THE BEGINNING OF THE SYMPOSIUM

A week of drinking and gaiety, including several dances, a visit to the brewery, and a barbecue, finished up on Friday night with the Engineers' Ball, a grand scale affair, with a gigantic and luxurious supper, which proved the downfall of many a satiated guest.

Finally came the all-day trip to Rottnest Island.

A mixed party left at ten in the morning on a ferry, which travelled down the Swan, through and past the port of Fremantle, and so out to sea to "Rotto." This island is a pleasure resort of sorts, there being holiday houses and shacks, which can be rented for week-ends. It is in particular a holiday haven for young people, and so was well prepared to receive us.

Steady drinking was the order of the day for some, while others retired quietly to hidden coves, arm-in-arm, or explored the island. As the day wore on the tempo of the island life increased, and darkness brought this to a whirling climax.

Too soon came the return voyage, on a restless sea with a biting wind sweeping the deck of the ferry.

All of us who visited Perth will remember our pleasant stay. However, certain memories remain staggeringly clear:

I.B.G.M., who arrived at Perth with one of three huge cases, empty.

The lass who wanted to celebrate nine months to go, and insisted on sharing her champagne with us.

The same young lass who, on being invited in for a civilised sip and a quiet hand at poker, left in the small hours of the morning, leaving four Engineers without a penny to their names.

The conductor who felt that the morals of C.C. and a shapely young thing were his special concern.

A certain card-sharper who couldn't deal a wrong hand—to himself—or were you just lucky, Ian?

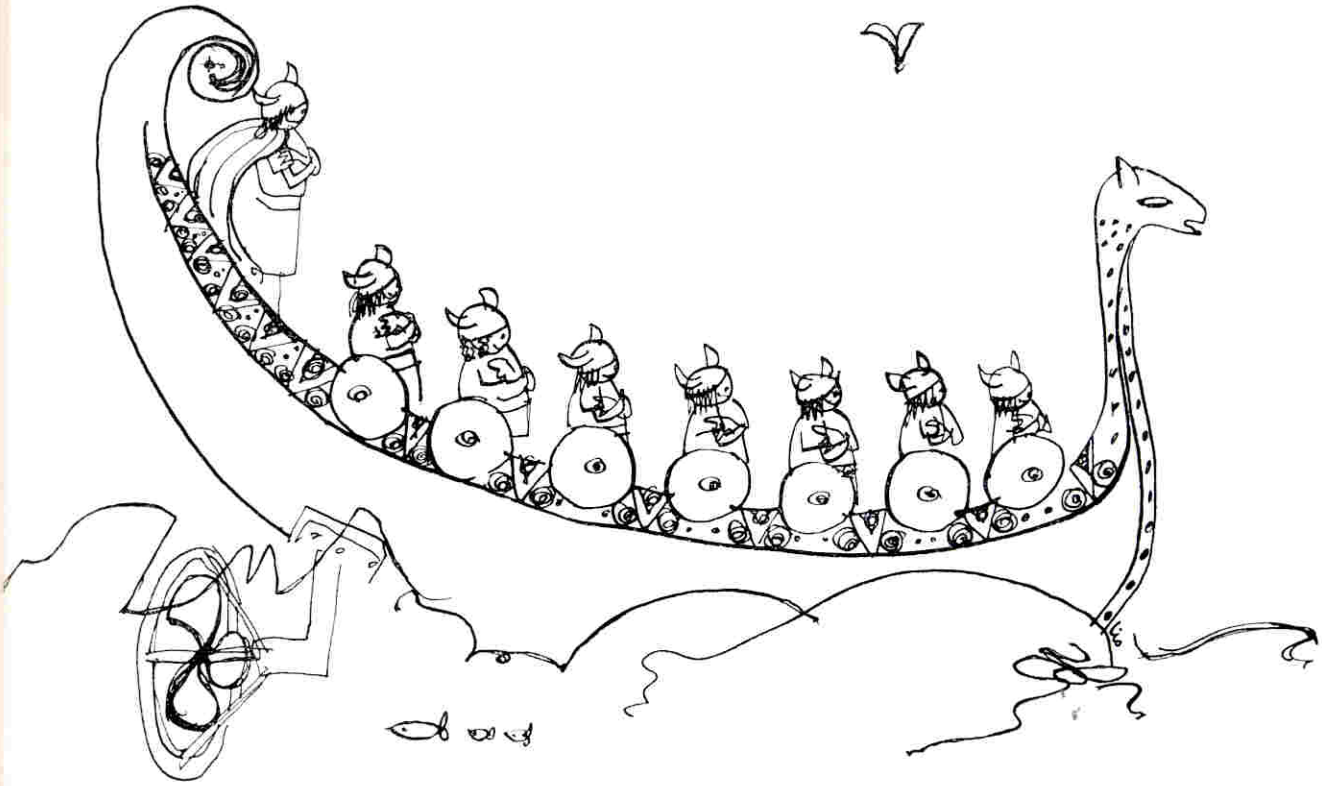
The slowly-tiring conductors, who were determined to limit our nocturnal activities.

The "Blah!" who drank a jug of beer on Rottnest Island, straining half of it through the hairs on his chest, to the slight amusement of two unwanted females, while Ian told them what the dragon did.

And the four Engineers who walked four hundred yards from the ferry to the beer garden, drank steadily through the day, enjoying the warmth of the sun, the gentle breezes, and the delightful company, and still managed to walk four hundred yards back to the ferry unaided ten hours later.

All Engineers should experience at least one Symposium while at the University. It is an opportunity that will not come your way again, and by participating in this Australia-wide gathering of Engineers you will fulfil an essential part of the transition from student to qualified engineer.

The thanks of all of us go to the Engineers of Perth, who so ably organised and conducted this Symposium.



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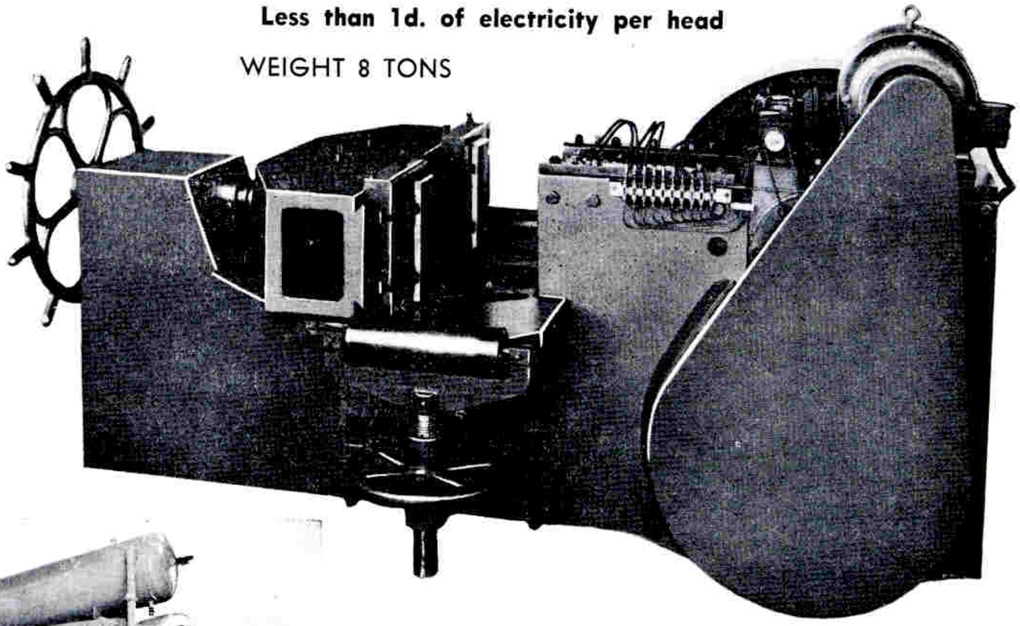

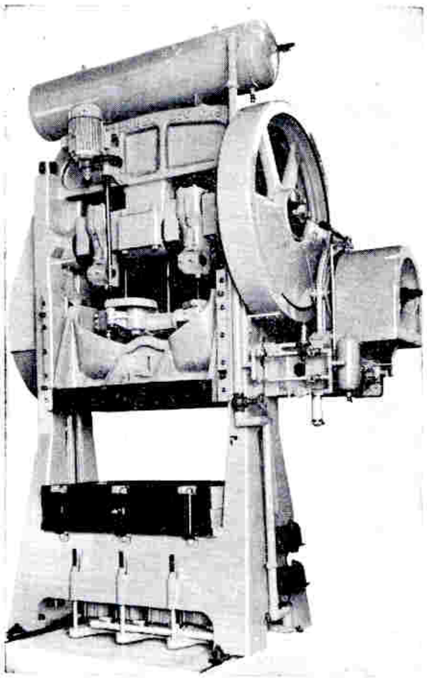

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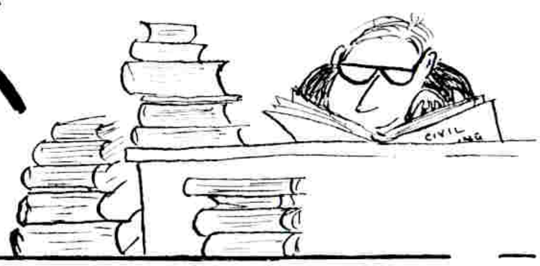
TEXT BOOK PLUS

by M.R.HASKARD.



For most students text books just mean problems in one way or another. Strange as it may seem, there is one text book which shows us how we can rid ourselves of our problems. This book is the Bible. While many people laugh at this statement, I think this is a good time to have a look at Scripture again, since this is the year that the New English Version (NEV) of the New Testament has been released.

The Bible can still be classified as a best seller, for the million copies of the new translation that were printed were sold within a week of publication—10,000 of them were sold in South Australia alone. Just why is there such a demand, and why do so many people around the world read their Bibles?

Lord Macaulay said: "The English Bible—a book which, if everything else in our language should perish, would alone suffice to show the whole extent of its beauty and power." Many people sharing this view simply read it for its power, freshness, and beauty of language. Others, however, read and study Scripture from a historical point of view, for a large percentage of the book is history. Engineers read it to trace back their particular profession to its beginning, or to see what structural feats were achieved in past days—the building of a 450 ft. boat, the supplying of water to the city of Jerusalem through a tunnel of solid rock.

However important these reasons are, by far the greatest number of people who regularly read their Bibles do so because it tells them about a living person—Jesus Christ—and how by faith in Him we can be reconciled to God, and know Him as our Father and Friend. St. Paul, writing to Timothy, says: "Remember that from early childhood you have been familiar with the sacred writings, which have power to make you wise, and lead you to salvation through faith in Jesus Christ." (Timothy 2, 3:15.)

Despite the large number of Bibles sold in Australia, just how many are read? Perhaps the figures for church attendance taken in the 1954 census can give some indication of what the situation might be. Of the 8,033,754 Australians who claim to be Christians, only 26% had attended church within the last week. In 1955, 33% described themselves as "regular church-goers," but this may mean regularly *only* once a year. (Current Affairs Bulletin, Vol. 22, No. 4, June, 1958.) If these figures are any indication, then only about one-third of the Bibles in circulation are read. Why is this so? Surely expensive books are not bought to act as door-stops, although they may end up this way.

