1963

hysteresis

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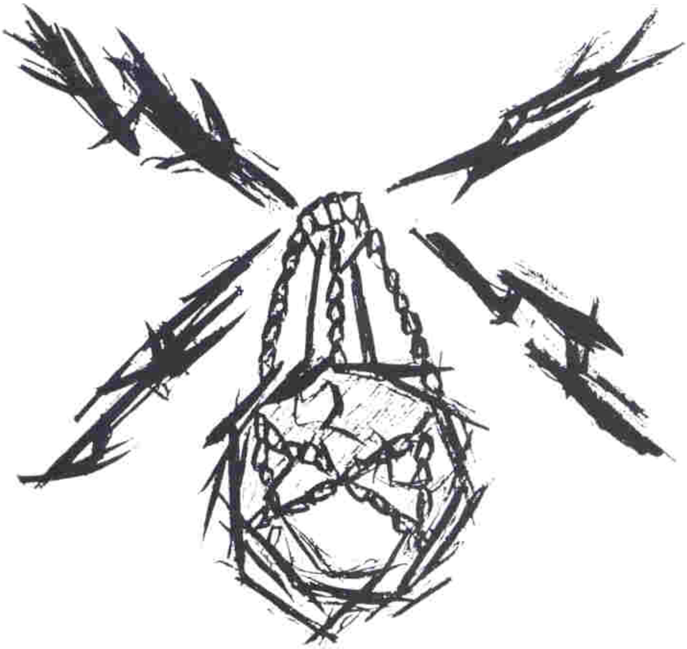

official yearbook
adelaide university
engineering society

HYSTERESIS - - - - - 1963

Editors: Frank James, Michael Porter

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CONTENTS

EDITORIAL

L'amore di qualunque cosa e' figiuolo d'esso cognitione.
L'amore a tanto piu fervente, quanto la cognitione e' piu certa.

Knowledge of a thing engenders love of it;
The more exact the knowledge, the more fervent the love.

LEONARDO DA VINCI.

Those people who have read "Hysteresis" in previous years will realise that this edition constitutes a substantial breakaway from the tradition which has prevailed since 1957. This follows partly from a change which has occurred over the years in the optimum economic layout of a magazine of this nature, and partly from the editor's chronic addiction to change.

When one looks around at one's fellow engineering students, a passage from the tenth book of Plato's Republic comes to mind. The passage can be roughly rendered thus:

". . . spirits of a day, at the beginning of a mortal race (death enduring), the spirit will not be assigned to you by lot or chance, but you will seize upon a spirit, and let him who chooses first seize upon the life with which he is of necessity familiar."

Observing the atmosphere of uneasily single-minded application to examinable work which permeates the faculty, one wonders whether other activities are adequately pursued. Are engineers uncultured, unaccomplished boors, good for use only as a sort of innovating computer? Some groups demonstrably are not, but they seem to be in minority. Recent attempts to form an A.U.E.S. library, theatre groups and a dinner party were nervously laughed out of existence. Over the years, such things as debates, the Engineers' Revue and similar intellectually stimulating activities have died.

In contrast to his partly disguised, but yet unflinching aim for a B.E., the engineer-to-be adopts to most other activities a most uninspiring attitude, if attitude it can indeed be called. Most have some outside activities, but these are in general uniformly uninteresting and apposite, and could well be classed as narrow. This is somewhat incomprehensible when one considers the multitude of opportunities for Australian engineering undergraduates to broaden their horizons and improve their individual lots, the lot of their fellows and the lot of those that they contact. The spirit of adventure and achievement is sadly missing in the attitude to travel, self development and learning.

And so we come to our quote at the head of this editorial. Until the greaser tries these activities let him throw no stones, and let us hope that he will indeed try them; that he will seize upon a spirit of vital adventure, clear his mind of over-preoccupation with life's mundaneties and try a less innocuous part. In the words of Gilbert and Sullivan's Pirate King.

"Oh, better far to live and die
Under the brave black flag I fly,
Than play a sanctimonious part
With a pirate head and a pirate heart."

Let the engineer not fear the line St. James i., 8

"A double-minded man is unstable in all his ways."

Unless all which has been said here has been misunderstood, these activities applied as should be, can only aid study. To the original quotation can be added another, also attributed to da Vinci:

"The senses belong to the earth; reason when she contemplates stands outside them."

Let us not starve the senses, but widen their sphere of experience and increase their awareness that they may better complement reason and help clarify our concept of the nature of the Universe whence we convert "the great source of power in nature to the use and convenience of man." This cannot but aid our personal application of ingenuity to engineering, especially if it engenders love of our subject. In the immortal words of Alfred, Lord Tennyson:

". . . ; that which we are, we are;
One temper of heroic hearts,
Made weak by time and fate, but strong in will
To strive, to seek, to find, and not to yield."

(Ulysses.)

This is not an old or a new idea, it is an enduring one. In 1912, Sir Ernest Shackleton is quoted as saying:

"Object, I have no object. Can't you understand, can't you sympathise with the idea of the romance of the absolutely unknown and the unattainable? But of course you can."

(*The Tapestry of Life*—Blathwayt.)

Those of us who have, and shall continue to urge, an increased awareness and greater sensitivity to our surroundings might be encouraged by the words of Arthur Hugh Clough:

"Say not the struggle nought availeth,
For while the tired waves, vainly breaking,
Seem here no painful inch to gain,
Far back through creeks and inlets making
Comes silent, flooding in, the main."

and now a thought for students and staff alike, expressed in the words of H. L. Mencken:

"An enthusiast is willing to go to any trouble to impart the glad news bubbling within him. He thinks that it is important and valuable to know; given the slightest glow of interest to start with he will fan that glow to a flame. No hollow formalism cripples him and slows him down. He drags his best pupils along as fast as they can go, and he is so full of the thing that he never tires of expounding its elements to the dullest."

(*Prejudices Education*—H. L. Mencken.)

Let any reader who denies romance and adventure as existing actualities of our environment merely spend a little time meditating on the end or limit, or boundary of the universe.

Meanwhile, with John Keats:

". . . on the shore
Of the wide world I stand alone, and think
Till love and fame to nothingness do sink."

(*When I Have Fears*—Keats.)

and finally for the other side of the record,

"He who feels most, is the greatest of the martyrs."

(Leonardo da Vinci.)

The Dean's Page

"And ye shall hallow the fiftieth year . . . it shall be a jubilee unto you. . . .

Leviticus 25:10.

It is with pleasure that the writer takes up the task of writing this article, because he is th first who was an undergraduate member of your society to be eligible to do so. Therefore, it is a once a great privilege and a great responsibility. It was not until 1920, when earlier Deans ha completed their courses, that your Society was formed. Until then Engineering undergraduates ha joined the Science Association.

This year our Engineering School celebrates the Jubilee of the allowance of the first Regulations, and of the conferring of the first Degrees in Engineering—upon 24 graduates in all, 22 of whom surrendered their Degrees in Science to get it, and two of whom completed the transition course set. One of the latter, Mr. J. R. Brookman, attended your dinner this year.

If the reader will turn to the chapter in the Bible from which the verse at the head of this article was taken, he will find that in the year of Jubilee was an Holy Year, ushered in with the blowing of trumpets throughout the land, a year in which bond slaves were freed, alienated land reverted to the families which originally owned it, and which assembled there again, and a year in which the fields were left untilled. It was a time of emancipation and restoration, of a fresh start. How far do our celebrations follow this pattern?

Of course, over the centuries, most of us have lost the art of trumpet blowing (??), but modern equivalents are television, radio and the press. Some came "home" to our Conversazione, which you ran admirably, and regained their heritage with more besides in our greatly improved facili ties. But is that as far as we may go? Thos early peoples sought to correct the mistakes th half century had brought. Perhaps it would b wise for us to look back before peering ahead "In preparing for the future, think sometimes o the past," said someone.

Our backward look will reveal four things:

First, we will be impressed with the excellenc of the road set by the staff of earlier times. I 1913, the courses offered were Mining, Metallurgy Electrical (two courses), Mechanical, Civil anc Architectural Engineering. Today we find tha Mining has been dropped, Metallurgy is bein taken care of by the Institute of Technology, anc the Department of Architecture is a separat Faculty. Meanwhile Chemical Engineering ha become a separate discipline, and we now have the four major disciplines of Electrical, Mechani cal, Civil and Chemical Engineering. Time anc progress have demanded expansion and change but in the main, our courses are substantially o the same pattern as in 1913, with emphasis stil on breadth before concentration on depth.

Second, we will observe that though the pattern has not changed much, the approaches in the professional subjects have. In 1913, Mathematics and Physics were as prominent as they are today, but the professional subjects contained much more descriptive matter than they have now. It is believed to be fair to estimate that courses are at least a quarter as hard again as they were in 1913.

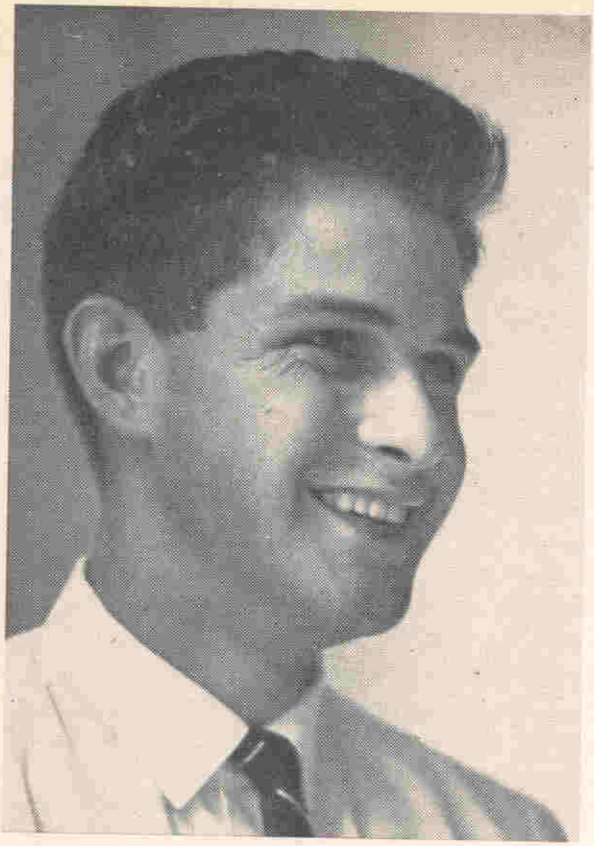
Third, those of us who are fortunate enough to remember the teachers and undergraduates of 50 years ago, will own that there has been little change in real quality. Greater specialisation prevails in teaching, because of the numbers involved, but character, erudition and consecration remain in equal evidence. Nor does the writer believe that students are duller today than when he was an undergraduate, despite the change in his viewpoint.

But, perhaps, the most evident change lies in the fourth observation—the phenomenal physical growth in buildings and equipment, and of student and staff numbers. Since 1920, when the writer first entered the school, floor area is 30 times, student population $6\frac{1}{2}$ times, annual running costs of the school about 100 times, and total staff about 18 times as great as they were then in the Engineering School. These increases have brought about problems of communion. In 1920, most of us knew all the others. Today, some teachers do not meet students until their final year, except through the functions of your Society. Here is an important role.

But our backward glance along the road should also notice the neighbourhood through which it ran, and the climate which prevailed during the journey. Through an industrial growth (revolution almost), and a demand for graduates "set fair", the nature of our progress has changed. Consider one event, that in 1913 radio was without the thermionic valve. (The writer remembers "hearing" that one arrived in the Physics Department about 1921, but never used one up to the completion of Physics III in 1922). Remember, too, that aviation, automation, communication and land transport, with all their associated demands on engineering, have developed in these 50 years, but then notice that man himself is much the same, and so are the noblest things to which he aspires—freedom, love and worship—but that they are in a different environment. These things we must preserve.

To peer ahead and see what to jettison, and when to do it, and what to take aboard with us on our journey is much harder. Probably the road and its environment will change more in the coming 50 years than in the last. Should our courses maintain their existing breadth, or must they divide more and diverge earlier? Or is the answer greater unification of courses, leaving diversification till the professional years, as in the Medical Course? The writer inclines to the latter view because knowledge is extending so fast, that he believes our undergraduate courses should concentrate the provision of a set of tools to deal with it. Mathematics, Physics, Mechanics, Industrial Control and the experimental approach provide the tools, but not the end for which knowledge must be used.

Analysis is certainly helpful, but is not an engineering achievement in itself. That requires the art of synthesis "to get the best answer now" for the purpose of service to our fellowmen, and not an idealistic answer at sometime which may be too late. Great needs, which are the strong Voices of God, remain to be satisfied: people are hungry, illiterate, divided, isolated, homeless and destitute. "Great things are done when men and mountains meet." Go on and conquer these mountains. Your jobs will be to minister to these people through your chosen profession. The next 50 years are yours—and theirs.



President's Report

Surely one of my most difficult tasks this year has been the production of this report. If one is of doubtful literary ability, as I am, one's natural reaction is to turn to the previous editions of the Society Magazine to study the efforts of one's predecessors, whose ability in such matters cannot be questioned.