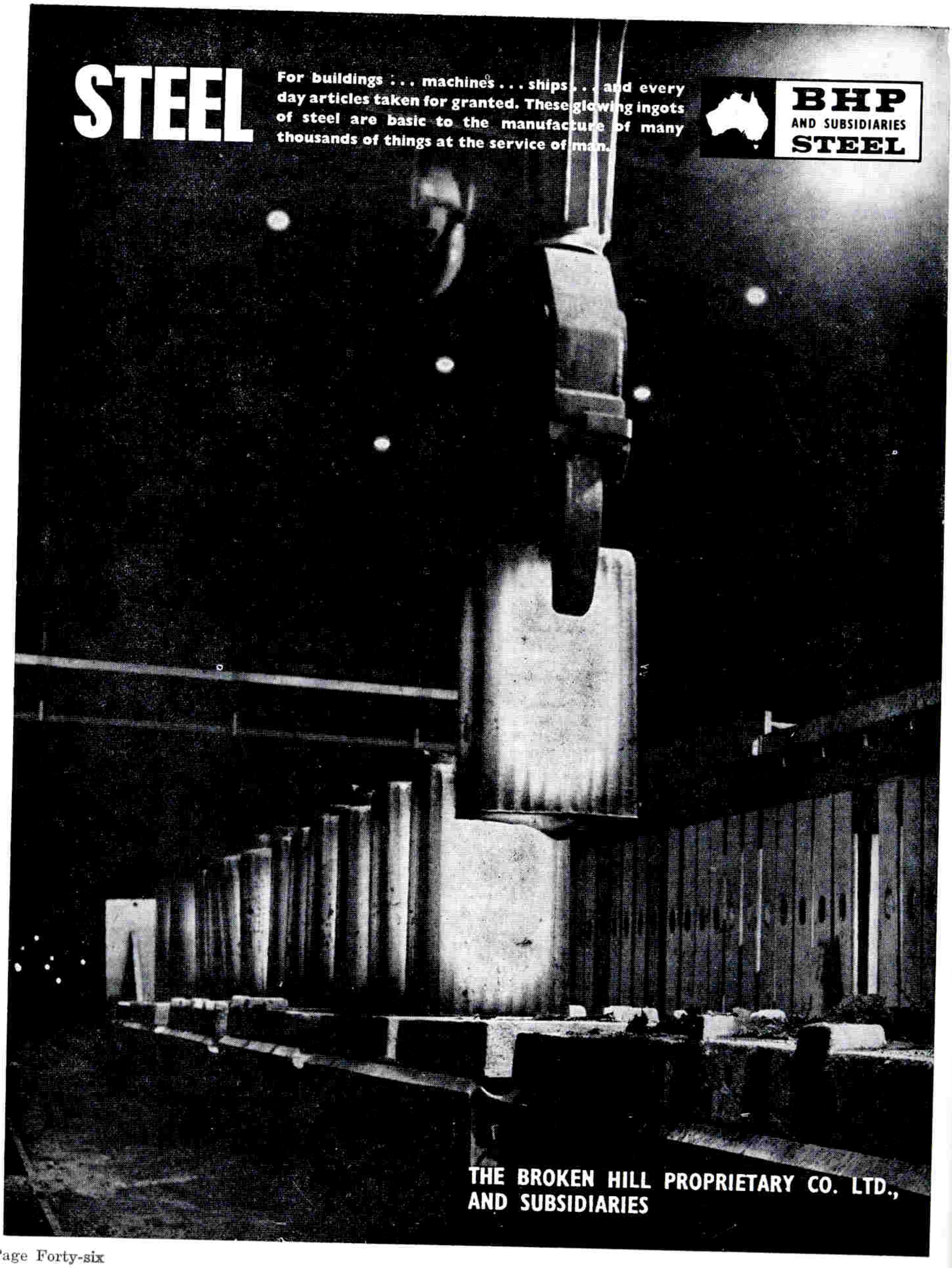
Tradition demands that most respectable and sociable people keep a Bible somewhere, just as they keep a volume of Shakespeare's works. It is not there to read, but to create a good impression on one's own mind, if not on the minds of others. What an illusion!

And again there is the subject of sin. Now, sin is an old-fashioned and revolting word, but it does occur in the Bible. It says, too, that all have sinned, and those who won't admit it are liars. But are all men liars? Conscience tells us—yes. Because we don't wish to admit it, we refuse to read the truth about ourselves as revealed in the Scripture.

By far the greatest number of objectors to reading the Bible make statements like: "I can't be bothered," or "It's too difficult to understand." Still further there are those who say: "It's all baloney," and yet if asked whether they have ever read the Bible you very often find the answer is No—they have only read some of it. Some may say they read it when they went to Sunday School, but surely you wouldn't expect to solve an Applied Maths. IIA problem with just the elementary knowledge you had at Primary School. Why, then, do some people do this sort of thing when it comes to understanding the Scripture?

The release of the New English Version has been one of the greatest events of this year, for it completely eliminates all reasons for not reading and endeavouring to understand the Scripture. The N.E.V., completed after thirteen years of co-operation by scholars in Britain, presents God's message to man, but in modern English. "Time" magazine has reported the Poet Laureate, John Masefield, as saying: "The new version cannot fail to move the living world. The work, greatly planned, has been manfully done. That which slept has been awakened."

Well then, as was said at the beginning: How about it? Let each of you examine the Bible again. At the University you exercise your mind and body. How about your soul? Start by prayerfully reading the N.E.V., and see what the Scripture really has to say. Yes, I said prayerfully, *for if you want to understand it,* and are prepared to take the consequences, why not ask Him, the Author, to help you? In doing so you will meet Him—Jesus Christ.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RESEARCH ACTIVITIES OF THE CIVIL ENGINEERING DEPARTMENT

Although research in Civil Engineering represents only a small fraction of the research involved in man's grasp for knowledge, even within the classification of Civil Engineering, a wide variety of research fields exist. This Department maintains an active interest in a number of these fields, some of which are described briefly in what follows.

In the field of structural engineering preliminary work has been completed in preparation of a study of the stresses and strains in concrete dams by the use of models. Much time has been devoted to the selection of suitable Australian raw materials for the model, as it is necessary to produce a concrete in the model having elastic properties which may be accurately scaled down from similar properties in the prototype dam. A model of the raised Mount Bold Dam has been constructed in the Chapman Laboratory, using a lightweight concrete. The model is loaded horizontally by hydraulic jacks on the upstream face, so arranged as to simulate as far as possible a triangular water pressure distribution.

Another interesting project commenced recently is an investigation of the behaviour of flat plates by the Moire method. In this method the plate under test has a reflective surface, so that the reflected image of a sheet marked with a set of closely spaced parallel lines may be photographed from the test plate itself. By taking successive photographs on one negative, with the plate in the unloaded and then loaded conditions, the slopes, and hence deformations of the plate may be obtained from the interference fringes of the parallel lines on the photograph. The apparatus constructed in this Department has used black perspex plates in the study of numerous problems on plates, flat slab floors, and raft foundations.

Work on grid structures commenced several years ago by this Department is continuing. At present a skew grid bridge structure is being investigated, with the object of determining the effect of the relative stiffnesses of main beams and transversals upon the stresses and deflections of the grid. A digital computer is being used for all of the theoretical calculations, and excellent agreement has been obtained between these results and experimental observations taken on a skew grid made from brass beams which have been tested in the laboratory.

Soils engineering, acclaimed by two members of the Department as the basic fundamental field of Civil Engineering (although others dispute this) is being investigated along several approaches. Current research work is directed towards an interpretation of soil strengths through novel experimental tests such as the Vane Test and the Collapse of Thick Cylinders under different loading conditions. A fundamental study of the structure of clays is being undertaken in connection with work on the action of soils.

Research and consulting work for both private enterprise and also Government Departments occupies much of the time of the soils men. As an example of this type of investigation, permeability tests were recently completed for soil at the proposed Chowillah Dam, which will be constructed as a storage basin near Renmark, on the River Murray. In addition, ad hoc testing on the sinking of structures into position in alluvial type soils is being carried out as part of an investigation on the construction of a proposed structure at Port Adelaide. Consulting engineers frequently make use of the facilities for soil testing in the Soils Laboratory of the Department, and the foundation conditions for a number of multi-storey city buildings have been investigated by members of the Department.

During the year members of the Hydraulics staff have been engaged on both developmental and research projects. An outlet structure for Drain No. 11 of the South-West Drainage Scheme at Edwards Street, Brighton, has been designed, and model tests made. The prototype outlet allows for a maximum discharge of 150,000 g.p.m. across the beach, without excessive beach scour. A special valve has been developed for the E. & W.S. Department for use on the Mannum-Adelaide pipeline. At present feasibility studies for a proposed tunnel under the Port River are in progress, to examine the ventilation problems associated with the tunnel. Recently a new irrigator was developed for Pope Products Ltd., which seems potentially to effect savings of approximately £20 per acre on infield costs. As current costs are of the order of £120 per acre, and the new Civil Engineering Department design is likely to reduce this figure to £100, economics are obvious, especially as a number of 100 acre fixed spray irrigation schemes are now being installed. Work on the wind loading of structures is continuing, a gust anemometer having been erected and in operation since November, 1960. As yet no worthwhile results have been obtained because of the extraordinarily calm weather. The anemometer produces warbling audio tones proportional to wind direction and velocity, which are recorded on magnetic tape. This investigation will be advanced further this year, when the relationships between short duration wind gusts and the resultant structural loading are examined. It is expected that special high speed photographic and pressure recording equipment will be in full service this year for a study of water hammer in pipelines.

This year, for the first time, traffic engineering is the subject of a post-graduate research investigation. Professor R. B. Potts, Professor of Applied Mathematics, is carrying out research work in Traffic Dynamics, and this Department is assisting him with experimental work. We have already measured speeds and spacings of cars in a traffic stream on various highways in the metropolitan area to test a "car-following" theory which describes single lane flow in simple terms. Work is in progress on two problems. One is to develop a mathematical theory to describe the flow along a highway when it is broken up by traffic lights into "platoons" of cars. The other is to investigate the "acceleration noise" of a driver as a means of describing both driver and highway characteristics.

MR. D. S. BROOKS.

MECHANICAL ENGINEERING DEPARTMENT ACTIVITIES, 1960-61

Staff and post-graduate research activity may be summarised as follows:

Dynamics: A general study of the dynamic behaviour of first and second order mass-spring-damper systems with relaxation and preload characteristics and non-linear optimised automatic damping control is continuing. The main applications being studied are vibration isolation with random excitation (vehicle suspension), and in shock measurement accelerometry. Transistorised automatic control of a magnetic fluid damper developed for automotive suspension is being prepared for road testing.

Materials and Plasticity: Fundamental studies of the mechanism of plastic distortion in metals, and of chip formation in metal cutting, are proceeding. New experimental techniques are yielding useful information, and a new theory has been propounded.

Thermodynamics: Transient phenomena associated with combusion in i.c. engines are being studied. Gas vibrations and heat transfer in explosion fronts are of interest. Resiliently isolated h.f.-response pressure transducers have been developed to provide "clean" records of explosion fronts unmasked by spurious mechanical vibrations. Abnormal "noisy" combustion studies associated with the knocking, rumbling, and surface ignition indicate a relation with surface temperature and heat transfer between gas and surface.

Fluid Mechanics: The interrelation between fluid flow and vibratory components of thrust, torque, and bending in marine propeller operation are being studied in the research water tunnel using a refined strain-gauge dynamometer developed for this purpose. Full-scale shaft strain-gauge recordings taken on ship trials of B.H.P. vessels at Whyalla as part of the study will provide information of value in propulsion system torsional vibration natural frequency calculations for new ships. The elusive factors of the influence of water entrainment on propeller inertia and damping are being studied. Propeller induced shaft and ship vibration are also being investigated.

Consulting and advisory work has extended greatly in recent years, and has recently included the solution of technical problems, such as the cause and prevention of ore train derailment when using dynamic braking with diesel locomotives, assessment of the comparative merits of rubber and steel springs in rail vehicle suspension, fatigue failure due to flow-induced vibrations, failure of machine and vehicle components associated with accidents, ship shaft and hull vibrations, ship launching characteristics, waste heat utilisation in industrial production, and optimisation of processes for economy. A considerable range of vibration and noise control problems in plant, machinery, vehicles, and buildings handled has included the design of a sound-proof control room, wood-working machine covers, and pulveriser noise control covers, and high-attenuation lightweight building partitions.

PROF. H. H. DAVIS.

JUST BRIEFLY

"An engineer could be described as a combined physicist and chemist who is professionally conscious of the value of the pound, a mathematician who is willing to arrive at a numerical answer, a draftsman who prefers to sketch in freehand style, a team worker who has a mind of his own but who can be convinced that there is value in the views of his confederates, and a reporter who can write in a clear, brief style."—William J. Gress.

HOW TO PASS SURVEYING

By JULIUS PEDRO ECKES (B.Ox.)

THE AUTHOR: *Mr. Eckes was born on September 19, 1960, at Adelaide, a suburb of Elizabeth and was educated at school. Following the completion of his secondary education, he passed through the Adelaide University, obtaining a parking sticker en route. Mr. Eckes has spent many years studying Surveying I and is consequently a leading authority on failing the subject. In 1961 he found it advisable to change his name following the publishing of an article on surveying and has not been heard of since.*

Definition: Surveying is a subject which, had you heard of its existence when you chose your course, you need not have done.

The Decision: Fortunately for our faculty, there is always a certain percentage of freshers who have never heard of surveying, and it is not until their second or third year that they discover their mistake. They are then faced with four choices which, in order of preference, are:

(1) To change their course.

(2) To wait until the course is changed.

(3) To commit suicide.

(4) To do surveying.

However, it must be remembered that at the time of their choice, they still do not know just what is involved in surveying, and are consequently not capable of a rational choice. Naturally, they do not want to change their course at this stage, and if they wait until the course is changed they may have to wait for six or seven months. To commit suicide is inconvenient, since the lift well would have to be cleaned out, and the department cannot afford the power to electrocute them, so the students are left with only one choice—to do surveying.

This article has been written in the hope that the ideas and suggestions illustrated may give students a better understanding of the essential principles of surveying. The article has been divided into three sections—instruments, field work, and computations—but before considering each section in detail, the student should have a general knowledge of the uses of surveying.

Why study surveying? This is a question that has puzzled students for many years.

How does surveying affect the engineer? Because of the lack of space, this question cannot be answered in any detail, but it is sufficient to say that it generally does.

Once the student has understood the significance of these two questions, he is in a position to read the first chapter of his surveying book.

INSTRUMENTS

All instruments that have more than one part have some means of adjusting each of its parts. At first sight this seems unnecessary, since the means provided for adjustment of the instrument merely provide a means of getting the instrument out of adjustment. However, the fact that the instrument can be adjusted means that you, and not the instrument, are responsible for the errors produced. Consequently you can be given any one of a historic collection of instruments—including the Wye* theodolite—and be expected to obtain accurate results.