One would then find pleasantly written, step by step accounts of the activities of the society, set out in the most favourable light, with discreet exclusion of some of the facts! Indeed, one would gather on reading such reports, that each year has been a supreme success for the A.U.E.S. With all due respect for these citizens, I doubt that this is actually so, but perhaps one's natural instinct is to conceal, or should I say, not reveal, the mistakes and failures of a committee for which one is responsible.

I have no illusions as to where we succeeded, and where we failed in 1963, and I intend to leave no illusions in the minds of the readers of this report. I trust, in doing so, that our members will not form the impression that this year has been an unsuccessful one for the Society: rather, I hope that this account will be of value to next year's committee, to whom, I regret to say, I will be able to give little assistance otherwise.

1963 might be described as an experimental year as far as the A.U.E.S. was concerned. We set out with certain objects in mind, some of which involved radical changes in policy. In some cases, startling success was achieved; in other cases, dismal failure. Credit must be given to those who were primarily responsible for the successes, while those who bear the blame for the failures are better left unmentioned.

It is expected that a Society, such as the A.U.E.S. should progress from strength to strength with each succeeding committee, as each learns from the mistakes of the last. But it can be safely said that the A.U.E.S. has been virtually stagnant over the last few years. The primary reason lies in the woeful lack of co-ordination between consecutive committees. Herein lay our first aim: to establish an effective link between committees. Needless to say, the only effective link is in written form, and to this end reports have been written by the organisers of all events this year. These are read to the committee, and after comments and suggestions have been added, are filed by the Secretary. Reports of this nature were written once several years ago, and were invaluable to us this year. It is a pity that subsequent committees saw fit to discard this idea. It must be kept going in the future at all costs.

As a further step in achieving this aim, it is planned to hold a combined meeting of the old and new committees after the annual general meeting, when the future policy of the Society will be discussed.

Aim number 2 involved the institution of more red tape, as the cynics choose to call it. Every member was issued with a membership card, and a corresponding filing card was kept by the Secretary. This was done for a number of reasons, the most important of which are as follows: (a) To allow Society Members special privileges over non-members, which cannot be achieved unless some reasonably reliable method of identification is available, and (b) To enable personal contact of any member at any time, primarily with an eye to postal publicity. In this respect we failed. While it was agreed that postal publicity is the best solution to the publicity problem, costs of the two letters sent out to members proved far too great.

This leads me to aim number three—improved publicity, which has been the aim of committees over the past "n" years. Here again we failed, primarily because we started by relying heavily on the postal system as mentioned previously. When this broke down, we turned to the next best solution—the distribution of printed propaganda by Year representatives in lectures. This achieved a certain amount of success, but was restricted by the fact that Year representatives could not be induced to collect the material at the appointed times. On top of this, we relied on conveners to organise additional publicity—blackboards and so on. With so much else to think about, the conveners often let the publicity angle slide till the last minute. In spite of this, the results of the questionnaire, which appeared in second term, indicate that publicity is adequate. However, I feel a more reliable estimate of the adequacy, or otherwise, of the publicity can be gained from the numbers that attend Society functions, since those who answered the questionnaire are obviously those who are directly interested and active in Society affairs. Certain recommendations will be put to the new committee regarding publicity in the future.

Other more direct aims with which the committee commenced the year, included the establishment of drinking facilities within the building other than the taps in the lavatories. In May, Coca-Cola, Fanta premix cup machine was installed in the foyer of the building, thanks to the efforts of Geoff Marlow, who fought everyone in the University to get it. Here we claim a success, but it will only remain so by rigid control of the use of the machine by future committees. An interesting sideline of this is the financial benefit to the Society.

The final aim of the committee was the establishment of a permanent Society Common Room to replace the present "black hole of Calcutta" on the second landing of the main stairs. To this end, a strong representation, together with a petition, was forwarded to the staff, who have been singularly unresponsive so far. The arguments for such a room are strong. The argument against is simply that the Society has been given such a room before, and it was used only for two-up and cards. However, this sort of thing usually occurs only if the room is not used in other more serious ways, and now that the Society has a reasonable reserve of finance earmarked for providing proper facilities, such a room could most certainly be used much more effectively. Success or failure in this regard is as yet indeterminate.

The new A.U.E.S. tie appeared in second term, and while opinions seem to be divided on the merits of the design, all agree that it is a considerable improvement on the old one. We claim no credit for the new tie, since the proceedings were initiated by the previous committee. It is fitting that it should have been brought out in the Jubilee Year of the Faculty.

As to the social activities of the Society, the pattern this year was not quite as stereotyped as usual. Some of the events of past years were replaced by others. Some were just not run at all. In retrospect, it seems that the experiments in this field were not too successful (understatement). Probably a resumé of the events which were run, and those which were discussed, but not run, would be of interest at this stage.

The first task of the 1963 committee was the entertainment of the Western Australian boys on their annual Gleddon Tour, in September, 1962. A cabaret was held in the Grange Hotel, with nurses provided. An enjoyable evening was had by all, although there seemed to be a slight shortage of nurses early in the evening. A number of the W.A. men overcame the problem by getting soaked.

The post-exams smoko, according to all reports, was a great success. Little more comment is needed on this event, and little more is available, without getting personal. . . . Trevor Stafford and

Richard Cox were responsible for the organisation, and did a great job.

As usual, 1963 opened with the Freshers' Welcome. The combination of some subtle sales talk, and the showing of a few colour slides of some of the Society's more subversive activities, induced a 98% enrolment of new members during supper. Movie films were also shown, and the usual supper period enabled staff and new students to mix informally. The attendance of staff members was pleasing, but it was felt that a number made no effort to attend. The age-old problem of new students' reluctance to talk to staff, and vice-versa, was still not overcome. The solution can only lie in the staff members themselves. Geoff Marlow and John Hutchinson were the organisers of the Freshers' Welcome.

The Med.-Engineers tug-o-war resulted in a resounding victory for Med. as far as the "Tug" went. However, Engineers won the "War" in no uncertain manner. Thanks go to Rhys Roberts and Hugh Smith for their part in the organisation.

The ball was a great success for the 500 or so who attended. The high-light of the night was a bike race between staff and students in which the Dean, Mr. Farrent, proved supreme. The decorations were said to be the best for many years, and we are indebted to Vic Sobolewski for the magnificent paintings which adorned the walls of the refectories. He has a great future as an artist (abstract, of course). The Ball was convened by Peter Waters, with the help of a sub-committee of seven, two of whom resigned when their suggestions were not employed. The efficient organisation was a great credit to Peter and the boys. Owing to the fact that the Aquinas Ball was held on the same night, the numbers attending were reduced somewhat, and probably this, plus the extra expenditure on the cocktail party, resulted in zero profit on the occasion.

Relations with the Institution of Engineers were strained a little by their refusal to allow the cocktail party to be held in their premises, with no adequate reason given. However, the S.A.L.T.A. clubrooms provided a cosy atmosphere, although a trifle crowded. Thanks go to Geoff Marlow and Dave Dungey for the success of this show.

The number of staff who attended on this occasion was again disappointing. Perhaps they should be informed that the Society Ball is not a rock-'n-roll booze show, but a formal Ball.

Socially, the Ball was a complete success this year. However, its primary purpose is to raise money for the Society. The organisation involved is tremendous, and if this function is not fulfilled, then it would seem to be not worthwhile continuing with the Ball in future years. Interest appears to be flagging in Faculty Balls on the whole, and it will be necessary to revise the scheme of the Ball completely if it is to continue.

A small armada of Adelaide cars set out for Sydney to the Engineering Faculty Bureau Symposium during the May vacation. Those who went enjoyed a wonderful holiday and gained some valuable experience, in more ways than one. These shows are really worthwhile, in spite of the cost involved. Any engineer who misses out on an interstate symposium has missed a great opportunity. Thank you, John Hutchinson, for handling the organisation at the Adelaide end. Unfortunately, John was forced to miss the show because of illness. Next year's Symposium will be held in Adelaide.

The Staff-Student Golf Day was attended by approximately 11 staff members and 14 students. In spite of light rain, the barbecue lunch was thoroughly enjoyed by all, and many empty bottles were a stark memorial to the ignominious defeat of certain students during the afternoon's play. Owing to the incompetence of the person responsible for keeping the scores, we have no record of who won on the day. Geoff Marlow must take the credit for the idea, and for the organisation behind the event. This was the first year the A.U.E.S. has sponsored such a show, and its success ensures its place in future years.

After numerous requests earlier in the year for a dinner dance, this was arranged on Friday, July 12. The response from students was pitiful, and executive of the committee exercised its power to cancel the event on the preceding Wednesday. Following this, a number of people said they had intended to go but "had not got around to buying a ticket". The committee is not entirely unresponsible for the failure of this event, since advertising was not 100 per cent. Although most people knew about it, they had not been brainwashed sufficiently. It also appears that the decision of the committee to hold the show on a Friday night was detrimental to its success. It is to be noted that there were several other dances on the same night. However, this was one experiment of the committee which failed, and its failure will speak strongly against an attempt to hold a dinner dance in future years.

The less said about the Engineers-Nurses' Barbecue the better. The number of nurses available was hopelessly inadequate, but those who were lucky apparently enjoyed a very pleasant evening in spite of the rain. Those who were not so lucky spent much of the evening towing cars out of the mud. The fiasco at the Queen Elizabeth Hospital will go down as a classic committee failure; this is surprising, since the organisation was done by committee members of unquestionable organising ability.

The Society Dinner was one of the most successful for many years. Some 110 engineers, including 13 staff members, gathered at the Gresham Hotel to celebrate the Jubilee Dinner of the A.U.E.S. Among the guests were Mr. J. R. Brookman, who graduated in 1913, and Professor Potts from the Maths. Department, who gave excellent speeches. The behaviour of the students was not too bad, apart from the souveniring of a number of items of hotel property, and we have been invited to book there again next year. Hugh Smith and Roger Humphries did a great job in the organisation.

After the success of the car trial in 1962, it was proposed to run one this year. The two people who were appointed to run the event proved worthless, and so it was cancelled.

Congratulations to the five gallant engineers who battled their way through the flour and eggs to score a resounding victory for the greasers in the Tyas Cup, particularly to Lindsay Southcott, who organised the team.

On the non-social side of activities, the A.U.E.S. has achieved marked success this year. The usual Tuesday films were organised by Paul Gunson, who provided members with an interesting and widely varying selection of films.

The Conversazione was acclaimed by both staff and students as very successful. Some 1,500 visitors inspected the 64 exhibits on display throughout the Faculty. Its success was largely due to the many students who helped run the exhibits on the two days on which the show was open. My thanks, also, to Mr. Farrent and his staff for the strong support they gave us. The organisation was done by a sub-committee of nine, including two members from each department. Congratulations must go to these nine students for a tremendous job. It is a pity that more students "cannot find time" to help run worthwhile shows like this. Although the Conversazione was officially in commemoration of the fiftieth year of engineering in Adelaide, its success indicates that it may be a good idea to hold one at regular intervals, perhaps every five years.

Frank James and Michael Porter are handling Hysteresis this year. I will take this opportunity to thank them for taking on this job and handling it so well.

My most sincere thanks go to the secretaries of the Engineering Faculty for the wonderful support they have given us during the year. They have been infinitely patient, and have worked their fingers to the bone with A.U.E.S. business. Without them the Society would indeed be in a bad way.

By way of advertisement, the Students and Graduates Section of the Institution of Engineers, Australia, is looking for student members. They have several benefits which are really worth having. Contact the Secretary, Bagot Street, North Adelaide, for further information.

I would like to thank the Committee for the efficient way they have worked together to organise the Society activities this year. The committee itself was 25 strong, but I regret to say there were several passengers. Here I do not refer to the part-time students who could not get to meetings—this was inevitable. A committee like that of the A.U.E.S. cannot afford to carry members who will not do their share of the work. At the same time it has been shown this year that it is ridiculous for a part-time student to accept a position on the committee. It is possible that some changes in Constitution could solve the problem.

The method of delegation of responsibility this year was quite satisfactory. Two members were appointed to look after each of the minor events, while the major projects were organised by sub-committees. The successful and efficient organisation of the Ball and Conversazione speaks very highly for the sub-committee method of delegation.

Finally, may I wish Peter Waters and his committee every success in the coming year. I feel they have a good foundation to work from, and the Society can look forward to great things.

PETER CHAPMAN,
President, 1963.

4th Year Class Notes

Your faithful correspondent has been asked by the management of this excellent publication to write a not too scurrilous record for posterity of the activities, or inactivities, perpetrated by the members in the Fourth Year of their studies in this, our place of learning, the University of Adelaide School of Engineering—in short, a set of class notes. And by the great Lord Harry, a set of class notes proper, they'll not get but a diatribe consisting of constructive gripes and winges concerning the subjects taught and their content.

Names will not be mentioned for three reasons:

1. To protect the guilty.
2. To protect the correspondent, who at heart is a chicken.
3. The lack of funds of the management of this rag to cover court costs and legal fees, assuming some leagle eagle would be nit enough to risk his reputation (hah!) in taking the case.

However to get down to the dirt and scandal.

Economics

Instead of learning useful, practical things such as how to make money, how to get something for nothing, how to cook income tax returns, how to make money, how to invest the odd quid or two, and at what odds, how to make money . . . money . . . money . . .ah-haha-hahhh—. Well, anyway, what do we get—GNP's MRS's, ACC's, MPP's, SCIIAES's and what have you. As far as utility of Economics is concerned, and its subject matter, the region of operation is certainly not Pareto Optimal. But then this is only a value-judgment.

Civil Engineering I (9S)

Hah! (which is the sum total of your correspondent's knowledge of this subject.)

Mathematics III

This is understandably enough, divided into two sections—the clean, pure maths., and, of course, the other sort, engineering maths. proper.

The pure maths. is so disgustingly pure that it stinks. Big deal. The other sort, well she's about 5 ft. 4 in.—er, consists of numerical something or other methods.

The one consistent fact recurring is that, to obtain the least accurate approximations of the solution the longer and more involved methods have to be used. Again, big deal.

Hydraulics

This is a wet subject (at this point your correspondent craftily ducks chalks, inkwells or whatever is handy for the disgusted reader to throw, irritated by such puerile puns). To continue, this subject has been considered throughout the year as the breeding place of hah-hah jokes. Thus it is unfair to say that the subject is wholly wet the whole time. A little bit of drying up on someone's part, and the subject becomes, as it were, hot air. Having no more constructive criticisms to offer, your observant correspondent subtly moves to the next subject.

Mechanical Engineering

This subject has been cunningly subdivided into, among other things, two sections:

1. Thermodynamics, which includes steam generation, i.e., production and circulation of large hot air masses—which is an adequate description of the subject.
2. A section, the name of which your correspondent is ignorant of, due to the fact that he has attended but nine lectures or so, so far, during which he has been unable to fathom out what the subject is about, nor has he been fortunate enough to meet someone who has. The lecturer will be raffled off later in the term.

Electrical Engineering II

Now this is a lulu of a subject, this subject is . Also it However, nevertheless. . And the green grass grew around, around, and the green grass grew around.

[*Eds.—Upon the advice of a Final Year Law Student over a glass of beer at the Richmond, most of our correspondent's constructive, if a little bit blunt, comments, had, of necessity, to be deleted. Anyone wishing to know the comments, however, obtain them by sending in one pound in unmarked two-shilling notes. Plain envelopes will be used.*]

This then concludes the brief report of fourth year activities. If some readers still are in doubt as to the point of this report, your correspondent suggests that you have a little think about it, and if still in doubt, consult Fitzgerald & Kingsley (2nd Ed.), chapter 9. (Problems 9.12-9.16 should be attempted, and solutions forwarded to your correspondent (no prizes given), as of yet, he has been unable to solve them.)

Your correspondent,

V. C. SOBOLEWSKI.

Some Impressions of California

Although I had previously visited California in 1937, and again in 1951, my present study leave was the first opportunity I had to pay an extended visit. With my wife and younger son, I lived for just under a year at La Canada (pronounced LOCKinyarda) about 15 miles N.E. of downtown Los Angeles, and when possible spent my weekends in the San Gabriel Mountains, or on the coast.

In La Canada are the Discanso Gardens, with a world-famous garden of 6,000 acres of camellias grown under a top cover of Californian oaks, and a famous rose garden acres in extent with specimens illustrating the evolution of the rose from the Middle Ages and the Persian gardens.

The beautiful residential districts make much use of ivy as a ground cover. Thick plantations of trees with well-kept lawns near the houses, and the shingle roof houses match perfectly into the wooded background.

Hunt'ngton gardens, park, and galleries also is a wonderful place to visit, with 10 acres of cactus gardens, many acres of lawns and trees, and a valuable art collection. Australian eucalypts are widely planted in Hollywood and Beverly Hills as ornamental street trees.

For children and adults, Disneyland and Marineland are truly American in conception, and enjoyable. Great expense has gone into the former, and many relics of early American life, such as the saloons, Mississippi steam boats, Indian encampments and frontier villages are reproduced. At Marineland, the aquarium is wonderful, and the trained whales, porpoises, dolphins and seals provide interesting entertainment.

At Pasadena, "Cal Tech" gives lectures each Friday on a wide range of topics covering a wide range of activities—satellites, botany, geology, earthquakes and so on.

The country is varied and beautiful, and before pressure of population crowded out the citrus and avacado orchards on the coastal plains, and smog polluted the atmosphere of the cities, it was an excellent place in which to live—in 1937 it was lovely.

Never have I seen such enormous areas of geographical upheaval—the rock strata lie in all directions in the large cuttings made for the mountain roads, and in Ventura county one sees oil derricks on the tops of mountains and as submerged wells at sea, while the seas to the north of Santa Barbara wash up tangled seaweed smothered in tar which oozes from subterranean springs.

From Santa Barbara to Monterey, the coast is fascinating. Mists make the mornings and evenings cool, and the days are usually sunny. In the summer, pelicans sail up and down the coast, diving frequently for fish, and accompanied by large grey gulls—called fulmars—who feast on the refuse the pelican disgorges before he digests the new catch. Curlews, plovers and ducks are often seen in batches of 30-50 along the beaches, while seals are quite common on the rocks and islands.

From San Diego to San Francisco, there is a famous highway "El Camino Real", the King's highway, along which the early Franciscan missionaries founded, in all, 24 missions from San Diego in the south to San Francisco in the north.

These missions were planned by founder Padre Janipero Serra, to be one day's march apart. As the old records say so poignantly, Padre Serra walked 13,000 miles for God, converted 6,000 Indians in all, and was President in 1767 of the Missions of Gaja California.

The old cooking utensils, the rough wooden tables, chairs and doors, made by adze, and the pestles to grind the maize—with samples of the early varieties of corn cob, which are a mixture of golden and dark brown corn—are all preserved, together with the vestments of the church, and paintings by the Indian converts. The early days of the missions are readily visualised with their wine pressing floors, their wash troughs watered by ducts from the springs, and the mission graveyards with their simple headstones that tell of dedicated lives. Perhaps, if gold had not been discovered in California, its evolution could have been a more gentle one, and the infamous Barbary Coast need never have been.

These famous missions, of which that at Santa Barbara is the largest, show a blending of Latin and Indian cultures, producing some wonderful work. The church here is an instance of Italian design—the fathers made the plans—the craftsmen were Indians trained by the missionaries, and these added their native colours. Now these are mellowed with age, the effect has great interest and charm. The old world gardens which surround the monasteries with cypress trees centuries old add to the effect. At Santa Barbara, the gums grow to perfection, and one of their proudest possessions is a large Moreton Bay Fig tree. The earthquake of 1907 cracked the church, but fortunately it was repaired without taking down the old structure.

Santa Barbara has a delightful Spanish atmosphere with beautiful wrought-iron work, half-round tiles and balconied windows. The balmy climate, lovely gardens, the beautiful mountains behind the town and the coastline make it a haven for the well-to-do retired.

The sea really abounds with fish—yellowtail are plentiful. There are often terrible tragedies when a storm comes up; occasionally boats are overturned and the occupants, if not found soon enough, float around in their life-jackets until devoured from below by the Mako sharks.

An Australian, however, is fascinated by the running streams of ice-cold water in the early spring, when the snow thaws in the 8,000-10,000 ft. high mountains, the high redwood forests, and the beautiful national parks.

Yosemite is a high granite plateau, cut by deep gorges with waterfalls, lakes and a beautiful stream. In mid-summer, Yosemite Valley is hot, and the stream wonderful to bathe in. For those who are prepared to travel with pack horse, there are hundreds of mountain lakes with trout fishing. Camping at 9,000 ft., even in mid-summer, is cold with sharp frosts—and to add to the interest, squirrels, gophers and chipmunks abound. In fact, if one stays in the camping reserves, one soon realises that many folk, such as teachers, seasonal workers and students "go wild" for periods of a month to six weeks, and live off the land—shooting deer for meat and fishing in the streams.

Los Angeles is well-provided with beautiful trips—the mountain lakes at 6,000-9,000 ft. in the San Gabriel Mountains, the Mojave Desert, which, in the spring, is a beautiful carpet of wild flowers, and the long bathing coast—all within two to three hours drive of the city centre.

All this, however, is in marked contrast to the city life. The visitor wonders how people can live through the smog-ridden centre of Los Angeles. With the tall mountains and mists flowing in from the sea, the coast is naturally misty, and temperature inversions can exist for days at a time. With two to three million cars on the road each day, the fumes pour into this trapped air, and this often results in smog which makes one feel sick, and one's eyes stream with tears. The smog is developed by ultra-violet light on the fumes releasing ozone.

On the highway, the roar of traffic is incessant, and with fog drifts across a previously clear road, and a maximum speed (commonly exceeded) of 65 m.p.h., telescopic collisions involving 10-12 cars are quite common—occasionally 50-70 cars are involved. It is really surprising to see women sitting in the front seat of a car, heads together, talking while travelling at 60-70 m.p.h. Traffic, however, is very well organised and policed, and the accident rate low compared to the large volume of traffic. Numbers of interesting lectures I wished to attend, proved too much of an effort with 1-1½ hours travelling each way through the dense traffic.

In California, 1,200-1,500 people are arriving daily, attracted by the employment offered by electronic and space industries. Added to these is a well-to-do group which winters in California, and moves to the east coast for the holiday season.

This makes living costs high, and as a relic of the Barbary coast days at the turn of the century, when the west coast was peopled by adventurers, one is asked to pay rent two months in advance, one month being for the last month before one leaves, and a substantial deposit for breakages, which is never returned.

The ordinary people with whom one works are good fun. The mechanics are full of mischief, and wise cracking all the time, and one soon comes to enjoy their good nature, particularly when one realises that they thoroughly enjoy a good repartee at their own expense.

There was one negro mechanic, a very good fellow, who was popular with everyone, but there are deep personal aspects of the colour problem. Clearly, some of the more intelligent negroes put their money into cars, holidays and music rather than founding a family, and in residential districts, the effect of negro residents, even those of professional standing, can have an adverse effect on property values. This can result in rapid changeover of property, an effect sometimes exploited by land agents to the great upset of the residents.

Frankly, I should not like to live my workaday life in U.S.A., the pressure of population is ever present. Further, I greatly appreciate Australian secretarial assistance, the excellent government services of the British tradition, but there is no doubt a perfect holiday would be six months to a year caravanning in the outback of U.S.A. The scenery is beautiful and infinitely varied, "English" the language, and the people kindly and good humoured.

E. O. WILLOUGHBY.

July, 1963

It's a Hard Life!

I fell to wondering that morning as I vainly tried to choke down a greasy egg, what fiendish quirk of fate could have put any seven-hour practical on a Monday. Especially an Elec. II. prac., I thought, as I fuzzily weaved through a crowd of pedestrians.

Some creep murmured a good morning as I parked the car, whereupon he was told to get lost—I lose a lot of friends on Monday mornings. Scraped a pedestrian off the bumper and staggered off in the direction of the University, S.S.W. on my compass.

Probably would have got to the lab. about 9.20 by the clock on the wall, if I remember rightly. I must have been brighter than usual that day, because I remember observing that it was going backwards. A few of the heavies were there already. Someone with a keen business sense was making book on the time of Marlow's arrival. I put two-bob at 5 to 1 on 10.15, and slumped on to a stool.

About 9.30 a glassy-eyed demonstrator appeared. I asked him what experiment we were supposed to be doing. "Brandy and dry," he said, "but go easy on the dry." I grabbed his clammy hand and stuck it on the high tension, which threw him off his chair on to the floor. As he picked himself up, I heard him mumbling something about that stuff having more kick than he thought.

Marlow fell through the door about 10.05, and was promptly mown down by Porter, who was riding an R.F. bridge around the room. A shout of glee went up from the bookie. I helped Marlow to a seat, which was whizzed from under him by an irate punter. At this point, James created an interesting diversion by slumping across a hot soldering iron.

The next half-hour was spent in laborious concentration, at the end of which I had decided that in all probability the experiment was something to do with a reactance tube frequency modulator, whatever that might be. At all events an R.F. oscillator was required, and having seen one on a newsreel several weeks ago, I knew all about these. I set forth to find Marlow to inform him of my discovery, and found him after a short search half way into a C.R.O. He said he was trying to find out what happened to all the electrons after they hit the screen, and didn't seem very impressed at all with my idea. Seeing as I couldn't answer that one either, we decided to do a bit of research on the subject, and after an hour or so, hit on the theory that they just died and collected in an ashtray at the bottom of the C.R.O.

The demonstrator appeared to be fully conscious by this time, and was wandering round muttering something about work. It seemed a good time to have a bash at this oscillator. I wired it up. Marlow had two bob it wouldn't work, and won. Decided it was lunch time. After lunch the demonstrator was induced to examine the obstreperous oscillator. He called a vet, who decided we must have a faulty valve. We removed the valve in order to replace it, at which the oscillator sprang into action. This appeared to puzzle the demonstrator somewhat.