Adjustments are of two kinds—temporary and permanent. The distinction is best illustrated by an example. A surveyor, levelling an instrument with a bubble, manages to get the bubble in the centre in twenty minutes by using the levelling screws and level tube screw. This is a temporary adjustment. He then proceeds to take fifty readings, but while he is doing this the centre of gravity of the earth shifts, and the bubble races up to one end of the tube. Consequently, fifty minutes later, having taken all his readings, and checked them, he discovers that the bubble has disappeared. At this he picks up the nearest ranging pole and strikes the instrument with such force that he bends the horizontal axis, vertical axis, and level tube screw, thus effectively preventing any further rotation of the instrument. This is a permanent adjustment.

Surveyors during the past 500 years have developed many useful and ingenious instruments, and several hundred useless ones. Surveying dates back to the days of the early Egyptians, when Slowcomb (inventor of the slow combustion stove) noticed that if the top was left off the stove pipe you could sometimes see through it. With this ingenious device he found that he could observe the female species at close range while appearing to be doing something quite different. The idea caught on so rapidly that by the 16th century A.D. the female species noticed what was happening, and kept further away. This necessitated equipping the tube with lenses to compensate for the extra distance—hence the telescope.

Using the telescope, all went well until the beginning of the nineteenth century, when the secret of the lenses was discovered, and the

* This valuable instrument was manufactured by Galileo in 1610, and given to his mother-in-law as a Mother's Day gift. She threw it on to the rubbish tip, where it remained rusting until discovered by a scrap metal merchant in 1812. He sold it to the Russians, who used it in the Crimean War to frighten the Turks. In 1855 it was hit by a cannot ball, which bent the barrel so much that it was impossible to see through it. The Russians abandoned it, and it fell into the hands of the British Light Brigade, who brought it back to England as a souvenir. In the process several of the parts were lost, and have never been found. In 1930 it was given to the South Australian Museum, who sold it to the Adelaide University for 2/8½.

scenery resorted to high speed in order to avoid detection. Not to be out-done, man's genius was revived, and the result—a vertical and horizontal axis, by which the telescope could be swung around at high speed like an anti-aircraft gun.

Then came the greatest discovery of all.

Previously surveyors had found great difficulty in obtaining vital measurements owing to lack of co-operation on the part of the subject. With the discovery of the Tacheometer the problem was solved. All the surveyor now has to do is to measure the three diameters (from a safe distance), and multiply by π, assuming a circular cross section.

Because of the large number of instruments available, only a few of the instruments are discussed here. The rest are just as useless.

Tripod: It does not take the potential surveyor long to realise what a time-consuming device the tripod is. Just because an object is stable, with only three points of support, does not mean to say it has to have only three legs. In my opinion a polypod would be a much more useful device.

Imagine a polypod with nine legs. To set up the instrument all one has to do is to splay the legs out at random angles and set it on the ground. Then, while an assistant holds the plate horizontal, you simply walk around the instrument and lift all the legs that are not doing anything useful. If the polypod has enough legs then, by the laws of probability, it will have at least three legs in the correct position, and these may easily be identified from the fact that the instrument collapses when they are lifted.

The legs not being used for support may then be put where required, and used for coat hangers, towel racks, aerial poles, firewood, etc.

Plumb-bob: No sooner has the student beaten the tripod into submission with a ranging pole than he is faced with another problem — the plumb-bob is not over the peg. Usually his first reaction is to burst into tears, but the solutions are really quite simple.

Either (1) Shift the peg,
or (2) Use steel pegs and magnetise the plump-bob.

Both methods are satisfactory, but care must be taken with (2) to ensure that the peg does not follow the plumb-bob when shifting the instrument. This sometimes happens when the ground has been ploughed up by excessive applications of (1).

Optical Square: This is a compact hand instrument which enables an experienced surveyor to see his left eye with his right, and vice versa. (Otherwise useless.)

Level Tube: This is a device attached to most instruments to amuse bored surveyors. The aim of this game is to get the bubble in the middle while leaning on the tripod. (If you do succeed, do not be tempted to turn the vernier plate through 90°, as this is fatal.)

Ranging Pole: A stout pole, preferably steel, for use in case of attack by an irate surveyor or other wild animal encountered in the undergrowth.

Cross Staff: This is what you have to cope with when you accidentally leave your theodolite on a road and it gets mangled by a passing semi-trailer or bus.

Chain: A device used by surveyors before the introduction of the push-button type.

FIELD WORK: SURVEYING CAMP

As soon as the exams. have finished at the end of each year, everyone celebrates the return of freedom—everyone, that is, except the poor surveying student. Why is this? What has he done that would prevent him from celebrating with his friends?

The answer lies not in what he has done, but in what he has not done—namely, surveying camp. During the year the student has few opportunities to show his ignorance, and so the University has decided that every surveying student will attend a surveying camp.

While in camp the student is required to report the finding of any human remains, as such reports are vital evidence in tracing missing surveying students. In the past many students have disappeared during surveying exercises, and in most cases very little is known of the circumstances of the disappearance. However, there are one or two notable cases which should serve as a warning to future surveyors.

In 1897 two parties, A and B, each equipped with a theodolite and tape, set out from two points, X and Y, with the object of setting out an arc of a circle, radius 2,000 feet. Unfortunately, due to slight errors and a misunderstanding as to which side of X Y the centre was, they failed to meet in the centre of the arc. Confident that they would meet, both parties continued to plot their curves, and if it had not been for an observant surveyor from another party, who noticed both parties go past twice, they may have been lost for ever.

In 1928 a small party was lost during an exercise in which the party was required to take levels along a road as far as they could go in the given time. This party was particularly fast, but unfortunately they became lost after half an hour, and since they could not understand what they had written down, they were unable to find their way back. After many minutes of wandering through the countryside they came across the local pub. As luck would have it, however, their surveying instructor knew the area well, and was soon able to locate the missing party.

Whether you enjoy field work or not depends on you. Provided you ignore the flies, snakes, heat, dirt, bad-tempered instructors, and the calculated malice of inanimate objects such as blackberry bushes and barbed-wire fences, you can really enjoy field work. It is the calculations which you have to do afterwards that mar an otherwise perfect day.

COMPUTATIONS

A quick look at field books from past years shows that our accuracy is already down to 1 part in 12. Consequently we cannot afford to lose any more significant figures in our computations. Hence the use of 7-figure logarithms. At present 8-figure logarithms are not readily obtainable, but printing was begun in 1932 on a book of 33-figure logarithms (to the base π), and the first book should be available early in March, 1987. For those doing Surveying I this year this should be of great assistance in solving question 3 of set 5.

SURVEYORS HARD AT IT!

Normally, surveying calculations are done by computers in a matter of a few minutes. However, this would mean that the rest of the three hours allocated to Surveying I computations would be wasted. Besides, "I had to use 7-figure logarithms, so I don't see why you shouldn't."

Normal students always have difficulty in obtaining the right answer when using 7-figure logarithms. However, this trouble may be overcome by using one of several techniques, two of which are outlined below.

(1) Try setting your work out neatly. For example:

Aim: To divide 4 by 2.

Calculations:

Number		Logarithm		Antilogarithm
4	——›	1.7020600		
2	——›	1.3010300		
		0.4010300	——›	2.00000000

Answer: 2.00000000.

NOTE: (i) You still make mistakes, of course, but there is a better chance that you will get it right (approx. 1 in 10^{19}).

(ii) In problems like the one given above the student is sometimes tempted to guess the answer. This is dangerous. It is far better to spend a few extra hours on the problem, and be sure.

(2) Calculate the answer to 2 significant figures on a slide rule, and get the remaining 5 significant figures from someone else.

Another excellent method is to take the total number of results obtained in the class (n) and find the root mean square of all n values.

To allow for errors in this calculation, this should be repeated n! times to obtain the results A_1, A_2, A_3, - - - - - -. This method should then be repeated, using A_1, A_2, A_3, - - - - - - instead of (n), to obtain B_1, B_2, B_3 - - - - - -, and so on. The final result (Z) occurs when a set of answers is obtained such that $Z_1 = Z_2 = Z_3 =$ - - - - - -. The method is therefore self-checking.

At present I am working on a solution to question 1, set 1, using this method, but since I have not yet reached a solution, I hesitate to recommend this method.

Once the student has mastered the art of using 7-figure logarithms, he is in a position to solve his first problem. This is when he discovers that surveyors are allergic to the F.P.S. and M.K.S. system of units, and prefer instead to record measurements in rods, poles, perches, chains, acres, links, etc., etc. At first sight this seems most unreasonable, but this random collection of historic units has many advantages over the F.P.S. system.

Firstly, since you have bought a book of 7-figure logarithms, you should take every opportunity to learn how to use them.

Secondly, all the units are related by natural physical constants. For example, to convert acres into square fathoms, all you have to do is multiply by K, given by the equation:

$$K - \frac{C R_\infty h}{E_o}\left(\frac{N}{\pi}\right)^{\sqrt{\frac{7}{10}}}$$

Where C = velocity of light in a vacuum,
Roo = Rydberg wave number for infinite mass,
h = Planck's constant,
Eo = energy associated with le. v.
and N = number of beans in a cup of Nescafe.

If you have any doubts about the validity of this relation, try it for yourself. Similarly, the relation between any two units can be shown to be a dimensionless combination of naturally occurring physical constants. This, of course, simplifies calculations quite considerably.

CONCLUSION

By now you will have realised that reading this article was a waste of valuable time which should have been spent doing surveying. However, I would not worry about it, since the author spends much more time writing these articles than you do reading them, and he passed. For those doing Surveying I for the first time, remember that the first year is the worst. After that you get used to it, and there is always the chance that you might pass, anyway.

SOME DIVERSION

By DJAKA SOETRATMA

I am not going to tell you about some engineering masterpiece which was achieved by Professor Such-and-such somewhere, or about some engineering project which some engineers managed to bungle, but let us just sit and think a little bit about, say, what we have been doing in the University, what do we get out of it, etc.

In this age of automation, space rockets, and inter-planetary travel, people have been crying for some changes in education system to produce more scientists, engineers, etc. Do not take any notice of how they propose it ought to be done, but have you ever wondered yourself just what IS education? Is it what we are doing in the University, or what? Without trying to be a Freud—if you do not know who Freud was, ask any Teachers' College student, preferably female, then you'll be sure to get answers more than you need or want to know—to me education is a "process" which aims to develop a human being into a decent, capable, and responsible citizen, thus creating people with initiative, deep sense of responsibility to the society, and awareness of their duty to other fellow citizens. Hence it is not just schooling, wherefrom you learn and master some facts such as two by two is four (I believe it is correct, isn't it?), or that a voltage drop developed across a conductor is proportional to the impedance of the conductor and the current flowing in it, as according to Mr. Ohm, or that in the field of feedback control system the transfer function of a closed loop system is $\frac{G}{1 + GH}$, where G is the forward loop and H is the feedback loop transfer function respectively, and that to get the time response you must take the anti Laplace of the above function, etc. These are all parts of education, but not THE education. Education, to me, is a process which goes on throughout one's life.

When we were still small children we often asked why the wind blew, why it rained, why this, and why that. When we got a satisfying answer we felt happy, if not, we kept asking, and gradually, if we were still not satisfied, we tried to find the answer ourselves. This search of an answer for the querying mind helped to develop initiative. And initiative is one quality of a capable person. So here you started your education. It is disheartening, however, to notice that when one grows older one tends to accept things blindly, and too few "whys" are asked and reasoned, for I believe that a querying mind, properly used, will help to achieve a happier outlook towards things. Just take, for example, a case which all of us have been confronted with at some time or other, that is, the practical work. It appeared to me that quite a lot of us considered that the practical work was just something to be done so that we could satisfy the curriculum, and thus we could sit for the exam. Consequently it was mostly done "mechanically," and quite often half-heartedly, especially if it concerned subjects not directly in our particular field of interest. However, if we could just stop and think for a moment about just what the real purpose of a practical work was, we might be better off.

In my opinion, a practical work is designed to help us to think and to give reasons why we think along a certain line. This will help us to give an opinion, judgment, or a decision on other matters wisely. If we could look at it from that angle there would not be any frustration, or a maddening feeling just because a particular work did not give the expected results. Instead, it would provide us with a challenge to find a reason why it did not work.

Another aim of education as I understand it is to be a responsible citizen. To be a responsible and decent citizen one must follow a certain moral concept. I, being an Indonesian, keep sacred three moral precepts which have been handed down from our ancestors, and have become a basic part of the Indonesian culture. These principles, I think, are most important in moulding character and behaviour. They state that all young people must respect, obey, and devote themselves to three types of persons in their life. They are:

1.—"GURU," which means "teacher." It is meant in the broader sense of the word, however, and does not only mean the teacher in school, which teaches facts. A teacher is meant to be a person who not only imparts knowledge, but also gives lessons in moral values. Such moral values are considered the most valuable weapons for life.

2.—"RATU," which literally means "ruler" and, broadly interpreted, as "the law," the rules of the religious and secular community and nation.