With this achievement under our belts, we set about constructing the modulator. Marlow wired it up, and, at length, announced proudly that it was ready to go. The demonstrator went out to look for a fire extinguisher. The rest of the class headed for cover. We stood well back and I heaved a book at the switch. To the dismay of the crowd, nothing happened. It was subsequently found that the fuse had blown primarily because Marlow had been reading the resistance colour code back to front.

Eventually, the contraption was induced to work, after a fashion. The demonstrator thought we had pulled a "fasty", and went over the circuit with a fine-tooth comb looking for faults. He found seven, but we convinced him that these were accidental. On correcting them, nothing he could do would induce the thing to operate again, so he spent the next hour trying to restore the circuit to its original condition while the boys tuned in to Elvis Presley on the R.F. bridge. Unfortunately, this was soon interrupted when one of the oscillators decided to operate at the same frequency as Elvis. Peace then reigned for a while except for the occasional zing of a resister flying past, and the crackle of fuses, until James discovered that the C.R.O. he was trying to get to work had been unplugged half an hour ago by someone. Panic ensued as James embarked on a wholesale C.R.O. unplugging war.

Meanwhile, in Chicago . . .

The first-grade teacher took one look at Wilmer and knew he was going to give her trouble. But when she started to explain arithmetic to her class, she was pleased to see he was paying close attention. When she had done several problems, she asked: "Are there any questions?"

"Yes," said Wilmer, "where do all them little numbers go when you rub them out?"

Mechanization of Teaching

• S. KANEFF, Electrical Engineering Department

One of the largest electrical enterprises in the United States of America now markets "electronic classrooms" in which each student has a private compartment containing, apart from the usual seat and desk, an array of knobs, push buttons and television screen. From a central library of tele-tapes, the student is able by remote control to select his lesson or demonstration which is then performed on his individual screen; he is able to stop the progress of the programme and even to repeat desired sections. Facilities exist for questions to be asked by the teaching programme and for the student's answers to be processed. Equipment for many thousands of individual stations has been sold or is on order. Other manufacturers have well-advanced similar schemes for placing on the market in the near future; some systems being designed with a general purpose digital computer as the central control and data processor.

Programmed books are becoming commonplace. Several organisations are selling programmed lessons, together with the necessary mechanical gadgets for running through the programmes.

Some American educators are talking seriously of the "Timetable College"—an institution in which the student will spend his time moving from one teaching machine to the next, working with each device at his own rate and pausing only for sleep, meals and recreation, the present system of set vacations being dispensed with completely. They believe that even with already-developed techniques it is possible to employ students' time much more effectively and to cover more material in a given time with better learning that at present.

However one views such developments, they cannot be ignored—it is most likely that they represent the crude beginnings of the kinds of technological aids to education which will be employed in large numbers, and probably at great expense, in the latter part of this century.

As well as being a portent of probable future inroads by technology, some of these developments indicate a trend in education which we may call educationalism—the utilisation of devices almost as ends in themselves in the fond hope that, if sufficient funds are forthcoming, good education must result. As with "Big Science" during the past 20 years, in which astronomical sums have been spent on certain projects, many of dubious value, the sheer magnitude of the tasks and the finances available have seemingly imparted respectability, justification and even desirability: so in education, with a multitude of pressures to educate ever-increasing numbers of people with always inadequate teaching resources, when larger sums become ava'lable, there is a strong temptation to spend on items which show immediately obvious returns for money spent—for example, the physical acquisition of new buildings, equipment, facilities and amenities—and to be less concerned with the vitally necessary requirements for producing good teachers and an environment conducive to good teaching and learning. Provision of student bowling alleys, billiard rooms, skyscraper air-conditioned buildings, digital computers for schools, and the like (as has often happened in the United States when increased funds have appeared), are not prime factors in the improvement of education, although some of them may be helpful. Money should be spent in those activities and directions which can be identified as actually improving education most effectively, even though this is much more difficult to accomplish.

Recognizing that widespread use of mechanical aids to teaching will mean the expenditure of very large sums, the question may well be asked, "Is there, in fact, a case for using teaching machines?" Several other related questions arise also, but before attempting to answer, it is, of course, necessary to indicate what is meant by a teaching machine.

There seems widespread agreement that the Socratic method of teaching with one tutor per student can produce excellent educational results. A continuous process of feedforward and feedback between tutor and student ensures that not only does the student complete each section of work satisfactorily before passing on to the next, but few misconceptions can remain for any length of time; the tutor being able to adjust his presentation to take account of the motivation, needs and capabilities of the student in a manner clearly not possible in the case of one teacher with a group of students. Attempts have been made in the past to mechanise this process, but it is only in the previous 30 years or so that significant progress has been made, the main stumbling block being the absence of an adequate theory of learning to cope with the usual teacher-student situation. Although a number of theories of learning now available are believed adequate in restricted circumstances, the main problem is still present.

However, with certain reservations, some recent techniques for the mechanisation of teaching have proved successful within the limits of topics of very restricted scope. Devices which accomplish this rely on specially arranged and selected information and test material which may be printed in book or separate lesson form, or may employ special equipment (mechanical, electromechanical, or electronic-electromechanical) for presenting this to the student and for assessing his performance: such devices are being called "Teaching Machines", although the former is more correctly designated as "Programmed Instruction" as in this case no machine, in the normal use of the word, is necessarily employed. Existing devices have a number of principles in common: a continuous active response is required from the student who is given well-defined practice and testing after each learning step; the student is informed with as little delay as possible as to the correctness, or otherwise, of his responses, and errors are consequently soon corrected; each student proceeds at his own rate, able students are not delayed, while weaker students receive supplementary assistance as required. An important practical means becomes available for handling the individual differences between students.

It should be noted that although the above-mentioned devices are based on some particular learning theory or aspect of such, there is no proof as yet that their success stems from this fact —it could well be that other properties of the methods used may play a key role; for example, the clear presentation of subject matter and the competent anticipation of students' difficulties, coupled with the fact that progress with the programme can be made only if sufficient attention and concentration are employed by the student. No doubt many similar questions arise, having at present no satisfactory answer.

It is outside the purpose of this brief article to discuss the various programming philosophies, programme details and machine structures involved (a useful reference in this regard is, "Teaching Machines and Programmed Learning— A Source Book", edited by A. A. Lumsdaine and R. Glaser, National Education Association of the United States, 1960). It is apparent that for such aids to be effective, the programmer must foresee all possible difficulties which the student may encounter—he must meet these difficulties in his programme, which should be arranged in such a manner, however, that a student's time is not wasted in progressing through material and help sequences which are, to him, too easy and likely to cause boredom. This is no mean task. The effectiveness of the method depends obviously on the skill and experience of the programmer.

In the above systems, the mechanical equipment of a teaching machine plays only a very secondary role, at least as far as the educational process is concerned. The machine does little which cannot be achieved by simple "programmed instruction", as it merely mechanises this instruction, employing basically the same philosophy and programme. Cheating can, of course, be made almost impossible when a machine is used. However, some further justification can be found for mechanisation because of the possibilities of data processing, which enable not only a complete record to be obtained of each session on the machine for later reference by teacher and student (thus allowing, among other things, an assessment and improvement in the programme), but also this information can be automatically processed as required, so relieving the teacher of much routine effort: this attribute will undoubtedly be an important feature of future machines.

The restricted application and inadequate theoretical basis of existing devices has already been noted. Other significant limitations in methods for mechanising teaching also must be mentioned. In spite of serious intelligent attempts to produce adequate programmes, it is not possible to cover in an efficient and effective manner all possible difficulties, especially inadequate is the determination of the precise nature of particular difficulties, and the offering of a suitable remedy—most programmes do not even attempt this immense task. Further, criticism has been levelled at some methods whereby it is claimed that the student is merely trained to "perform" rather than to understand and think effectively— this is very much a function of the programme philosophy employed, and indeed, such criticism is often quite appropriate in the case of our normal non-mechanised educational practices.

Considering, then, devices already available for mechanising teaching, it seems only fair at present to conclude that whereas programmed instruction methods, when utilised simply as printed material, are effective for restricted topics; complex expensive mechanisation of these programmes, even with the accompanying data processing advantages, is not warranted. This is not, however, the last word on the subject.

Returning now to our initial question and rephrasing it to read, "If suitable devices are available, is there a case for using teaching machines?", some factors which produce an affirmative answer are:

(a) It seems unlikely, with the present construction of society, that there ever will be sufficient teachers, let alone sufficient good teachers; consequently effective methods to aid available teachers would be valuable. There is, of course, no suggestion of *replacing* teachers by machines.

(b) Tutorial-type teaching on a sufficiently large scale to cope with the individuality of every student seems impossible without mechanical assistance.

(c) The teaching profession, especially in the highly developed Western World, is seriously under-rated. One way in which teachers may raise their status professionally is by becoming more productive, and by performing work of a higher level. This would happen if machines could take over routine tasks, leaving the teacher with time to apply himself to the higher aspects of education, guidance, stimulation and the imparting of wordly wisdom. Raising the status and conditions of teachers would seem to be ultimately beneficial to all.

In summary, much has been said elsewhere concerning the world crisis in education: use of suitable teaching machines promises to ease this crisis.

The many possible dangers in using teaching machines on a widespread scale cannot be overstressed. Some have already been mentioned. Another serious problem concerns the possibility of producing conformity and uniformity of thought in large numbers of people exposed to an apparently identical method of education. Many claims have been made that this has, in fact, happened in the United States over the past few decades, even without mechanisation of teaching. Clearly, great care must be taken to avoid such pitfalls whatever the method of education; but it should be realised that the teaching machine itself is neutral in the matter, and merely reflects its designers' and users' built-in views.

Consider now the likelihood of suitable devices being forthcoming. The advent of an ideal teaching machine implies complete knowledge of a general theory of teaching and learning—a not inconsequential piece of information. It seems possible to bypass this requirement, however, by attempting to simulate the activities of a good human teacher, and in this manner, ultimately to discover the necessary vital information. In any event, the problem is fraught with complexity, and seems unlikely to be solved overnight; considerable interdisciplinary research effort is necessary to be able to involve a machine intimately in the educational process.

Progress in research on the simulation of cognitive processes holds promise of aiding solution of these problems. A situation can be envisaged in which student and teaching machine together form a self-organising system, the goal of this system being the attainment of some educational objective. By a series of presentations of information and tests, the machine, acting on the student's responses, might build up a simplified model of the student, and use this to determine the manner and content of further presentation of information and testing, to control the help given to the student, and, by posing supplementary questions, it might be able to analyse and resolve his difficulties. The model would be subject to continuous readjustment in the light of each new response from the student.

(This process has been achieved in a very simple and elementary manner in the case of a keyboard-skill teaching machine by Pask in England. The operator is given instruction by the machine, which keeps a running score of errors in pressing each key, and adjusts its own programme to present more often those keys on which errors are more likely. The task is speeded up as the operator becomes more expert. A measure of success achieved by this machine is indicated by the fact that the teaching machine method of instruction takes only a fraction of the normal time for instruction to achieve the same proficiency.)

Major problems are involved in realisation of the abovementioned system, including a method of effective communication between student and machine, the building up of an adequate model of the student, the use of this model to control the educational sequences, and the method for forming questions and reacting adequately to answers. Apart from the provision of the necessary machine structure, no programme in the previously-discussed sense appears necessary, the machine would build up its own programme as learning progresses and could reproduce it, if required, at the end of the session. This programme would probably not be optimum for any other student, however. Unlike present-day teaching machines, this device would not be only of secondary importance, nor would it be conceptually trivial.

Such a device, apart from its potential as a teaching machine, would appear to have value in educational research in general. A long-term project in the Electrical Engineering Department is concerned with aspects in the development of the necessary structure for realising these objectives.

A Remote Controlled Ball

• M. KIMBER, P. LEIGH-JONES, P. SYDENHAM,
and numerous other well-meaning advisers.

Spring turns a young man's thoughts to love; maths tutorials turn the undergrad's thoughts to anything but maths. This is how the idea of a remote controlled ball came into being. It was felt that the Engineering faculty should have the biggest and the best, even if only one.

Thoughts on the idea of a seemingly uncontrolled ball visualised a hollow three foot diameter ball driven along by a radio-controlled internal trolley. As Prosh was a term away, it was decided to attempt to enter the ball in such an illustrious event, and thereby obtain a little reimbursement to defray costs.

The first step was to build a vehicle to run on the inside surface of the ball. A trip or two to the disposals stores resulted in a credit entry in the expense account, and a debit in the proprietorship fund for two 24v., 2A generators, and a lot of odds and bits to form the necessary gear trains. Each motor drove one wheel through a crude gear system (with a safety factor of 1·1 on the output shaft as far as torque considerations were concerned). It was geared to give 10 m.p.h. flat-out. They were mounted end to end. A 24v., 11AH wet battery was placed behind, and a castor in the central rear took the rest of the weight. After a coat of hammertone, it was handed over to the electronics team, whilst the ball itself was being constructed.

The ball had to be suitable for an internal aerial system to be used. Fibre glass was the answer. As no mould was available to form the ball on, this had to be constructed also. A hemispherical $\frac{3}{8}$-in. wire frame with a maximum mesh of about 4 in. x 2 in. was built up. This was covered with old flywire, and provision for a strickle plate to smooth the plaster covering to the hemisphere was added. Numerous trips to a plaster works obtained sufficient plaster to cover the frame. (When dry, it weighed about 90 lbs.) An edging strip was fitted in which the connecting lugs were set in order that they could be moulded into the dome. Floor polish was applied as a release agent. The donated fibre-glass matting pieces, and the resin were duly applied to both ball and person. The result was a spiky, hairy outside surface to the dome, an average thickness of $\frac{3}{16}$ in., with a tolerance of plus and minus an eighth of an inch, endless lumps of itchy fibres from top to toe, and a very large depletion of funds.

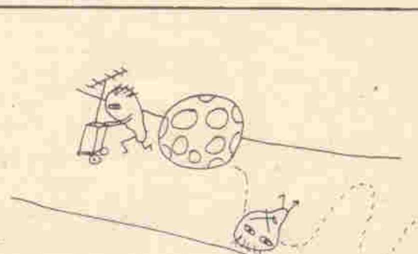
This half was removed without too much bother, as the inside surface did not cure due to the wetness of the mould. Compressed air was forced in small holes over the dome, and this lifted it off to a large degree.

This first half was then placed in the bottom of the mould, and the next half was similarly applied. (The correct release agent was obtained, and the mould was repaired.) Distaster! This time the resin cured overnight and firmly fixed on to the mould. More hands, a 7-lb. sledge hammer and horrible words managed to free the mould by its slow destruction. The hairs were then removed with a rotary sander, and the two halves were joined with metal threads in the lugs. The lugs were free in one half. The resultant weight was about 30 lbs. It was extremely resilient, as a few accidental blows with the sledge hammer were taken with very little damage.

In the mean time, more maths tutorials, and a vacation had evolved the control system. Two separate audio frequencies modulating a carrier

It's easy to apply

The never-fail release agent.



Quite well controlled.

controlled the two main functions of steer and drive. The speed was varied by varying both motor currents equally, and steer by varying the two motor currents differentially. The amplitude of the signals, after separation in selective filters, varied the base currents of power transistors controlling the armature currents. The fields were run at a constant current. Two oscillators, a modulator, transmitter and a two-dimensional joystick control unit comprised the terminal equipment. The aerial was a vertically polarised ground plane operating on 288 megs.

A braking relay shorted the armatures and removed the battery for low levels of input signal. As the signal increased, the relay was cut out, and the brakes therefore were released. This proved quite adequate, in fact, almost redundant, as the whole unit needed very little to stop it anyway. Diodes prevented reverse rolling. As the motors were often overloaded, two visual indication channels were fitted, where upon a 60w. lamp for each motor lit up for excessive currents. They were green and white for distinction, and shone through the ball at the rear. They were very effective at night as they spent most of the time on. These lamps required more power than the motors combined. To start and stop the beast, a small hole and a long rod were used to turn on (and off if the hole could be found and aligned quickly enough) the main switch. Outriggers were placed on the trolley to prevent it being tipped on its side by moving the ball from the outside.

As is usual with weekend papers, the first attempt was on the night before the big day. The functions all performed almost as was hoped, except for the fact that the turning circle was about 30 feet instead of the desired one or two. A few timely pushes at the correct position soon had this disadvantage eliminated. It progressed at a slow walking pace. The radio link was also not powerful enough, and a portable ham rig was located. Prosh morning came with still good chances of entering and completing the circuit. There was much last-minute activity; the transmitter, an enormous aerial, a genemotor, and a battery were lashed to a two-wheeled handtruck; the ball was given a few gaudy spots, and the unit assembled. The boys were underway. The ball was driven in a series of lumbering lurches and judicious pushes to the starting point from the Engineering building. Prosh started off, and the ball, with lights flashing and using the full width of the road, was "steered" along to Frome Road. It was carried up to the top for obvious reasons, and driven on to the King William Street intersection. Here a great tragedy occurred. The ball, bursting at the seams, split open even more, and one channel gave up the ghost and the system came to a shuddering halt. After a few convulsions and flashing lights, it passed away. A post-mortem, subsequently held, proved failure of the seams as the lugs pulled out and a flat oscillator battery.

Overall, the exercise was costly, useless, time consuming, heartbreaking, ridiculous, etc. It was, however, an experience never to be forgotten (especially in the pocket). Do you know of anyone who wants a fibre-glass ball? A possible use is to make it radio controlled.

Marino Rocks Lighthouse

• B. A. TOZER

During the long vacation of last year, it was my good fortune to be employed by the civil engineering contractor responsible for the construction of the Marino Rocks Lighthouse. This interesting, and somewhat unusual structure, was designed by the Commonwealth Department of Works for the Department of Shipping and Transport to replace the old Wonga Shoal light off Semaphore, and provide a land-fall light for the new oil refinery at Port Stanvac.

The site chosen for the new lighthouse was on a small hill above Marino Rocks about a quarter of a mile from the shore, and at an elevation of about 300 ft. above sea level. Facing due west out across St. Vincents Gulf, the new lighthouse was to be of reinforced concrete construction. The shape of the lighthouse was to be octagonal, the four major sides facing due north, south, east and west, the smaller sides being little more than bevelled edges to the corners of these. About 10 ft. square, the lighthouse was to rise to a height of about 50 ft. Fittings were to include the large lens and its electrically operated light, complete with switching for automatic control. As a safety precaution, an auxiliary diesel generator power supply was to be installed to function immediately in the event of a failure in E.T.S.A. transmission line supply to the site. The construction was scheduled to be completed by July, 1962.

The foundations were dug in leached limestone, and calcareous slates, typical of the Marinoan Series of the Adelaide System of the Proterozoic Era. An air compressor and jack hammers were needed to dig out the 3 ft. depth of excavation required for the footings. Some of the boulders encountered were of large proportions, and in the placing of footing concrete, it was necessary to use about an extra ½ cubic yard of concrete to fill the breakouts caused by dislodgement of these boulders.

The specification called for all reinforcement to be welded. This requirement was necessary because the lightning protection placed in the roof employed the steel reinforcement of the structure for earthing to a series of earthing pits placed around the structure. In fact, the lightning protection for the structure was felt to be more than adequate. However, it was not unreasonably so, because of the isolated and exposed nature of the lighthouse site.

The main body of the lighthouse was constructed using a slip-form and high early strength cement.

Slip-forming is a relatively modern method of concrete construction. It has been used in Australia in the construction of reinforced concrete silos for the bulk handling of wheat and barley, and recently on the liftwells of the new building for Adelaide Teachers' College. Its use in the construction of the lighthouse was in the nature of an experiment, which, despite some small setbacks, was successful.

The form-work was built up from five-ply with 4-in. x 2-in. timber bracing. Jacking of the formwork was by eight hydraulic jacks of 1-in. diam. threaded-steel reinforcing bars ("jacking rods") embedded in the set concrete.

Construction proceeded at the rate of about 15 in. per hour, the formwork being 2 ft. deep, allowed the concrete 1½ hours after placing before its being required to take loading. Concrete was supplied by a one-bag mixer, the total concrete required being only about 1 cu. yd. for each foot rise of the forms. The hydraulic jacks were operated by a small petrol engine operated intermittently to maintain the required pressure in the oil lines. Levels were maintained by the use of water indicators above each jack. These, although a simple and inexpensive measure, proved very effective in use.

The height to the main soffit of 40 feet was achieved in 2½ days, despite a breakdown in the petrol engine during jacking. With the failure of the petrol engine, jacking was continued by hand pumps, a little more tedious for the workmen, but equally efficient.

The main floor soffit was cast on the ground alongside the structure; it was a reinforced concrete slab, 12 ft. square with the four corners cut out as mentioned before and 6 in. thick. Provision was made for a man-hole for access through this slab for maintenance purposes. After the slab had attained its required strength, two mobile cranes were hired, and the completed slab lifted (its weight was about $2\frac{1}{2}$ tons), to its final position 40 ft. above the ground, on top of the walls, where it was affixed by cement mortar and additional reinforcement.

On this main floor soffit, the actual lens room was constructed. The front portion was aluminium-framed for the provision of glazing, whilst the rear and part of the sides were of reinforced concrete, a hatch being provided at the rear for access onto the balcony, 2 ft. wide, which surrounded the lens room.

The final part of the concrete construction work was the roof, a smaller soffit cast in situ on the lens room with embedded lightning rods and metal conducting plate.

Apart from the concrete work, the contract called for the provision of steel laddering inside the lighthouse, 2-in. diameter galvanised-iron pipe railings around the balcony, glazing of the main 180° window, provision of power supply via an underground duct to a distribution board within the building, and a concrete block mounting for the diesel generator.

Although this has only been a rough outline of the work undertaken, it may be seen that a little ingenuity on the part of a contractor can considerably reduce the problems of construction. I am deeply indebted to my employer for the interesting experience in practical civil engineering work which he offered me while I was there.

What were the first words Adam said to Eve? "No one can tell."

☆ ☆ ☆

A school teacher was riding in a bus and thought she recognised the father of one of her pupils, so she nodded at him. He stared blankly and took off his hat.

On the way out, he said to her, "I noticed you were looking at me—perhaps you will tell me who you think I am?"

"I thought you were the father of one of my children."

☆ ☆ ☆

Come, come, bid our raptures begin
Ere we lose both our youth and our leisure.
'Tis better repenting a sin
Than regretting the loss of a pleasure.

ANON.

☆ ☆ ☆

"No! No! Spare my virginity!
"When I lose that," said Rose, "I'll die!"
"Behind the elms last night," cried Dick,
"Rose, were you not extremely sick?"

MATTHEW PRIOR.

Wither Engineering?

• G. ELLESWORTH

The last half-century has been marked by a tremendous increase in the impact of engineering on every day life. Wherever we look, whatever we touch, we see and use engineering products: from the clothes we wear, the chair we sit upon, the books we read, to the television set which distracts our reading, and the telephone and typewriter ringing in our ears all these, and virtually everything else we are wont to describe as "the amenities of the present day", are mass-produced articles with a high "engineering content".

It may be well to remember that this has not always been so: even in our grandfathers' time, clothes and furniture were largely hand-made, correspondence was not yet mechanised (on much of the mail today not even the signature is written by hand, although a forlorn attempt is usually made to *pretend* that it is!) The printing press had long since taken over from the mediaeval monks and clerks who produced such magnificent illuminated manuscript volumes, but the printer's craft was still very much a medium for individual artistic expression.

Our recent drift, or rather flight from the old established and well accustomed "appurtenances" of a civilised life has led to a great increase in the number of so-called engineers engaged in the satisfaction of the multifarious material needs of a technological society.

This, in turn, required an equally, or perhaps even more rapid increase in the educational facilities intended to meet what was thought to be an insatiable demand for such engineers. In this headlong rush forward—if forward it is—too little time has been spared to consider the proper functions of this new breed of engineers, nor even to establish what "kind of animal" he was supposed to be.

Rather typically, it is only now, when a doubt has appeared on our horizon about the number of engineers society can absorb, that we pause to think what our place is, or should be, in the community. Let us have a look then at the zoological species "engineer" with a view to determining what it is, what its functions are, how it fits into its environment, and especially what ecological factors may prove fatal to its survival.

We may start by quoting from a learned journal:(1)

"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."

Our troubles begin when we accept this kind of parody as anything other than an almost diabolical description of a nondescript engineer. (This may be considered an almost diabolical mixing of metaphors!) If we are prepared to accept this vague shadow of a universal genius as a satisfactory public image of the professional engineer, and if our universities set themselves the task of mass producing this "article" (borrowing the most up-to-date techniques of automation from engineering, of course), then we are condemning engineering, as a professional discipline, to extinction. For the days of the Universal Genius have closed nearly four and a half centuries ago with the death of Leonardo da Vinci, and anyone who, in our generation, is attempting to compete with the physicist, chemist, mathematician and economist all at once, and at the same time try his hand at the liberal arts, is not a genius but a fool. (It is unfortunate that, as is well known, the two are often hard to distinguish!)

But if we are agreed that it is not the function of engineers to ape the physical or social sciences, nor the liberal and fine arts, what is it then that constitutes the essence of being an engineer?

It will be best to refrain from any metaphysical definitions of "engineership" and confine ourselves to a functional specification. Further extensive search of the literature(2) reveals that, as often happens, "the French have a word for it". Reference to a dictionary(3) shows that the French word for engineer is INGENIEUR, and that it has for its root the verb S'INGENIER.

Under S'INGENIER we find "Chercher, tâcher de trouver dans son esprit un moyen pour réussir", which can be freely translated (for those who have failed to keep up their French) as "to seek and endeavour to find the means of success by use of the intellectual faculty".