3.—"WONGATUA KARO," which means both parents. We feel that respect, obedience, and devotion must be given to our parents, who brought us to the light of the world, and to whom we owe the gift of life. Devotion to parents is a very real concept; it is usually sufficient to rebuke a child by saying: "What would your father think?"

These principles are highly respected, and I do not think they can be found written in any book. They are just handed down from generation to generation. So here is one aspect of education that you will not get from your schooling, thus confirming what I said before—education is not just schooling.

Apart from keeping those principles, one ought to have guidance in following them. This guidance is normally provided by the parents. Now let me tell you an incident in my own life which occurred at the time I got engaged. At that time my father took me aside and said to me very seriously: "My son, you are about to establish your own life. My blessing goes with you; my duty to guide you is now nearing the end. Until you were two years old you were my king; from two to seven you were my child; from seven to the age of ten you became my opponent; and from the age of ten until now you have been my younger brother. Now you are starting a new life, and you are my equal."

Now, just what did the old man mean by that speech? Well, to me it meant that he wanted to stress that even after he became a father he still had to educate himself, to better himself, in order to be able to give guidance to me. Perhaps I had better elaborate a little bit in order to appreciate what he had gone through. When a child is a baby he is indeed the king. The parents are his servants, meeting his every want and demand, doing everything he wants, sometimes with great sacrifice. Thus he is really the king, and the parents are his subjects, without question absolutely at his command. Then when he reaches the age of between two and seven the childhood years begin, and here guidance starts. The parents lead him by the hand and help him to reach those things beyond his reach, and they are still needed to serve him and to meet his demands. At the age of seven he begins to assert himself and to selfishly demand whatever his pampered self desires. In this period the parents have to be careful not to fulfil his every want, or to give him all he asks for. When he grows to a teenager, then comes the period of rebellion or, to coin the German phrase, "sturm and drang period" (here's Freud again), a period which is so decisive for the future of the child. In this period the parents must be tactful, and conduct their guidance in such a way that they act as if the child were their younger brother. Then begins the time when the young person has to follow his own life, become a member of the adult community, a member of the family of life. From there on the father has to treat him as an equal, giving advice when necessary, and giving support when it is proper. So, you see, now you could appreciate what he had been confronted with. He had to keep bettering himself so that he could give the guidance to me.

In conclusion, you can see now that when you have graduated I will not say you have been fully educated, like other people used to say, but I'll say you are just fully qualified, since education goes on, and you are still in the middle of it.

"INSTANT" SLIDE RULE HISTORY

By J. H. FOWLER

For many years engineers and engineering students have been linked in the public mind with the slide rule, which they use so consistently to expedite their calculations. The engineer, in his turn, has demonstrated his affection by referring to his calculator by such nicknames as the "slip-stick" or "guessing-stick." However, how many have stopped to consider that their portable analogue computer has a history of almost 350 years?

In the year 1614 John Napier, Baron of Merchiston, gave to the world his discovery of logarithms, which have since advanced the art of computation beyond recognition. Only six years later Edmund Gunter, a Professor of Astronomy, designed a logarithmic line of numbers which was to become the forerunner of our slide rule. The Gunter line was utilised by adding the appropriate lengths along the line or scale with a pair of dividers. On the Gunter Scale were included additional reference scales to give the sines, tangents, versines, and meridian line, making the scale very suitable for navigation computations.

William Oughtred has been established as the inventor of the rule consisting of a sliding pair of adjacent scales, and also of a circular slide rule called by him a Circle of Proportion. These instruments were described in publications by William Forster, a mathematics teacher in 1632, and again in 1653. In these works Forster gave the constructional features of the instruments, and instructions for their use.

During the next two centuries the slide rule remained very much as described by William Forster. However, specialised scalings were devised for calculating timber quantities, volumes of liquids, and one important scaling appeared on the Everard Sliding Rule "for ullaging of vessels or casks, i.e., for finding exactly what quantities of ale, beer, wine, etc., remains after any part has been drawn off." In 1779 Boulton and Watt of steam engine fame produced their Soho slide rule, designed especially for engineers.

Although the advantages of a cursor or runner had been suggested as early as 1782 by none other than Isaac Newton, it was not introduced as an essential part of a slide rule until as late as 1850. This brought the mechanical design of the slide rule to its present state. In this year the Mannheim rule was introduced, although the familiar white celluloid facings did not appear until 1886. White plastic material is still the standard facing, but prior to 1886 the slide rules were faced with boxwood, and in the luxury models, with brass or ivory.

At various times slide rules have been developed to satisfy demands for higher accuracy. The Fuller rule was one of these, and consists of a spiral scale on a cylinder about four inches in diameter and 10 inches long. The equivalent scale length is no less than 41 feet, and the calculator is correct to four significant figures.

Since 1900 the slide rule has changed little in either scaling or mechanical detail. Cheaper accurate slide rules are of moulded plastic, which operates very satisfactorily. However, the very best rules are still made on a wooden base, faced with plastic material. This century has also seen the introduction of the so-called duplex or double-faced slide rule, on which there is more space to fit the more complex scalings required in modern engineering practice.

Initially, the duplex construction lacked rigidity, and was not favoured by engineers, but these objections have now been overcome by improved construction methods.

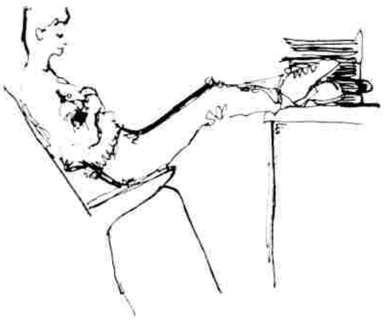
This history, although incomplete, has included the most important stages of slide rule development. Today we find the slide rule being used more and more outside the fields of engineering practice, and the manufacturers are satisfying this demand by producing rules with special scalings to solve financial, typographic, textile, and other problems. Oughtred's idea of using two Gunter lines on separate scales to overcome the manipulation difficulties of a single line has seen many improvements, and it is probable that the full extent of the range of usefulness of this instrument has not been reached.

The sexual instincts of the camel
Are stronger than anyone thinks,
For after long weeks in the desert
He makes violent love to the Sphinx.

Now the Sphinx's most intimate quarters
Lie deep 'neath the sands of the Nile,
Which accounts for the hump on the camel,
And the Sphinx's inscrutable smile.

—Anon.

He is a fool who thinks by force or skill
He can turn the current of a woman's will.



THIS AND THAT

STUDENT-BUILT "SKIMMER"

A small hovercraft, weighing only 250 lbs. and measuring 11 ft. 5 in. long, has been built by students of the College of Aeronautical and Automobile Engineering.

The "Skimmer," as it is called, has a centrifugal fan of about 2 ft. 8 in., which is driven through a vertical shaft and centrifugal clutch by a 40 h.p. Johnson outboard motor. Air is guided in a duct to the outer edge of the machine, where it is directed inwards at 30°, creating a curtain of high velocity air.

Hovering height depends on the number of persons carried, but with one it is 4 in. to 5 in. at full power. Movement over the ground is effected by tilting the machine in the required direction. This is done by the driver leaning over.

Excluding the engine, the cost was £70 for materials, and took about 50 man hours.

A Marathon is a long, hard pull, but you get somewhere.

A merry-go-round is easy riding and lots of fun, but you get off right where you got on.

TRAFFIC RIDES "PIGGY-BACK"

Engineers, in their research to solve traffic problems, have proposed a high-speed electrically-powered highway system. The highway would comprise a series of rubber rollers, similar to inverted roller skates, spaced about 20 feet apart, and built on the ground. The rollers would be powered by small individual motors. Cars would be supported and propelled by the rubber rollers. Guide rails on each side of the roller-road would steer the carriers along the rollers. It is claimed that the system could transport automobiles and their occupants piggy-back fashion at speeds of up to 150 m.p.h.

SLING A NEW DECK

The traffic capacity of the George Washington Bridge in New York is being increased by 75% by the addition of a lower deck. Extensive new approaches are being built.

The bridge was opened in 1931, and in 1932, the first full year of operation, 5½ million vehicles used its eight lanes to cross the Hudson River. By 1959 this figure had increased to 38½ millions.

To relieve congestion, an additional six traffic lanes were provided on the lower deck. The new deck has already been fixed in position, and consists of 76 sections each 90 ft. long, 108 ft. wide, and 30 ft. deep, weighing 220 tons. For the river-spans these sections were assembled on barges and floated out to a point below their final location, and raised directly into position.

The project is scheduled to be completed in 1962, at a total cost of $183 million.

STEEL BRIDGE FLOATS 360 MILES

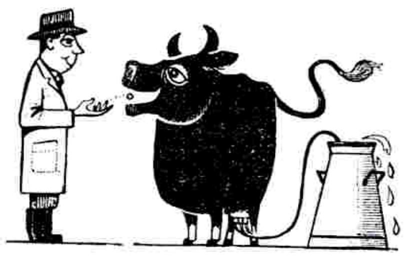
A prefabricated welded steel bridge weighing nearly 200 tons was floated from the River Tee works, where it was made, 360 miles around Britain's east coast to its site on the Thames. The journey took three days.

UNDERWATER DEVELOPMENT

Recent progress on submarine design has been outstanding. Atomic reactors have been designed little bigger than modern diesel equipment, as compared with the massive prototypes of the earlier fifties. In trials, submarine reactors have operated at or near full steam without refuelling for nearly 100,000 miles. Last year the "Triton," in retracing Magellan's trip around the world, covered 41,500 miles in eighty-four days without surfacing. Progress in atmosphere control has also been remarkable. Conventional submarines had to surface or snorkel every few hours. The feat of travelling ninety days without coming up for air represents a considerable achievement. Modern vessels use an electrolytic generator to ionise water to produce oxygen (and hydrogen which is pressurised), but new developments are being considered.

TRANQUILLISERS FOR NERVOUS COWS

An agitated cow is not likely to be an efficient milk producer, nor will an over-excited bullock make the best grade when he eventually reaches the fat stock market. Milk and meat production both suffer if the animal's energy is wasted by unnecessary exertion or stress. Several lines of research are being pursued. Music in the cow-shed has proved a boon to milk supplies. Tranquillisers are now being used. Experiments in the U.S.A. have shown a 12% improvement in growth rate for cattle. However, the New York Psychiatric Institute reports that the tranquilliser Chlorpromazine had a long-range depressive effect on monkeys.



She: "I nearly fainted when the fellow I was out with last night asked me for a kiss."

He: "Baby, you'll die when we go out!"

NEW WORKSHOP PRACTICE

A new metal removal technique, based on the use of electrolysis, has been developed in the U.S.A. This process might well replace conventional metal-cutting processes in a wide range of applications.

An example of the process was the "machining" of a rough forged turbine blade with a working surface of 2 in. x ¾ in. to a finished size .001 in. in five minutes, it being 0.35 in. oversize on both faces.

Metal is removed by passing a direct current between a workpiece anode through an electrolytic to a cathode tool. This current removes electrons from the work piece, converting the surface atoms into positive ions, which dissolve into the electrolytes. In practice the electrons are brought close together to achieve a very high current density, and the electrolyte is pumped between the electrode gap at high speed. This prevents deposition of material on the cathode. A current flow up to 1,500 A per sq. in. is possible, and low voltages of about 5.9 V. are used.

The latest application of the technique is the drilling of fine holes down to diameters of 0.012 in.

PROTECTION FOR CONCRETE DAM

Protection for the concrete arch of the Esch-sur-Sûre Dam (Luxemburg) demanded an easily applied protective coating on the dam, both below and above the water-line. Synthetic rubbers, Neoprene and Hypalon, were chosen by the constructors. Protection is required in this instance because the water of the River Sûre is very pure, and therefore highly aggressive to concrete, as well as to metals. Coatings of Neoprene on Hypalon were not just rubber-band paints: they were solvent solutions that were applied like ordinary paint, but dried by the evaporation of the solvent. Black Neoprene 1 mm. thick was chosen for the submerged part of the dam. A light grey coating of Hypalon, whose resistance to sunlight, weather, and abrasion is better than coatings based on Neoprene, was applied to the water-line area to a thickness of 0.4 mm. This area is alternately immersed and exposed to air.

MISS ENGINEERING
What about a few more?

ACKNOWLEDGMENTS

We wish to thank E. J. McAlister & Co. for their courteous treatment of our problems, and their co-operation in the publication of this magazine.

The Editors for 1960 for showing us the ropes.

Our advertisers, who have shown confidence in our literary venture by taking space in "Hysteresis." We would ask our readers to back us up in our vote of thanks by patronising them wherever possible, to the exclusion of their competitors. The staff of Charles Brown and Associates have worked long hours on our behalf to gather these advertisements.

The many people who have contributed to this magazine.

CHAMPAGNE

By C. D. PALM

Champagne with foaming whirls,
As white as Cleopatra's melted pearls.

(Byron).

Champagne was not always the dry sparkling white wine that we know today. Prior to the latter part of the 17th century champagne was known as a still wine, and it was not until 1682 that it was first "made" to sparkle.