(1) Hysteresis 1961, p.49
(2) Hysteresis 1962, p.25.
(3) Potit Larousse Illustre

There can be little doubt that this applies, or should apply, to the professional engineer. But could it not also apply to others, and if so, how does it set the engineer apart from other members of the species "homo sapiens"?

We need not here concern ourselves with the social sciences or the liberal arts: these disciplines are sufficiently far removed from engineering to permit no confusion (or competition). But the relationship of engineering to the "natural" sciences, especially physics and chemistry, is both intriguing and topical, in that there is some talk about engineers being an obsolescent (though possibly cancerous) growth on the otherwise pure body of the (natural) sciences.

The distinguishing characteristic of the engineer-scientist may be found in the reference to the *means* of success. Although the natural scientist (physicist, chemist, zoologist, etc.) may devise apparatus and techniques for his research, his ultimate objective is largely analytical in character. He is seeking to discover the laws of nature. There is an elemental form of synthesis in the natural sciences, but its purpose is to investigate the feasibility or physical realizability of concepts. (This should not be considered as belittling the physical sciences, for the backbone of any scientific problem, and even more any engineering problem, is usually broken when the answer to the question of feasibility is found.)

The professional engineer's task is, by contrast, largely synthetical in character. His funtion is *not* to discover the laws of nature, but to apply them. In this he should make use of the laws discovered by the natural scientist, as well as the results of any realizability studies performed by him.

On those sure foundations he must erect the superstructure of his own "means of success": he will be judged successful if he can employ his powers of intellect to choose from the vast amount of material supplied to him by the "pure" scientist the most appropriate selection and weld these together to meet the technical needs of society. Viewed in this way, there can be no justification for regarding engineering as either obsolescent or a mere off-shoot of physics or chemistry. His place in the scientific and social environment in which he lives is clearly and distinctively determined by the essential functions which he is required to perform. There need not be—indeed, there must not be—a withering of engineering.

A more pertinent question to ask would be: whither engineering?

Space here is insufficient to deal comprehensively with so intricate a problem. But one thing is certain: we must look to the universities to find a proper answer to our modified question. This is not to say that ivory towers and crystal gazing go well together, nor to imply that the universities have done too well in the recent past in resolving this socio-technological conundrum.

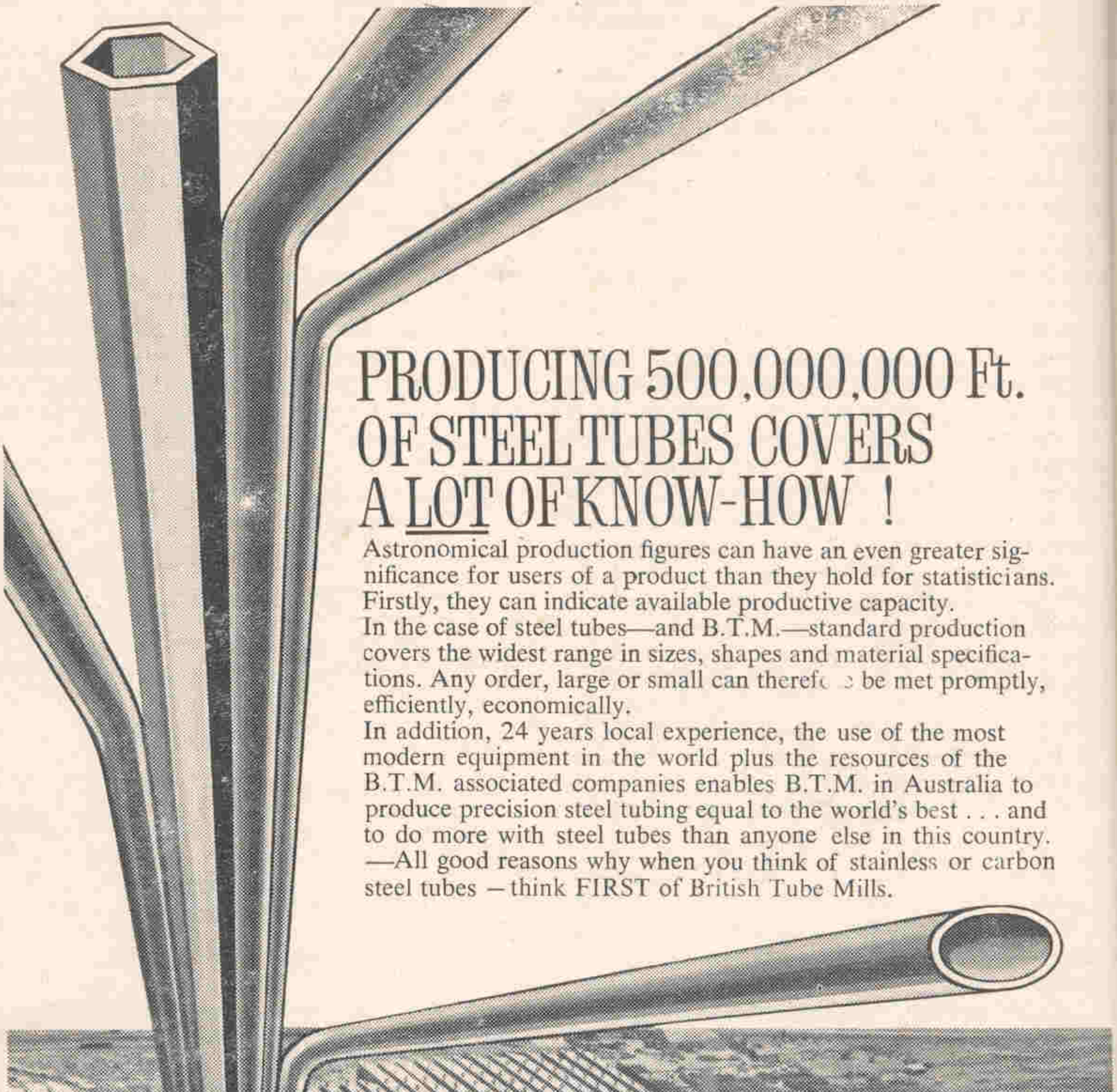
But it must be recognized that the attitudes and actions of the engineers (and others) in our universities today will largely determine the character as well as the calibre of the profession in the generation or generations which follow. Perhaps a brief examination of some points of friction, indicative of a structural weakness in tertiary education in general, and engineering education in particular, might serve to highlight the sense in which the universities may help to insure the future health and prosperity of the profession.

The first observation we may well make is to note the difference between the mediaeval and present-day functions of a university. The universities of the past made no claim towards "training" undergraduates, nor did any section of the community expect graduates to possess prescribed skills upon completing their studies. Thus the older universities were, in a very real sense, places of learning, rather than training establishments for this or that profession.

Modern universities, by permitting themselves to be diverted from their proper role, may have caused tertiary education to cease performing its essential integrating function in the community. The many specialised and often competitive disciplines within our universities may even be thought to act as a differentiating rather than an integrating influence.

Engineers are by no means free from guilt in this matter. Indeed, it may well be asked whether engineers have not been so preoccupied with developing the *craft* of communication (traffic in material things as well as information) that they have almost lost the *art* of communicating with others. If "civilisation" may be defined as an advanced stage of enlightenment and social development, then such a deterioration in the art of communication may prove the death knell of our form of civilisation. Its "survival" may depend on our willingness and ability to sacrifice some pseudo-utilitarian specialisation in the universities in favour of a return to an untrammelled search for new concepts and an appropriate framework to accommodate them.

One symptom of this malaise of tertiary education today is the obsession with answering questions. It is not entirely the fault of undergraduates, especially engineers, that they devote so much of their time to *answering* questions instead of asking them. Let us conclude this brief discussion of a weighty problem by making a concrete proposal towards an improved educational system for future professional engineers: let examinations, based on answers to selected questions be abandoned, and be replaced by examinations consisting of a series of *answers* to which the candidates are to supply the *right* questions!



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Is Your Mind Versatile?

Question 1:

You have invited the Prime Minister, the Duke of Edinburgh, the Dalai Lama, and "Sugar" Ray Robinson to attend the opening of a five-mile, single-span suspension bridge you have designed. You suddenly realise that when the tape is cut, the first 2,000 feet of the bridge will split longitudinally down the centre deck due to transverse stresses. Would you

a. Throw the scissors in the river?

b. Perform rapid calculations on the back of a cigarette packet and order the immediate installation of the necessary reinforcements?

c. Elope with the Dalai Lama and catch the next submarine to Peru?

Question 2:

You are guest of honour at a banquet tendered by the Institutions of Ballistical and Petrochemical Engineers and the Panamanian Institute of Public Sanitation. You are invited to give an impromptu address on "Theories of High Speed Flight and Their Effect on Sewage Disposal", about which you know little more than the fundamental principles. Would you

a. Pretend to have amnesia?

b. Perform rapid calculations on the back of a cigarette packet and show that the theories of high speed flight are contrary to the theory of relativity?

c. Elope with a waitress and catch the next submarine to Nicaragua?

Question 3:

After a party the night before, you rise late and carelessly attire yourself in a paint-streaked boiler suit and a battered solar topee. There are several bodies on the floor, and the whole place needs a thorough cleaning. Sure enough—you have visitors. Would you

a. Lie down with the rest of the bodies?

b. Take off the solar topee?

c. Pretend to have amnesia?

Question 4:

You are spending the afternoon at the beach with your girl friend, her parents and your little brother. Fearing lest your little brother annoy your woman's parents (who are taking a nap), you suggest that he fills up all the holes with sand. This he does, beginning with the open mouth of your fairy's father. Would you

a. Scrape out the sand with a mussel?

b. To put the man at ease, poke sand down your own windpipe?

c. Pretend to have amnesia?

Question 5:
Would you mind not writing in the margin?

Question 6:

You are walking down the street one day when an unknown, but beautiful, girl dashes up to you. Thrusting a baby in your arms, she cries: "You are my husband! If you love me, feed the child!" Would you

a. Accept your fate philosophically?

b. Put the baby in your pocket and walk on hoping nobody will notice?

c. Run?

Question 7:

You are at your new girl friend's house for supper. She has a large Alsation which takes an instant and active dislike to you. During the course of the evening, the dog bites a large hole in your right leg. Your girl friend laughs and says the dog is only playing. Would you

a. Laugh and fill up the hole with cake?

b. Find another girl friend?

c. Pretend the dog has given you amnesia?

Virtuous women are like hidden treasures—secure because no one is seeking them.

OSCAR WILDE.

Why Study Politics?

• By ALLAN DAWSON

University students of politics are sometimes asked why they study politics. Many university courses. such as engineering or medicine, have obvious uses, and most people who graduate from engineering or medical faculties subsequently practice engineering and medicine respectively. Furthermore, it is sometimes pointed out that few politicians have academic qualifications in political science, while most of those people who do have such qualifications do not become professional party politicians. A different criticism often made of political science is that disagreements between political scientists' opinions in their subjects are more widespread than those between, say, engineers' opinions and engineering.

The second of these criticisms is perhaps the more fundamental one, and I shall consider it first. There are several ways in which political scientists disagree. Opinions differ on questions of the facts of politics (what *actually happens*), the explanations of political events (what *the cause or causes are of this or that event)*, and the values held (what is *morally desirable)*. It is much more difficult, as a rule, to find out what the causes of political events are than to find out what the events themselves are. There is such a huge quantity of political data, that it is difficult to decide just which data to use to explain this or that set of events. Indeed, it might be said that political science suffers from a glut of facts, and an acute shortage of adequately tested theories connecting them.

The main reason for this is the impossibility of conducting controlled "laboratory experiments" in politics. A striking example of this problem is in the variety of theories which seek to explain why the government of the Soviet Union acts the way it does. One author reviews ten theories which trace the causes of the Soviet government's behaviour variously to the traditionally imperialist policies of the Russian state, from Tsarist times, onwards to belief in Communist theories, to Russian methods of child rearing, and even (believe it or not) to repressed homosexual impulses!

Faced with such a variety of contrasting theories held by Western students of Soviet politics, one might be tempted to conclude that the academic study of politics is futile. If, however, we set our sights on a less ambitious target than explaining the causes of the Soviet government's decisions, we find that the variety of opinions is far less. The varieties of opinions held by Western political scientists on the facts of Soviet politics, and on the probable actions of the Soviet government, are far less than the variety of explanations in these theories. Thus, for example, both the theory that the Soviet government is acting on decisions prompted by Communist principles, and the theory that it is acting to increase the power of the Russian State (as did Tsarist governments), would explain why the Soviet government has had aggressive policies towards neighbouring states. It is clearly useful, however, to be able to ascertain political facts and to make at least short-term predictions, even if tested explanations connecting political events are less readily found.

The third type of disagreement between political scientists is that due to different ethical values. It is in practice, very difficult, if not impossible, to eliminate considerations of ethical values from a study of political events and their inter-relationships. Hence, two authors of different political views are likely to give two quite different accounts of the causes and relative importance of events in the same period of political history because they attach different ethical judgments to the same events, and thus emphasise different aspects of their topic. Political scientists strongly influenced by Karl Marx, for example, are usually highly critical of capitalist ownership of industry, and thereby tend to emphasise its importance in politics.

Political scientists disagree, moreover, on what political policies ought to be followed, and, in this respect, of course, they are acting as politicians rather than as political scientists. Political science can shed light, as we have seen, on the probable consequences of different political actions, and thus enable political action to be more rational in the sense that it is more likely that the desired end will follow the actions taken. In other words, political science can bear a similar relationship to practical politics as, say, physics does to engineering.

The criticism that political science is a useless subject to study because there are few professional careers for which it is a preparation, can now be answered. I suspect that there are two reasons why few politicians do specialised degree courses in politics at university level: firstly, few people choose at the age of eighteen or nineteen to become professional politicians (in contrast to would-be engineers or doctors); secondly, as politics is a rather insecure profession (politicians being liable to be voted out every few years) most politicians like to have a more secure career to fall back on, such as the legal profession, a trade union official's post, or a private business.

There are other occupations besides that of professional politicians, however, where a background of political science is most useful professionally. The diplomatic service needs personnel with a knowledge of politics akin to that gained by academic study. Australian foreign policy, for example, if it is to be intelligently thought out, has to take into account such things as the influence of the internal politics of the United States and Indonesia on the decisions made by Presidents Kennedy and Sukarno. Obviously such knowledge can hardly be gained without a close study of political systems such as those of the United States and Indonesia. In addition to foreign affairs, other branches of government can usefully employ political science graduates, although the need is perhaps less obvious because more people in Australia know about Australia's internal politics than about Indonesia's internal politics, simply because they live in Australia and see its politics first hand.

Democracy presupposes that the public has reasoned opinions on at least the more important political issues of the day. The agencies, such as the press, radio and TV which help to shape public opinion, have therefore a responsibility to present news and comment on the news that is accurate on questions of fact; which distinguishes facts from opinions and judgements of value, and which presents intelligently reasoned comment on the news. All these are more easily achieved by those trained in political science.

A student of politics can then hold that politics is a subject worth specialised academic study as follows. Firstly, although there is wide disagreement among political scientists on the causal relationships between political and social events, there is far wider agreement on what the events are, and on what short-term predictions can be made; both of which are of practical use as well as academic interest. Secondly, although there are few professional positions for which degrees in political science are essential, the knowledge and skills that are taught in these degree courses are of the greatest value in important professions, such as the civil service and journalism.

NOTE: In this article, the words "political science" have been used as a convenient shorthand for the phrase "academic study of politics", and "political scientist" for "person who does an academic study of politics." I do not intend this usage to be taken as any opinion on the question of whether, or in what sense, politics can be "scientifically" studied.

UP BOYS, AND AT 'EM!

FOILED AGAIN!

VICTORS' MA

THE STARTER

VICTORY!

SPECTATOR?

AFTERMATH I.

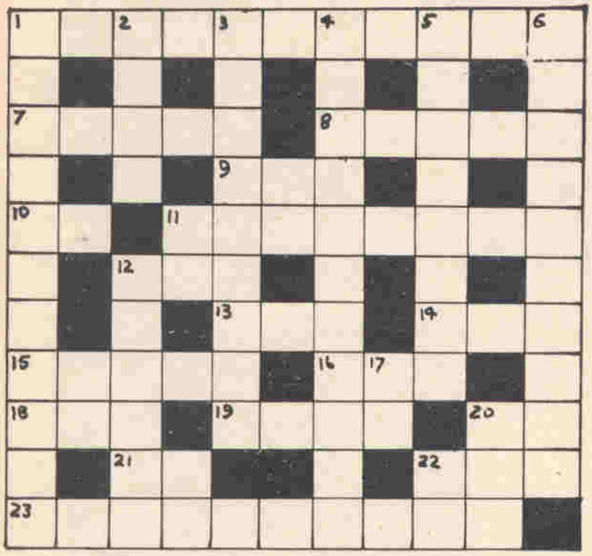
AFTERMATH II.

TRIUMPHAL ENTRY

DEFEAT

EGG SHAMPOO

Faculty Cursewords



We are not including a solution because we think you should know better than to expect one. If in doubt, consult any (dis-) reputable rag—the answers are bound to be there.

—Ed.

ACROSS

1. Our faculty.
7. Contraction.
8. Spooky.
9. Holidays (?).
10. Greek letter (commonly used for density).
11. How a bad lecturer delivers his notes.
12. Japanese currency.
13. Essential part of an engineer.
14. Label.
15. An engineer must be full of these (not jugs of beer).
16. Born.
18. Sun.
19. What llamas and engineers both do.
21. Attempt.
22. Long time.
23. Type of long-span bridge.

DOWN

1. Undertakings.
2. When you see a good-looking girl, you do this (if you're normal).
3. Suffer from this before exams.
4. Branch of Electrical Engineering.
5. Annoy.
6. What you do if you are wrong the first time.
11. Down from (Lat. prep.).
12. Steel specimen under test does this.
17. And.
20. Part of an atom.

Introduction to Oil Painting

• P. H. SYDENHAM

The general impression is that in order to paint with oils a good sketching ability is needed. This is not the case. The identification of an object is defined by the blocks of varying colour in its structure. Sketching is a mere line representation and is harder, as skill is required to portray the necessary image.

Oils are versatile and can therefore be manipulated to get the required result. Also the final form has more character than sketches and water colours, as it has a surface texture. The texture depends on the surface of the material and the method of application of the pigments. This article is designed to help the reader overcome the barrier of unfamiliarity. It should be realised that all the talk in the world will not make a good artist. The reader must be ready to have a go and see if he can create to his own satisfaction.

The oils come in 2 oz., 4 oz. and 8 oz. tubes. There are larger tubes but these are of no use generally to the beginner as large paintings are not a wise starting point. The basic pigment used is some form of white. A large tube is advisable, say the 8 oz. The other colours needed to start with are given in the diagram (4 oz. tubes are the best proposition, and cost about 5/-). Oils are thinned to the required consistency with pure turpentine as only a little is needed and it is expensive. Rinsing and general cleaning are done with mineral turpentine. About $\frac{3}{4}$ in. of each colour is squeezed on to the palette, in the order shown. The order does not matter very much but it is essential that the same order be used each time to develop a technique. Also the colours will appear to vary with different surrounding colours and the feel for the colours will be altered.

The brushes used are called 'hogs' as the bristles are from pigs. They have long handles and thin flat bristle shapes. They are totally unlike the 'squirrel hair' types as they are stiff and firm with a chisel edge. Some artists use the latter for very fine work but this is not for the beginner. The size used will depend on the style, but one with $\frac{1}{4}$ in. wide bristles and another with $\frac{1}{2}$ in. are sufficient. The same brush is used for all colours by wiping the excess off on an old rag at each change of colour. The brush is only rinsed at the end of a session or for extreme changes in colour. The larger brush is handy for filling in large areas, but the brush size will be determined by the texture desired.

The paints are traditionally applied to heavy canvasses stretched on a frame but these are expensive, hard to prepare and are hard to mount. There is also an oil-proof paper with an embossed finish resembling canvas available at art shops. Masonite, pre-coated with at least two heavy priming coats, is about the best to use as it is self-supporting and is easy to mount into a frame. Also if an old painting is not needed any more, the old paint can be sandpapered off and a coat of primer applied to mask the under painting.

A small spatula, such as is used in chemistry, and a good supply of old rag is about all that is required to complete the kit. A stand to support the board at about 60° to the horizontal, and a box to keep the gear in are a nice refinement, but are not essential. The essentials will cost three to four pounds. Materials for a 12 x 14-in. painting cost about 4/-.

A few concepts are needed before the oils are actually applied. Firstly, you will probably have noticed that the list of colours does not include a black. Pure blacks, such as graphite, rarely occur in nature. If the blacks are viewed critically, it will be seen that they are not all the same, but are really very dark shades of the colours of the spectrum. In fact, graphite is really a very dark brown. The van Dyke brown listed is one of the apparent blacks. Secondly, as already stated, the colours appear to vary with different surrounding colours. This is because the colour we interpret is that of the object mixed with colour that is reflecting. The actual colour therefore to be painted will depend on the surrounding colours. Also, the shape of an object is partially dictated by the rate of change of the shade—once again, by the amount of light reflected. Lastly the matter of shadows. The shadow shade will be the same as the object and will generally have a distinct clearcut boundary. With these points in mind, the reader should now be able, once familiar with the materials, to create objects that appear to have three dimensions.

As most would-be artists are shy with their first attempts it is wise to start with indoor studies such as still life (portraits and life studies whilst being interesting are not recommended as they are difficult and distracting). Still life consists of such things as bowls of fruit, flowers and the like. A contrasting background and not too much in the study are to be desired. To get some idea of the final appearance a frame cut in a piece of paper used in a manner similar to the camera view finder is advised.

Having decided on the study, set it up and put out the paints. The oils are placed out as shown and a thin light wash is made of one of the light browns. This is used to place in the main outlines of the study. Do not labour with this for very long as it is only a rough guide. If a change of heart occurs, use a slightly darker wash over the others. This outline will be completely covered in the final painting. Red is to be avoided as it is hard to cover. Now place a quantity of white in the clear portions of the mixing area and proceed to mix in the required colours until the shade desired is obtained. Place this on to the base with short multi-directional strokes, covering slightly the lighter and darker regions as well. Using the remainder of the unused paint, mix in still more of the colour until another shade is obtained. Apply this alongside the former batch. Now wipe out the brush and intermix the boundary to get the gradual change of shade desired. Repeat on the next side and so forth until the whole area is filled. It should now change from the darkest side to the lightest in a continous manner. It will also look round and appear to have depth. Continue for all shapes and the background. Do not attempt to put in any detail until all areas are filled as the colours and shapes will change and may not be as desired. If the shapes are not geometrically true, as is usual, then merge the oils over into the other areas until satisfied.

A good check for true geometry is to invert the painting and see if it still looks correct. Shading of the backgrounds also adds a more pleasing effect. The final finer points can now be put in, taking care to leave the already applied paints as undisturbed as possible or the result will look murky and will not be fresh and stimulating. Do not try to put too much detail into the picture as this is extremely difficult and unnecessary. It is surprising just how much can be omitted and still look reasonable. When satisfied the painting is allowed to dry. This takes up to four or five days so there is no hurry to finish the painting and many changes can be made before completing it. For a professional look, a couple of coats of copal varnish is recommended. The varnish also fills the small pores and makes it easier to keep clean.

It is very hard to make this hobby a paying concern but now and again a sale of a canvas is a rewarding event as it helps to defray expenses and is very encouraging. Each March the "Advertiser" holds an annual art exhibition. It is quite easy to get an entry accepted and there is a good chance of a sale if the picture is reasonable. There are also other art shows but they generally require membership of a club to be allowed to exhibit. The price depends on the size, but the reader is advised to not aim too high. A price of 5 guineas to 10 guineas is reasonable. This may seem high but there is a lot of work in a painting and there are many failures in between each good one. Another point worth noting is that the general public like to look at the modern styles, but more often buy the nice old-fashioned pictorial types to hang at home. It is necessary to frame the pictures for display as this gives them the finished look.

A few trips to the art gallery and a look at a few books will help to clarify these ideas. If you see a style you like there is nothing to stop you copying it, as yours will turn out different anyway. Painting is one sure way to obtain individuality. However, it is considered very bad practice to actually copy a painting as it does not show any creative powers. It is hard to find a really suitable subject and the artist will always strive for something better. If a colour in the study is not as desired then by all means put your own interpretation in. It is the creation, not the objects in it that is important. A few preliminary attempts to paint folded pieces of coloured paper placed in a heap will soon develop the ideas of depth and shape.

When all of this is done, you are in the same position as those who ride bikes over canvases and squirt paint on from the tubes. You may even turn out to be another van Gogh or Rubens. Don't be frightened—have a go and see if you can do it, but you must try first to find out.

A gentleman is someone who never strikes a woman without provocation.

H. L. MENCKEN.

Some Thoughts on the Employment of Engineers

We came across an article, written by Allan Shaw (Senior Lecturer in Mechanical Engineering), which seemed to contain some interesting points relevant to engineering students. For the benefit of those who do not know Mr. Shaw, he is one of those people who came from America and fortuitiously are attracted by Australia enough to settle down here. He has been lecturing here since the beginning of last year, and before this was a consultant engineer in New York.

Naturally enough, he has been making comparisons with American conditions right from the start, and so we are extracting from the above mentioned article: "An American engineer's comments on the airconditioning of multi-storey buildings" (1) some of the sections of possible relevance.

"Many Australian manufacturers engaged in engineering design prefer to employ non-graduate personnel. In fact, a leading Australian distributor in the field of airconditioning and refrigeration was convinced that the graduate engineer did not fit into his programme. This is in sharp contradiction to the present practice in the United States."

"There are many reasons why the Australian industrialist takes a different attitude from that of his American counterpart. The modern refrigeration plant that is being used in the U.S. is not manufactured here at present; the importing of this equipment poses problems in time, service and costs; the present demand may be too small to warrant its manufacture. Furthermore, the Australian industrialist may have good reason to prefer a quick return on his investment to long term benefits. He would prefer to make a larger profit with less turnover and would tend to discourage mass demand. His business is not as competitive as it would be in the United States and again, he would prefer to keep things as they are.