Champagne, as with many other wines, derives its name from a district in France near Reims. It appears that the district was first used as vineyards at the close of the third century, although the spread of viticulture is associated more definitely with the spread of Christianity, as the most solemn sacrament of the Church requires wine.

However, up to the late years of the 17th century wines from Champagne were of three types —one still and red, one pinkish, and the other grey with a slight sparkle, due to its natural saccharine or liqueur. This wine was not the bubbling sparkling wine that we know today. Even though corks were known and used in the reign of Queen Mary, it was in 1682 that Dom Perignon replaced the previously used wad of hemp dipped in oil by a cork stopper.

It is probably for this reason that Dom Perignon is hailed as the inventor of champagne. This is not so. Champagne was known long before Dom Perignon, as I have outlined above. His action of using a cork to stop the bottle meant that the carbon dioxide released by fermentation could not escape, and remained a passive prisoner until uncorked. Then it becomes the well-known bubbly wine which prompted Farquhor to write:

"Here, here, Master, how it puns and quibbles in the glass."

It is not only for the first use of corks in champagne that we remember Dom Perignon. While he was cellarer at Hautvillers he collected all grades of grapes, as it was his job to collect tithes from the neighbouring cultivators, and to get the best he blended or married products from different vineyards. He developed this skill to such a great degree that he could continue even when he became blind.

Dom Perignon, then, was not the first to invent champagne, to make it sparkle, but he showed the way to a more skilful use of grapes to get a continual production of first-class wine.

Another to whom the development of champagne owes a lot is Francois. He lived some 250 years later than Perignon, and it was he who developed a scientific precision in making champagne. By so doing he put the whole trade on a sound commercial basis.

Through this period the transition from still to sparkling champagne was slow. There was always, during this period, a group of connoisseurs who made no secret of their dislike of the "green" sparkling wines.

Francois, in 1836, published the results of his experiments on the proportion of sugar in the wine at the bottling period, and the expected quantities of carbon dioxide gas. Before this the proportion of burst bottles was as high as 40%, but thanks to Francois, it was lowered until, in 1842, it was only 10%. Further work has lowered this figure until today the percentage of burst bottles is very small indeed.

By 1860 white sparkling champagne had superseded the previous red and white wines. At about the same part of this century the trend swung to a lighter, drier wine. Although a sparkling white wine, it had a yellowish tinge to it, and a certain richness, which implied a sweetness as well as a higher alcoholic content. Again the introduction of the dry champagne was opposed in certain circles—the "boys" at the Military Club in London found it so "awfully" dry that the wine merchant had to take it back for a sweeter champagne. It was some fifteen years before the demand for brut (or dry) champagne become general.

Champagne is now made all over the world. Of all, the best known local champagne is Great Western—made in a little village in Victoria—and it is from this village that it takes its name. Here some 600 acres are under vine, and future plans allow for a further 800 acres. The method of making champagne here is the same as is used overseas.

The grapes are gathered by vintagers, and transferred to wicker sieves to be pruned and rid of bruised and unripe fruit. The sound grapes are removed to the press. About two-thirds of

the total juice is obtained from the first pressing, while the rest is of an inferior quality. The first pressing is known as the must. The newly-formed wine is transferred to vats for a few hours while the mucous lees are deposited, after which it is drawn off into casks and placed in the cellars, where the first fermentation takes place.

This fermentation is started and controlled by whatever yeast the wine maker may fancy. The temperature is kept constant at a fairly low value. In spite of this, the must bubbles and boils, and a tremendous agitation goes on until the yeast cells are exhausted. As the cool weather comes on the wine becomes quiet and clear, and is then ready for racking. The casks used are as small as practicable, to gain the maximum ageing by oxidation, without spoiling by a vinegar fermentation.

During the several years that champagne spends in casks and bottles before it is ready to go on the market, it must be kept still; it will react even to the vibration of trains, trucks, and cars. It must be kept at a constant temperature, as it will otherwise "fret and become ill."

Shortly before the wine is bottled the cuvée, or blend, is made up according to the wine maker's formula. In this way the best wines are produced by an art which no chemist in a laboratory can copy. However, the chemist is needed, as the quantities of sugar present in the wine must be accurately known, as well as the alcoholic and acid content. Greater than 3% of sugar would give too sweet a wine, and could cause an explosion, due to excess bottle pressure. Excess alcohol—more than 12%—inhibits the second fermentation, and 0.7% acid content ensures that the wine is not too tart. If acid content is less than 0.7%, then the wine may be hard to clear, and become cloudy.

After a relatively short—but not necessarily so—time, the wine is bottled in the familiar dark green heavy champagne bottles. Corks, made probably from Spanish cork bark, are held in by steel straps or agraffes, to seal against the high pressure produced.

These bottles are placed in tiers in the temperature-controlled vaults. Control of sugar content and temperature has almost eliminated explosions in these modern days. It is while the bottles are stored in the cellars that the second fermentation begins. The residual sugar is converted to alcohol and carbon dioxide gas. Too little sugar content in the wine when it is bottled means the wine doesn't produce its full effervescence. It is interesting to note that the pressure aimed for is 100 pounds per square inch. The temperature at the commencement of the second fermentation is held at 65° F. until a deposit of dead yeast cells indicates that a vigorous fermentation has started. The temperature is lowered to 50° F. until this fermentation period has finished, when it is again lowered, this time to 45° F., to ensure that any excess of cream of tartar is precipitated. This temperature is maintained for a month.

For some months the wine is allowed to remain at rest. Then for some time, between three and six months, the bottles are pounded and shaken to dislodge the sediment from the bottle. This period of clearing the wine is known as remuage. Special machines are employed to pound the bottles until the sediment is in suspension, and none is left adhering to the bottle. Bottles are then placed in racks at 45° with the necks down. Each day for several months each bottle is lifted and given a quarter of a turn. It is only when the wine is completely clear and the sediment resting on the cork that the operation is complete. Nowadays the bottle is carefully placed with its neck in a brine solution to freeze the wine in the neck. This fixes the sediment in place, and with the bottle right way up, it can be withdrawn adhering to the cork. The wine is now quite dry, and ready for dosing.

A measured quantity of syrup is added with sufficient champagne from a fellow bottle to make up the bottle to the proper level. The dosing machine keeps the bottle under pressure to reduce loss of gas. Sufficient syrup is added to give four sweetness grades—1% syrup to brut, extra dry has 3% syrup, sec or dry has 5%, while douse or sweet has up to 8% of syrup. The drier the wine, the higher quality we know it must be, because the syrup covers up poor grade champagne. After dosing, the bottles are corked and wired, and the champagne is ready to be labelled before being passed on to the market.

So it is that champagne, like most things produced today, has progressed and developed from the first wines produced in that district from which it derives its name. Its history, only a little of which I have mentioned here, proves a fascinating field of study.

Her lips quivered as they approached his. His whole frame trembled when he looked into her eyes. Her chin vibrated and his body shuddered as he held her close to him.

The Moral: Never kiss a girl in a jeep with the engine running.

Two morons each had a horse, but they could not decide which belonged to whom. They cut the mane off one to differentiate, but it soon grew again. Next they cut the tail off one, but it also grew again. Finally they measured them, and found that the black one was three inches taller than the white.

MORE MOBIUS 'MUSEMENTS

By P. J. SCALES

Although the concept of a "one-sided piece of paper" is not easy to visualise in the abstract, it is just such a surface which has provided, and continues to provide, people with an intriguing toy.

Fig. 1.

Its fascination lies principally in its ability to provide surprises, and this is done in many ways.

Take a long strip of paper with parallel edges. (Fig. 1). This may easily be formed into a cylindrical surface by bringing the ends together and joining them. (Fig. 2.) The cylinder holds no surprises, for we can visualise the results of most operations on it.

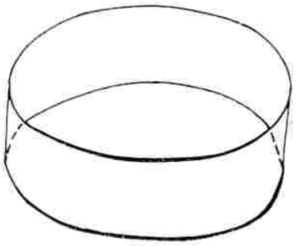


Fig. 2.

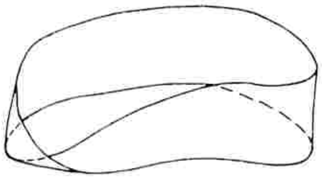


Fig. 3.

If we slice it in halves by a cut midway between the ends we get two cylinders, each of half the height of the original. Slicing at the one-third points yields three cylinders, each of one-third the original height.

However, if we give the ends of the strip a half twist (180°) before joining, a totally different kind of surface results. This is the Mobius strip of the first order. (Fig. 3.) This fascinating surface has but one bounding edge and but one side, for any two points on its surface can be joined by a line which does not cross the edge. Although this in itself is surprising, it is not nearly so surprising as what happens when we start halving or thirding the strip.

When halved by a cut along the middle of the strip, we get not two pieces, but one larger one of half the width and twice the length, having four half twists instead of the original one. (Fig. 4.) When, however, we cut it at one-third the width from the boundary, we return to the starting point, and have, much to our surprise, not three strips, not one strip, but two strips, one like the original, and one like that we obtained when the strip was halved, the two being interlocked once. (Fig. 5.)

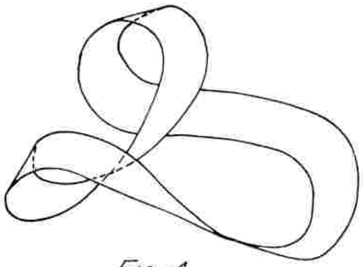


Fig. 4.

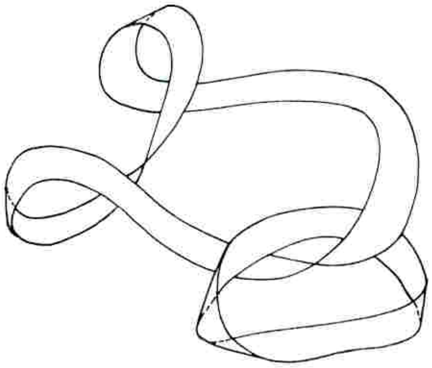


Fig. 5.

Cutting the strip into a larger number of portions can be expressed as a combination of the above two results, although the way in which resulting strips are interlocked quickly becomes complicated.

The Mobius strip of the second order, one with two half twists before joining, is two-sided, and has two boundary curves, but they are linked together. If this is cut down the centre, two strips result, linked together in the same manner as the boundary. When trisected, this strip yields a centre strip similar to the original, linked with a pair of strips similar to the result of bisection.

If a third half-twist is given to the strip before joining, a Mobius strip of the third order results. (Fig. 6.) This is one-sided, and has a single

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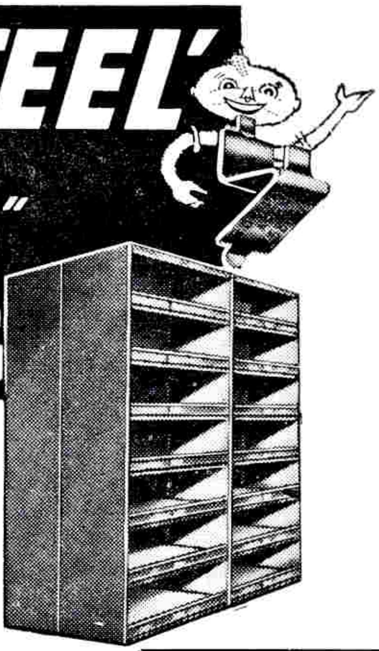

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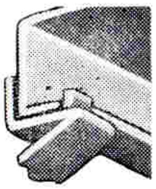

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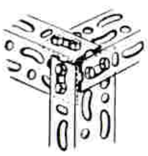

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FINSBURY, SOUTH AUSTRALIA—M 6426 *Telegraphic Address:* **'RUBERKEM'** *Adelaide* boundary curve, which is knotted. This leads us to a most surprising result. This strip itself is not knotted, but when cut down the centre the resulting strip will be knotted! (Fig. 7.)

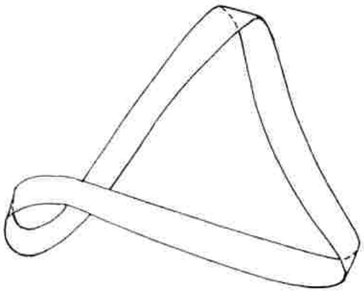


Fig. 6.

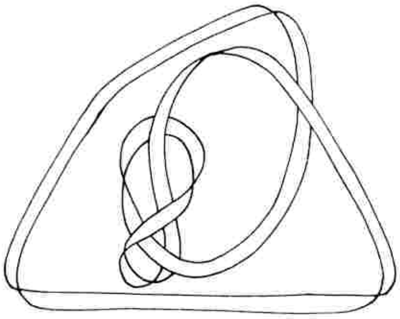


Fig. 7.

A facetious way of stating this is to say it is a method of tying a knot in a closed strip without actually knotting it! Although this seems hard to believe, it is true, as a few moments with a sheet of paper and a pair of scissors will soon show.

Generally, if there are no half-twists before joining, we obtain a Mobius strip of the nth order. If n is odd, the surface is one-sided, and possesses a single boundary curve, which is knotted for n greater than 3, if n is even it has two sides and two linked boundaries.

When a Mobius strip of even order is bisected, two strips similar to the original result, linked together in the same way as the boundaries.

When a Mobius strip of odd order is bisected, only one strip results, similar at the boundary curve (i.e., for n greater than 3 it is knotted, which has $(2n + 2)$ half twists.

If the strips are trisected, the centre strip will resemble the original, but the outer strips will be single or a pair, like the result of bisection, and they will be linked to the centre ring.

However, there is another fascinating aspect of the Mobius strip, and this involves the concept of a "nest of Mobius strips." If m strips are laid one above the other, and this group then given n half twists and corresponding ends joined, then there results a nest of m Mobius strips of the nth order. I shall attempt to explain some of the properties of this assembly when $n = 1$, and leave the reader to extend it at his leisure when, having completed his final exams., he seeks some pastime to while away the lonely hours.

The first thing to do is to convince oneself that the result of bisecting a Mobius strip of order one is a nest of two Mobius strips of order one. (Fig. 8.) Although this is easy if done the right way, it is by no means straightforward if done any other way, as a few minutes of trying will serve to show.

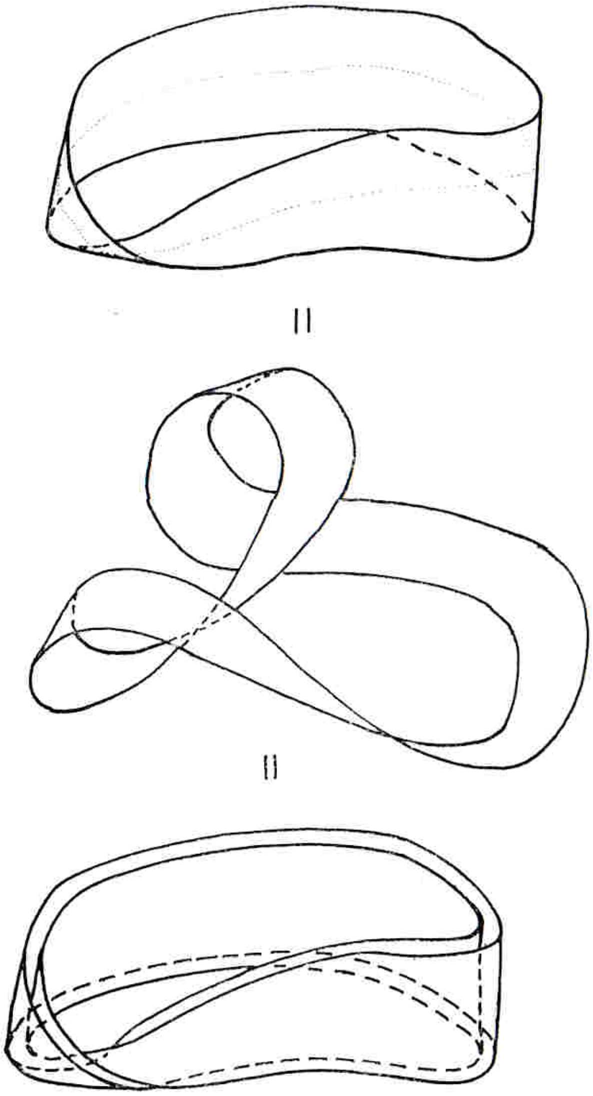
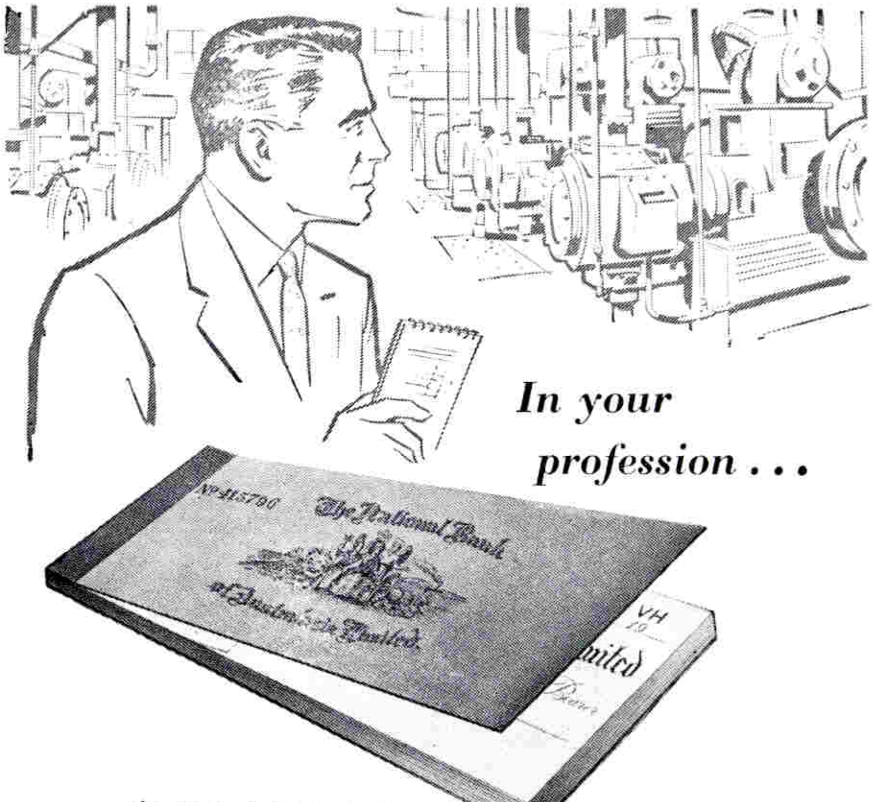


Fig. 8.

A frustrating time can be spent if a nest of two Mobius strips, or order one, is made, and this is deformed into one long strip (as can be done), and then it is attempted to rearrange it in its original form.


In your
profession . . .

It will soon be evident that bisecting a nest of n strips will give a nest of 2n strips, while trisecting a nest of n strips will give a nest of 3n strips. This is not surprising, although if the pieces, after jumbling, are to be reassembled into this form it often appears impossible.

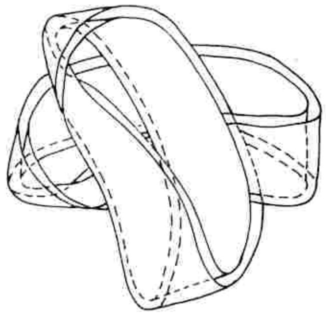


Fig. 9.

The manner in which the resulting pieces can be rearranged into similar nests is likewise fascinating.

For example, bisecting a Mobius nest of two, or order one, can be made to result in two Mobius nests of two, of order one, linked once. (Fig. 9.)

Similar results can be obtained for other more complicated combinations, all of them fascinating, but many of them hard to achieve. Nevertheless, the satisfaction of verifying these amazing results for oneself more than repays the time spent in their discovery.

ENGINEERING ANYONE?

You can see it at the beginning of any academic year—and what a pitiful sight it is! Those poor half-frightened kids, with their trousers nicely pressed and their shoes polished up bright and shiny, wandering uncertainly in the general direction of that big ugly building over there.

And what's that they're clutching nervously in their trembling little hands? Only a piece of paper with a big "A" printed on it.

Ah, now you know. They're freshers, enrolling for the first time. What's so special about that?

These are special freshers. These are engineers. They move slowly towards that ominous building, wonderously impressed by the magnificence surrounding them, no doubt calling to mind the exaggerated accounts of the glamor and tradition of the place that they have heard, and believed, if only because they were in town once on Prosh. Day.

Suddenly they are inside. The many-toothed wheels of the enrolment mill churn and thrash. Our freshers are tossed and battered, flayed and flurried, and finally spat out, wondering what the hell hit them.

And so another hundred students' names are entered in the books of the Faculty of Engineering.

But why?

Why did these seemingly intelligent lads choose engineering? Perhaps they just wanted something to do for a few years while they're waiting to inherit the family fortunes. Yes, perhaps. But it does seem a little silly to study engineering. After all, who wants to talk about bridges and things at a party? And then there's all that work. No. Arts seems to be a much better proposition.

Well, perhaps it's the engineers' high social standing in the community that attracts them.

Ha, ha! Hearty ha, ha! Ninety per cent. of the people who don't think of the man at the local garage with a dirty rag in one hand and a grease gun in the other when the word engineer is mentioned have never heard the word before.

Then there's just one other possibility. There must be money in it. Yes, there certainly is. After half as much work again as for any other course, the engineer can claim at least half the salary rate of his counterpart in, say, the medical profession.

Then why would anyone in his right mind want to be an engineer?

There is just one reason. He wants to be an engineer because that is what he wants to be. It is the only course which appeals to him. If any other appealed to him equally, he would surely have chosen it instead. He wants to create, and not only to create, but to create something useful, that can be used for the benefit of mankind.

He accepts the great challenge his profession offers to his ingenuity. He cannot bury his mistakes in the grave, like doctors. He cannot argue them into thin air, or blame the judges, like lawyers. He cannot, like architects, cover his failures with trees and vines. He cannot, like politicians, hide his shortcomings by blaming his opponents, and hoping that people will forget. He is praised or damned for what he does. This is his privilege.

And so you want to be an engineer. Despite the hardships and sacrifices, not to mention the complete lack of man's most vital need, women, you battle on.

—GREASER.

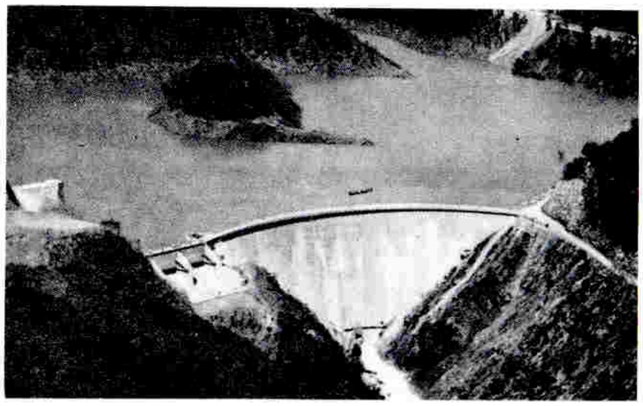
ON THE SNOWY

By A. N. VLADCOFF

The Snowy Mountains project was developed primarily for diverting water from the well-watered eastern side of the Great Dividing Range to the fertile but dry western plains. In going from east to west, the mountains rise only gradually to a peak height of 7,314 feet at Mount Kosciusko. There is then a steep drop of over 6,000 feet on the western side, and it is this geography which is responsible for the well-watered east but dry west. Clouds coming from the west condense as they pass over the high range, and the rain falling over the vast area on the east of the Diving Range mainly flows into the Snowy catchment. As the western side is steep, very little area is available to catch water to flow into the Tumut and Murray Rivers. In addition, melting snows covering great areas add further water to the Snowy catchment. As a consequence, the Snowy River frequently becomes flooded, and the water is wasted, as it runs through the well-watered coastal belt of Victoria into the Tasman Sea.

It is important to realise that the Snowy River flows at an altitude of some 2,000 feet above the Murray and Tumut Rivers. So in tunnelling the water from east to west, it is made to drop down through pressure shafts into water turbines, and so drive generators to supply power to Victoria and New South Wales. The complete scheme will eventually consist of four major power stations and many smaller ones. The scheme has basically one huge water storage, Lake Eucumbine, which stores all water not being used at the time. Lake Eucumbine is formed by an earth and rock fill dam across the River Eucumbine, which is a tributary to the Snowy River. This dam is nearly half a mile thick at its base, and is 380 feet high. It was completed in 1957, and at the moment is about one-third full. When full, it will contain nine times as much water as Sydney Harbour. This is enormous, but is really nothing in comparison to the catchment in the Zambesi River (Southern Rhodesia) caused by the Kariba Dam. (The Kariba Dam is of comparable height and length to the Eucumbine Dam, but is a concrete arch dam.) Water from Lake Eucumbine is then tunnelled to two different schemes. In the first scheme water passes through the Tumut I and Tumut II power stations, and then into the Tumut River, which then flows into the Murrumbidgee River. At the moment Tumut I station is in operation, while in Tumut II station generator installation is still proceeding. Both are underground stations, and will be the only ones such. The output power of these two stations is 600 M.W.

The second scheme, which is still only on the drawing board, plans for water to flow from Lake Eucumbine to the Murray River, passing through two power stations on its way (Murray I and Murray II stations). Murray I station originally was intended to be 1,000 M.W. power output, and underground. However, it is now to be a surface station of 760 M.W. output (eight generators, each of 95 M.W. output). Murray II station will probably contain four generators, each of 110 M.W. capacity. These two stations will be on the western side of the Dividing Range, close to the beautiful township of Khancoban. This township lies on a very flat plain, surrounded on all sides by mountains. The peak of Kosciusko can just be seen from this township. Viewed from the western side, Kosciusko is most impressive, rising over one mile suddenly. But viewed from the east it fails to impress because of the gradual grade.



VIEW OVER TUMUT PONDS DAM
(We acknowledge Nucolorvue Productions)

In addition to the basic scheme pointed out are various dams and catchments to collect every drop of water that falls on the Snowy Mountains. The Tantangara Dam across the Upper Murrumbidgee collects water which is diverted to Lake Eucumbine. This water eventually finishes up in the Murrumbidgee again, but in this way the water is controlled, being stored in the winter months, when floods would result, and used in the dry seasons as required, meanwhile producing power. The Tooma Reservoir and the Jindabyne Reservoir are other major subsidiary catchments, the first supplying water to the Tumut scheme, and the second to the Murray scheme.

The Tumut Pond Dam, collecting water for the Tumut I station, is a masterpiece of engineering beauty. Built by American contractors, it stands 280 feet high and 80 feet thick at the base. It is a concrete arch dam, built in the very narrow Tumut valley. The Eucumbine Dam, while not so pleasing to the eye, impresses because of its fantastic size. The choice of whether to build a concrete dam or an earth dam is mainly one of economics. Where the valley is very narrow, an arch dam often is profitable, as it requires far less concrete than a gravity dam.

The generators used in Tumut I and II stations were made by the Swedish firm, A.S.E.A. The turbines driving these are ordinary Francis turbines, which appear satisfactory even up to pressure heads of 1,000 feet. Generators having sixteen poles are used in Tumut I station, which means a turbine speed of 375 r.p.m. is necessary. In Tumut II station, however, turbine speeds of 428 r.p.m. are satisfactory, and so machines having fourteen poles are used. The higher turbine speed means that a smaller turbine can be used. The author was engaged on work involving the generator installation of this station. Generation is at 12.5 k.v., and this voltage is brought up to 330 k.v. by single-phase transformers in the power station. Underground cables then take the power to the surface, and then on to the transmission lines.

To those who have not yet visited the scheme I would recommend that they do so. Not only is the engineering side excellent, but the natural beauty of the Snowy Mountains regions is something to see. A day's hiking near Mount Kosciusko under a guide is especially rewarding, not only from the spectacular views to be seen, but also from the thrill of ski-ing. If you do not have any skis, it is not hard to ski on your shoes, provided the mountain is of the correct slope. If it is not steep enough you won't move. If it is too steep you may break your neck! But even if you do, you won't regret having gone to the Snowy Mountains.

I once had a classmate named Guesser,
Whose knowledge grew lesser and lesser,
It grew so small
He knew nothing at all,
And now he's a College Professor.

Mary bought a pair of skates,
Upon the ice to frisk.
Now, wasn't she a little fool,
Her little *.

"Read not to contradict and confute, nor to believe and take for granted . . . but to weigh and consider."

S.C.I.I.A.E.S. THE SUPREME

Looking back on the latter part of last year and the earlier part of 1961, we see new spirit and interest unfold in the ranks of S.C.I.I.A.E.S. members. During this period we can say there was shaped an everlasting memory in the society's history and traditions. For these were the days of plenty: plenty of fun and frolic, plenty of mystery and intrigue, and plenty of disorganised chaos.

Prosh Day, 1960, brought forth victory at the Drinking Horn for the men of purity. A crown which was shaped beyond doubt for S.C.I.I.A.E.S., and a crown which will be difficult to dislodge by those foolish enough to try. Yet the Drinking Horn was not the only conquest of the 1960 Prosh. Early the same morning men (and women) of purity convened to the East Parklands for sustenance. Early morning workers treading their weary way to fulfil their duty to society in the vast buildings of the city could not help but stop and gaze upon these poor unfortunate creatures preparing breakfast over crude wood fires. Those who preferred to ignore such carrying on were jolted from their semi-conscious state by the sweet (loud) strains of Dixieland jazz, provided by several quite well-known musicians. And so the dawn passed unto day and workers unto work, much wider awake than usual for that time of day. Oblivious to all of this, the purity breakfast was served and enjoyed (under the watchful eye of the television camera).

Further events had occurred before the breakfast. Very early the same morning, while couples hand-in-hand made their unsteady way home, a band of valiant puritans, under the leadership of two present committeemen, were involved in a hazardous mission in the centre of the city. Along the now quiet Rundle Street two large objects were placed at pre-selected spots. These objects had been under design and construction from weeks previous. Each contained a very high-charged car battery, timing device, car horn, and several cwt. of cement and steel ballast. To penetrate into this interior one would have to pierce two and a half feet of cement at the top, and ¼ in. welded plate at the base. The outside appearance bore a remarkable resemblance to an Adelaide City Council rubbish bin, and as in the case of so many of these bins, they were chained securely to street posts. To keep prying eyes from observing too closely these engineering masterpieces, a "Wet Paint" sign was hung on each. As the day wore on, and activity in the city reached its peak, two horns, one following five minutes after the first, were heard to echo up and down the street. Here human nature played her part. People from all walks of life stopped and stared, and so, as time passed, and the intent staring faces grew, so did chaos. However, to

NOT TO BE TEMPTED
S.C.I.I.A.E.S. members are untouched by modern standards

this enlarging situation came the protectors of our fair city—the Police Force. But harken—they could not disperse the populace. Experts were called, and in the meantime the traffic stopped. Some thirty minutes later, after many unsuccessful attempts (in which S.C.I.I.A.E.S. and Chaos remained masters), two police cars left Rundle Street with familiar noises issuing from their boots, and so was one more phase in puritan history recorded. (We were to hear later that all that afternoon car horns could be heard bleating their defiant message within the City Watch-house.)

Now let us turn our eyes to First Term, 1961. Now S.C.I.I.A.E.S.-sponsored adventures followed in quick succession.

1.30 p.m., Friday, May 5: A new World-wide Bed Cram Record was set in the University cloisters by S.C.I.I.A.E.S., assisted by a band of assorted rabble and fellow Engineers, with moral help from 1,200 onlookers. That day no one knew for sure who his bedfellows were, and though a little crushed and bruised, each became a part of an already growing legend. An interruption to the frivolity by one who dared defile the puritan right was met by a fitting judgment in the cool waters of the River Torrens.

Quote, "Advertiser," May 6, 1961: "A student thrown into the Torrens Lake, 75 others crammed on to a double bed. This is what happened at the Adelaide University yesterday in the University's most hilarious lunch-hour period for years. The occasion was bed-cram, arranged by S.C.I.I.A.E.S. The bed-cramming effort beat the U.S. record of 67."

1.35 p.m., Wednesday, May 10, 1961. Annual Med.-Engineers' Tug-o'-War. On this bright day in autumn the revenge held for a year against our nearest and dearest neighbouring faculty was unleashed. From amid the falling cloud of flour and eggs (rotten) were heard the cries of discontent so long in our hearts, and we lifted our heads in thanks to those above for giving us such a beautiful day in which to relish our greatest victory. For this was our finest hour. To anyone who watched the spectacle it would be foolish to ask who won, for never has a victory been more conclusive.

Quote commentator, ADS-7: "Throughout the event the Meds. suffered at the hands of the Engineers, and although the competition was declared a 'dead-heat,' one can only conclude that a victory had been scored."

Throughout the period of the above events and the preceding weeks S.C.I.I.A.E.S. had been preparing yet another achievement for her archives. Negotiations were made with the University of Detroit, Michigan, to place an entry in the University of Detroit's International Invitation Turtle Tournament, and for several weeks correspondence passed between S.C.I.I.A.E.S., Adelaide, and the U.S.A.

"Dear President,—Once again, or should I say the second 'International Inter-Collegiate Turtle Tournament' is being sponsored by the University of Detroit. Last year this event was carried by Associated Press and United Press International on their services. Douglas Edwards carried movies on coast-to-coast television, along with extensive coverage by four national magazines. Entries from all over the world were received. These included universities such as Heidelberg, Oxford, and the University of Alaska, with their entry, 'Nanook of the North,' who was placed second in a field of 390 turtles.

"There is a total of 15 places which are awarded trophies and given extensive coast-to-coast publicity. If you are interested in entering a turtle, please send me (care of University of Detroit), one turtle and one dollar ($1.00) to defray the cost of shipping him back to you after the race. The purpose of the race is to get publicity for the University of Detroit Spring Carnival. The proceeds of the Carnival here in the past ten years completely paid the $500,000.00 student pledge for the beautiful Student Union Building. Our new goal is a $2,000,000.00 Student Activities Building, which is very badly needed on the campus.

"Use your imagination in decorating your entry.

"Hoping to hear from you as soon as possible, as race is scheduled for May 1, 1961, at 12 noon. —I remain, sincerely,

"BOB BOWEN (Head Turtle Keeper)."

"Mr. Bob Bowen, Head Turtle Keeper, Spring Carnival, University of Detroit, Michigan, U.S.A.

"Dear Friends in the Northern Hemisphere,—Your letter concerning the International Turtle Tournament has found its way into the esteemed 'Society for the Confining of Immoral Impulses Among Engineering Students,' a society made up of the bulk of fun-loving students (both male and female) in the University of Adelaide.

"We feel best suited in the task of joining and supporting your cause. Please find enclosed £1 Australian (equivalent to 2.22 dollars), in the hope that our entry will receive the best afforded attention, and will appear at the peak of his efficiency for the tournament. A trophy, if won, will be placed in the treasure room of the S.C.I.I.A.E.S. Enclosed is a design we wish to submit in the decoration of our entry.

"We look forward to hearing from you again. The S.C.I.I.A.E.S. is only too willing to co-operate with fellow students in the U.S.A. in any matter with which you think we would be interested.—I remain, sincerely,

"DOUG REILLY, President S.C.I.I.A.E.S., Adelaide."

RULES FOR THE SECOND ANNUAL INTERNATIONAL INTER-COLLEGIATE TURTLE TOURNAMENT

1.—Your turtle must not weigh more than 250 pounds or less than 1/100 ounce.

2.—You must send your turtle, if it is cleanly shaven, to the tournament.

3.—If your turtle is a she, you must indicate on the entry blank (for protection) what color hair and eyes she has.

4.—All turtles must have their toenails clipped before they are allowed to race.

5.—Please let us know the type of music your turtle likes, so we can keep him, her, or it content while it is in Detroit.

6.—Please state the type of food your turtle likes best, so we will be sure not to feed it to him.

LEFT: Record - breaking attempt continues, despite opposition.

BOTTOM LEFT: The reward for "Tulloch Turtle's" distinguished efforts.

7.—Please enclose a copy of all previous races won by your turtle, and how fast you have clocked him.

8.—The breeding of your turtle is very important, and we would like you to enclose a copy of his pedigree.

9.—You can send along a trainer with your turtle if you so desire.

10.—Owners will be held for damages that their turtle may do.

11.—Length of turtle's tail may not exceed 2,359 feet when it is retracted.

"Doug Reilly, President S.C.I.I.A.E.S., University of Adelaide.

"Dear Doug,—On behalf of the University of Detroit Spring Carnival, we would like to take this opportunity to express our sincere thanks to you for entering the Second Annual International Inter-Collegiate Turtle Tournament.

"'Aussie" made an excellent showing, and was placed sixth in the finals. Other winners were:

"1.—California State Polytechnical Institute.
"2.—University of Kentucky.
"3.—Los Angeles Metropolitan College.
"4.—University of Detroit."
"5.—Natchez State College.
"6.—University of Adelaide, Australia.
"7.—Michigan College of Mining and Technology.
"8.—St. Joseph College.
"9.—University of Edinburgh.
"1.0—University of Auckland, New Zealand.

"Congratulations, and thanks again.—We remain sincerely,

"U. of D. Turtle Committee,
"GINNY COOK,
"BOB BOWEN, General Chairmen."

S.C.I.I.A.E.S. has now received its gold-plated trophy for our turtle's grand racing.

S.C.I.I.A.E.S. purity is being carried to ever higher celestial heights.

THE ADELAIDE UNIVERSITY REGIMENT

The Adelaide University Regiment, C.M.F., needs recruits and also engineering students for the proposed Assault Pioneer Platoon to be formed this year, so that it can carry out its function at the January, 1962, annual C.M.F. camp.

Instruction on all types of vehicles is another part of the A.U.R. training. From left, Lieut. Richard Evans, of Unley Park, S.A., and L/Cpl. Ralph Tabor, of Sandwell, S.A., both University students, take a few tips from Private Kevin Newton, of Norwood, S.A., who is a technical assistant at the University.

Camp attendance with this platoon in the long vacation will count towards practical engineering training, so it is hoped that many of the students will join the Regiment.

The Pioneer syllabus will include the technical handling of explosives, watermanship, mine laying and lifting, breaching and preparation of defensives, and demolitions.

At the same time, the terms of enlistment include excellent pay, good facilities during the camp, and comradeship among the men of the University.

A minimum of ten men is required to raise the Assault Pioneer Platoon, which will then be brought up to strength as soon as the recruiting rate allows.

Many Engineering graduates and undergraduates have served with the unit, and the present Commanding Officer, Lieut.-Colonel J. R. N. Twopeny, is himself a Bachelor of Engineering.

As an officers' cadre unit, the A.U.R. needs your assistance, for it is from such units that many of the leaders of the armed forces are selected in times of war.

The A.U.R. has a short but outstanding history.

When the C.M.F. was re-formed after the Second World War, in 1948, the A.U.R. was the first University to establish a Regiment. It was formed as an Infantry Battalion, with the primary role of producing a maximum number of officers for all arms and services.

Since that date more than 70 officers have been commissioned in the Regiment alone.

In the period 1948–52 the unit had built up a volunteer strength of 250 officers and men, and it could boast that it had won the Returned Servicemen's Trophy three times as the most efficient C.M.F. unit in S.A.

This was a remarkable achievement in competition with such famous Regiments as the 10th Bn. (Adelaide Rifles), 27th Bn. (S.A. Scottish), 43rd/48th Bn. (Hindmarsh Regiment), and the 3rd/9th S.A. Mounted Rifles.

On reorganisation of the Army these Regiments have since been incorporated in the 1st Battalion, Royal S.A. Regiment (BG), but the A.U.R. has remained an officers' cadre unit. This is obviously an appreciation of its potential as an officer production unit.

It still has its own Pipe and Drum Band, first formed in 1950, and the Napier tartan kilt adopted was chosen in honour of the Adelaide University Chancellor, the S.A. Chief Justice, Sir Mellis Napier.

When National Service Training was introduced, all University trainees did their obligatory C.M.F. training with the A.U.R., which was geared to ensure that the service did not interfere with University study time.

Today this is still the policy of the Regiment.

After the first intake of N.S. trainees, the strength of the unit doubled, and training covered a wider field, compulsory under the N.S. Act. Two rifle companies, the support company and regimental headquarters, were at full strength.

The year 1953 was important to the Regiment, for it marked the affiliation with the famous Royal Ulster Rifles, by approval of Her Majesty the Queen.

The bond between the two units was further cemented on the visit of the Colonel of the Royal Ulster Rifles to the A.U.R. annual camp in 1955.

Some of the equipment which will be part of the responsibility of the new Assault Pioneer Platoon. Shown looking it over are, from left, Private John Haslam, of Hawthorn, S.A.; Corporal Ian Ward, of Findon, S.A.; and Lieut. Ian Maitland, of St. Mark's College, North Adelaide, holding an anti-personnel mine. In front are a beehive anti-tank charge, demolition test set, and an exploder's dynamo.

Another honour was permission to mount a Government House Guard on the occasion of the Royal visit in 1954. In 1956 a Guard of Honour was mounted for the visit of the Governor-General of Australia, Sir William Slim.

In January, 1957, by approval of Her Majesty, Queen's and Regimental Colours were presented to the A.U.R. at a ceremony on the University Oval.

The Government decree terminating the N.S. scheme in 1960 affected the A.U.R. the same as all other units, and the C.M.F. compulsory service ceased.

The units is now back to the position prior to 1952—an under-strength unit, but with fine traditions built up over the past twelve years.

Two Honorary Colonels have accepted appointment to the Regiment since its inception—Brigadier A. S. Blackburn, V.C., and Brigadier Sir Kenneth Wills, K.B.E., M.C., E.D., who has filled the position since 1955.

From 1948 there have been six Commanding Officers, but it was the first, Lieut.-Colonel R. J. Lipman, a graduate in dentistry from the Adelaide University, who, by his individual effort, made the A.U.R. possible. With his experience as an officer of the 2nd Australian Imperial Forces in World War II, he was able to place the unit on a sound footing.

He was followed by an A.U.R. law graduate, Lieut.-Colonel J. A. Maitland, O.B.E., who today is the Secretary of the Law Society.

Every Wednesday evening the Adelaide University Regiment gets down to serious training at the Torrens Drill Hall. Above, an all-University student 3-inch mortar team practises loading. From left, Privates Patrick Bagot, of Medindie, S.A.; Sev Amadio, of Campbelltown, S.A.; and Joseph Lorenzin, of Warradale, S.A.

Preparing technical models is part of the A.U.R. Intelligence Section's job. From left are shown Sergeant Maxwell Weir, of Largs Bay; getting down to business with the paste is Private Sven Kuusk, of Woodville, S.A.; and right, Lieut. Jim Munro, of Aldgate, S.A., checks the details. All are University members.

Lieut.-Colonel R. A. Blackburn, son of a distinguished soldier, took over command from 1955 to 1957. He was a Professor of Law at the University, but is now in private practice in Adelaide.

Lieut.-Colonel I. B. Down followed, and in 1961 Lieut.-Colonel J. A. Pollok, M.C., handed over to Lieut.-Colonel J. R. N. Twopeny, who is the present commander.

The present second-in-command, Major P. O. G. Forbes, M.C., follows a line of distinguished war-time soldiers. His father won the Miliary Cross in the 1914–18 war, his elder brother the same decoration in the Second World War, and he himself left the Regiment to join the Australian Forces in Korea, where he was also awarded the Military Cross.

Many prominent members of the University have served with the A.U.R., including Professors J. P. Morgan, R. A. Blackburn, and J. J. C. Smart.

The Adelaide University Regiment Pipe and Drum Band has some teachers among its members. Practising, from left, are a drawing teacher from the Institute of Technology, Private Neil Wallace, of Tranmere, S.A.,; a student at the Institute and branch credit manager of an Adelaide finance firm, L/Cpl Ray Arthur, of Forbes, S.A.; and a drawing teacher from the Findon High School, Private George Phillips, of Edwardstown, S.A.

DEPARTMENT OF MINING, METALLURGICAL, AND CHEMICAL ENGINEERING

REVIEW OF ACTIVITIES FOR 1961

During the past year the number of staff and students actively engaged on research in this Department has grown to twenty. The main fields of activity being studied are the diffusion of gases through solids, production of lead from its ores, the corrosion of iron and its alloys, and heat and momentum transfer between phases. In addition, some work is being done on certain aspects of rocket propellants. The first, third, and fourth of the above projects are supported by the Australian Atomic Energy Commission, and the second by B.H.A.S.

Some of the techniques which we are investigating have been used industrially for many years, but lack a fundamental basis for future design work. Others, such as the use of "transport beds" for the reduction of lead ores, are comparatively new. In all cases the purpose of our research is to supply fundamental knowledge from which future plants may be built.

Partly because of the rapid expansion of our research activities, and partly because of an increase of almost 50 per cent. in the number of students in the 4th and 5th years of the Metallurgical and Chemical Engineering course. we are finding our present quarters somewhat cramped. However, rumours that the raising of the roof above our Department was undertaken to relieve pressure generated by over-crowding have no foundation in fact.

Since January the activities of our Mining section have been somewhat curtailed, as we lost our Reader in Mining (Mr. J. P. Morgan), who left us to become Professor of Mining in the University of New South Wales. In the meantime Mr. A. S. Lewis is carrying on single-handed the work of the Mining School.

DR. R. W. F. TAIT.

THE ROOM AT THE TOP

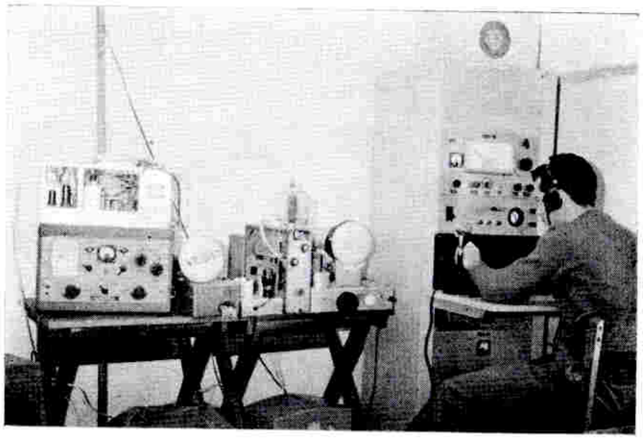
The University of Adelaide Radio Club is a group of students, from no faculty in particular, who have a common spare-time interest in some kind of gadgetry involving electronics. Most of the thirty-five or so members are fairly well acquainted with Ohm's Law and the use of a few tools, but no one needs to be a trained technician to join in.

The "shack" occupied by the Club is a small room at the top of the Electrical Engineering Department, ninety-eight steps from the ground, and near the circular platform perched on the roof. It is always open at lunch time during the term, as well as at other times, so come up and have a look around.

Everyone is impressed when he see a "ham" radio station. If he arrives at the right time he may find the owner talking to a battered old microphone plugged into a pile of parts on the table, with wire entanglements everywhere, and then hear the voice of the other fellow coming from hundreds or thousands of miles away. If the visitor can't escape in time he will himself be obliged to have a few words with the chap at the other end of the "ether," and it's a pretty thrilling experience. Most of these special radio stations, numbering about 5,000 in Australia, and 230,000 around the world, are privately owned, and inaccessible to the public, but there is one up in the Shack that is available at no cost whatever for the use of any students at this University. There is no reason why the Club shouldn't be able to contact any other amateur radio station which has adequate equipment, provided that it has gone about it in a businesslike way, and with due regard to a number of technical matters. We are rather restricted by certain regulations, but anyone who would like to arrange a talk with, say, students elsewhere in the world is invited to discuss it with one of our communicating "experts," and one thing that may help is a recent announcement that contacts needn't now be conducted exclusively in English, so you can speak Cantonese or Malay if you like.

One condition for the use of any of the Club's equipment is that an authorised member must be the holder of an "Amateur Operator's Certificate of Proficiency" issued by the P.M.G.'s Department. To qualify for the AOCP you have to pass an exam. with papers in radio theory (without the Maths.!), certain regulations, and Morse Code, which is pretty difficult. However, if you can manage everything but the Code you will be granted the Limited Certificate, to allow you to play only with the frequency allocations above 50Mc/S. There are ten members with one or other of these transmitting licences, and they all have private stations at home. The professionals who operate marine, aircraft, and Government stations are holders of various classes of the Commercial Operator's Certificate of Proficiency, which is of a higher standard generally. All amateur radio stations in Australia have call signs starting with the letters VK, followed by the number for the State. The call sign of this Club is VK5UA.

For reception, the set most used in the Shack is one that the U.S. Signal Corps lost at the end of World War II, and we eventually found it. It can be tuned between 1.5 and 18Mc/S, and is popular with the short-wave listeners because of its definite superiority over the "dual wave" set found in many homes. If any groups at the University would like to hear a particular radio broadcast from overseas they are invited to use the facilities in the Radio Shack. Write a note to the Secretary, Bob Ramsey, c/o the Shack (under the door) or Pigeonhole "R" in the George Murray Building, giving the date of the broadcast in GMT, the metre or frequency-band if you know it, and a return address. He would appreciate reasonable notice to help in arrangements with the caretaker. Seating and extension speakers can be provided if they are needed.



PRESIDENT MAX KIMBER AT THE HAM TRANSMITTER, AND (LEFT) PART OF THE TV STATION

In the TV Department a low-cost picture transmitter has been built up from a home-made TV set, various Government disposals items, and a heap of other nondescript articles. This TV station bears no relationship to any other model—it's unique. A permit has been obtained for the experiment, and pictures that sometimes conform to the S.A.A. code can be sent under the call sign VK5UA/T on a frequency of 292 Mc/S, in the amateur one metre band. There are also a few other "ham" TV stations in the metropolitan area.

Until some kind soul gives us the parts that make the TV studio camera "tick," a Flying Spot Scanner is being used with 35 mm. photographic slides. It is said that there shall be no commercials or music on any amateur TV picture, so we are confining ourselves to interesting technical topics.

But radio and TV are not the only things that are going on. A number of people are making Hi-Fi outfits, and a few even want us to build an easy electronic digital computer. All these bright ideas are covered in our monthly magazine, "Splatter" (which is available to anyone for a small donation). The monthly meetings are usually held in the Chapman Lecture Theatre on Monday nights, starting at 7.45. They are well publicised in the Engineering School and elsewhere at the University. They generally take the form of short talks, with suitable demonstrations of home-made equipment, films, and visits to interesting places like TV studios. If you would like to know more about the Radio Club, whose members practise what is really a specialist branch of Engineering for relaxation, please do come along and see it all for yourself.

A.U.M.C. NOTES

The winning Prosh float for 1960 is guided gracefully along Rundle Street by a capable crew of Engineers.

The "Adelaide University Modellers' Club" is a small group of keen model engineers. Our members' interests include boat building, model railroads, and aero modelling. The Torrens Lake provides an ideal ocean for boats, and is used for such in the warmer months. A permanent model railway layout is under construction in one of the clubrooms. There is no "flying space" within the University grounds that is available to aero-modellers, and all club flying is done at club picnics, held at National Park.

In the past club members have also used their talents with great success in the preparing of "Prosh" floats. To the author's knowledge, two first prizes have been won by the club. The first was for a full-size scale model train which actually ran in the tram lines. Last year success was again ours with the entry, "The R.A.A.F.'s New Fighter." This year we are hoping to put a float in the Prosh, provided good ideas are forthcoming.

New members are always welcomed, and interested visitors will be shown around. The clubrooms are in the George Murray Basement.

These poems were hastily prepared for the Final Year Mech. Engineers and Staff.

Now W.D.
Went on a spree
With tensile and flexuous stresses.
He was brought down
For acting the clown
In Mosquitoes designed by guesses.

Jim Fowler's the name,
And he wears it with shame,
For today his negative blackened.
His analogs fell
Back into hell,
From where they obviously came.
K. D. Lightburn.

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