"Needless to say, he would not invest in long term research on educational programmes. His staff would have a scarcity of engineers and scientists. For Australian conditions he would consider it more economical to purchase patent rights from abroad. Too few manufacturers take the initiative in developing their own products. To an engineer the slogan 'Buy Australian' might well be accompanied by the slogan 'Do Australian'."

We are here considering manufacturers of airconditioning plant.—Ed.

"The modern, advanced design multi-storey building requires a design staff with a "new look" amongst whom must be included at the inception of the project a mechanical engineer with an understanding of the special problems involved in the provision of the services to such a building.

"Some of the Mechanical Engineering departments of Australian Universities and Technical Institutes have had the foresight to recognise the growing importance of airconditioning and refrigeration in this country; they have enlarged their courses of study to include these subjects. There is, however, still much need for expansion; the fund of engineering knowledge is constantly increasing. At the same time, there is a trend towards the broadening and enrichment of the undergraduate curriculum. The Universities have all they can do to include the basic theory; it is becoming apparent that the future must see an increase in post-graduate courses to lift the level of understanding in this specialised field. This year a graduate course in this field is being offered by the University of New South Wales."

Mr. Shaw examines the contributions the engineer can make to the industry and with reference to research and development makes the following point.

"Australia, while making use of the best that is available the world over, must intensify its own efforts to devise airconditioning systems that are most suitable to its economy, weather conditions, power supply and national preferences. In starting its major growth at this time, it can proceed with a fresh approach that may establish not only new systems for its own use, but for the many under-developed areas surrounding it. In several years, Australia might very well be in a position of exporting its own airconditioning products and services."

Mr. Shaw concludes his article with a very positive note.

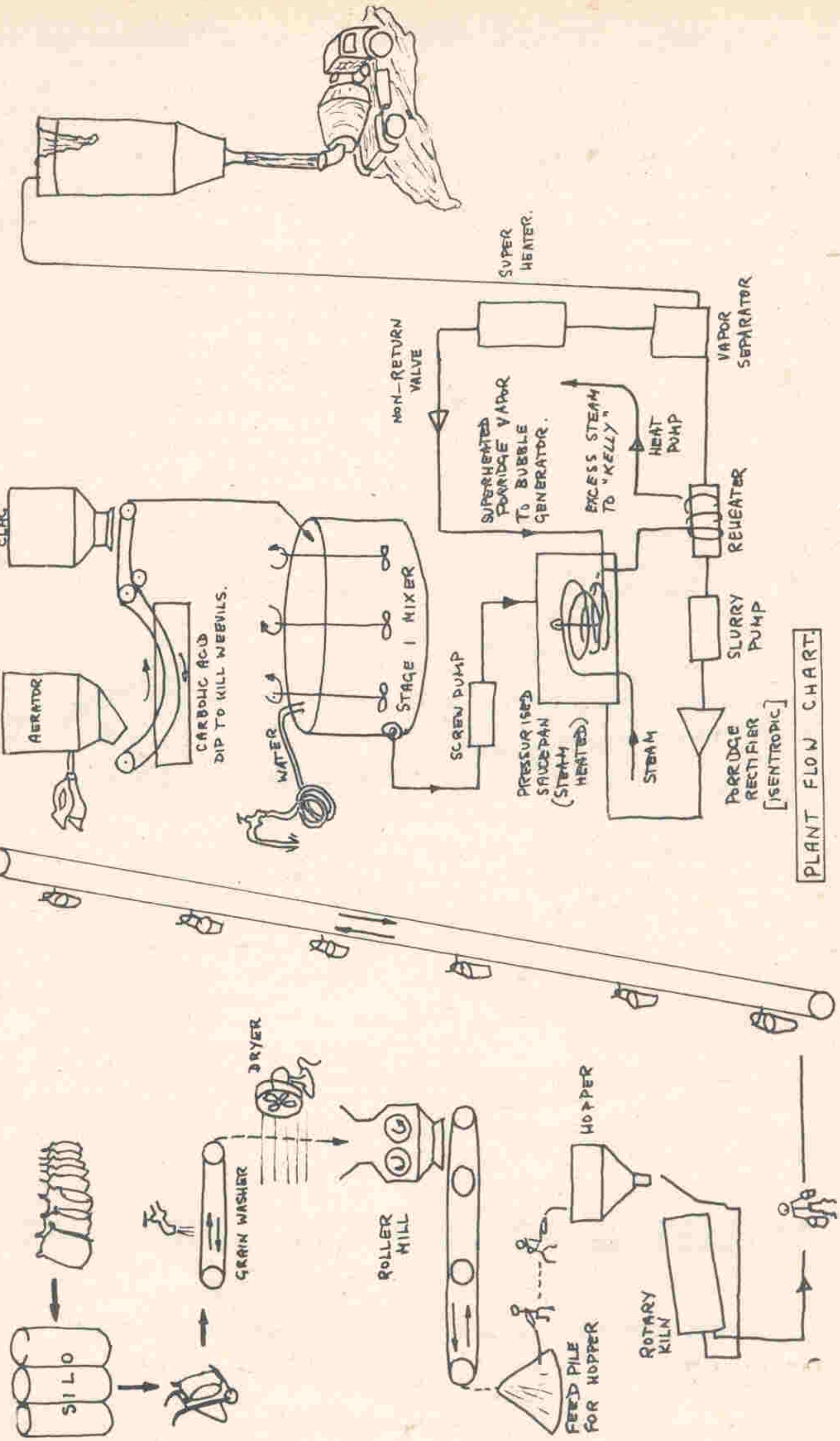
"The growth of the airconditioning industry is a dynamic process, dependent on the economy and development of the country, including the condition of its industry, educational system and status of its complete building trade. The mechanical engineer can play a very important role in the expansion of the industry if he assumes his rightful position of responsibility in the design group. This contribution can be made through his design drawings and specifications, by his establishing engineering standards, by research and development. The factors that made for successful development of the airconditioning industry in the United States have considerable significance for Australia. There are also many areas where conditions peculiar to this country govern expansion.

"From what I have observed, Australia has the potential to expand in the field of airconditioning and to contribute, through research and development, new systems and new products which are most suitable to its own conditions. An efficient industry employing qualified personnel, working with foresight and imagination, will find unlimited possibility for growth."

(1) "Architectural Science Review"—Vol. 6, No. 2; June, 1963 pp. 60-66.

Women can control their passion, but not their desire to rouse it.

LA ROCKEFOUCALD.


SILO
GRAIN WASHER
DRYER
ROLLER MILL
HOPPER
FEED PILE FOR HOPPER
ROTARY KILN
AERATOR
CARBONIC ACID DIP TO KILL WEEVILS.
DEHYDRATED SLAG
WATER
STAGE 1 MIXER
SCREW PUMP
PRESSURISED SAUCEPAN (STEAM HEATED)
STEAM
PORRIDGE RECTIFIER [ISENTROPIC]
SLURRY PUMP
REHEATER
HEAT PUMP
EXCESS STEAM TO "KELLY"
SUPERHEATED PORRIDGE VAPOR TO BUBBLE GENERATOR.
NON-RETURN VALVE
VAPOR SEPARATOR
SUPER HEATER.
PLANT FLOW CHART.

Recent Advances In Food Technology

The rapidly increasing population of the world has brought about a crisis. Present food resources are completely inadequate, making the most urgent task that of producing greater quantities of highly nutritional food.

World-wide research into this problem has led to astounding discoveries by the noted Eskimo nutritionologist, Dr. Eys Koob*. He realised that protein and vitamins, contrary to popular belief, were of little body-building value, and were, in fact, habit forming. Subsequent tests revealed that carbohydrates were the basic requirements of all living organisms.

Many tests were made to find a food suitable for world consumption. Among these tests was one involving half the New York police force. These men lived for two months on porridge alone. During this period, efficiency increased remarkably, proving conclusively the suitability of porridge.

Porridge — Manna for the Masses

Although not new, porridge had, until then, been neglected. Its true potential is now realised in many parts of the world, where production on a gigantic scale is necessary to satisfy the demand. New sources of raw material are being developed. In America, Du Pont has almost perfected a polymer porridge, while in France, a new delicacy, Plankton Porridge, has recently been introduced. Russian interest is seen in this headline from Pravda, 32/7/62, which read: "No Russian characters"**.

Australian Interests

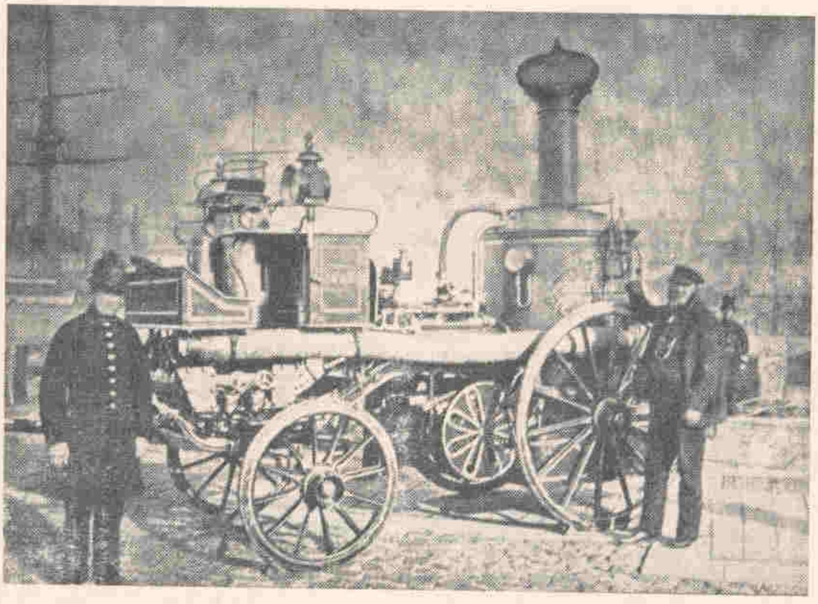
A bulk porridge plant about to commence operation will be the first of its kind in Australia. The company "Ready Mixed Instant Porridge (Aust.)" will be modelled on the parent company overseas. Already a vast supply network has been set up to cope with the expected demand. Introduction of this product is imminent. National Porridge Day will long be remembered. On this day, a large radio-controlled fleet of mobile porridge-mixers will move into operation to supply you, the customers. A mere phone call will bring porridge to your home in minutes.

This will be obviously attractive to housewives, due to elimination of time wasted in preparation. An exciting day may soon be like this:

Wake up to a hot cup of porridge, shower and breakfast, ahh! hot porridge. For the working man it's a porridge sandwich for lunch, and for the business man, pork'n porridge pie is a favourite. For afternoon breaks, vending machines will be nearby. Greet your husband after a long day's work with a tall glass of iced porridge—an excellent pick-me-up. Porridge schnitzel makes a satisfying evening meal, and, of course, formal occasions demand "sparkling porridge".

Handling

Being a semi-liquid, porridge lends itself to bulk handling. It is expected that domestic storage units will become popular in this state as in other states, where cellars and fallout shelters have been



converted. The company can convert your cellar for a nominal fee—handyman kits are also available.

* Dr. Eys Koob was assisted by Eskimo Nell during his research studies—we can only guess at his experiences.

** Which means "have no Russian characters".

So remember, when you see a yellow "Ready-Mixed" truck in your street, stop it and get a sample bucketful.

PROPERTIES

Freezing point	—3 Kelvinator
Boiling point	Depends on temperature
Triple point	3 take your pick
Flash point	Tries hard
B.T.U. rating	·0001 cals. per spoon
Viscostatic	
Thermal conductivity	·7 b.t.u. per sq. cmper ft. per °K per Svedsec perhaps
Electrical conductivity	½ a mho
½-life	About 12 o'clock
S.A.E. rating	30 in the tropics
Dew point	Any time
Isomorphic with mud	
Polymer weight	"n"
pH	15
Comp. factor Z	1 (ideal)
No known solvent	
Corrosive vapour	
Chemically sluggish	

One half she gives to passion; but, oh, the half I hunger for she dedicates to caution.

PAULUS SILENTARIUS.
(tr. Louis Untermeyer.)

Letter to the Editor

The Editor, "Hysteresis".

Dear Sir,

Knowing that you are always open for an investment in a good live proposition, I take the liberty of presenting to you what seems to me a most wonderful business, and in which, no doubt, you will take a lively interest and subscribe to its share capital. The object of the company is to operate a large cat ranch in Northern Australia, where land can be obtained cheap for the purpose, and details of the operation are supplied hereunder.

To start with, we require about one million cats: each cat will average about 12 kittens per year, the skins of which will bring 1/6 each for white ones and 2/6 each for pure black ones. This will give us about 12 million skins a year to sell at a minimum of 1/6 each, making our revenue at least £2,500 per day.

A man can skin 50 cats per day, and it will take 100 men to operate the ranch: therefore, the net profit will be £2,475 per day. We feed the cats on rats, and will start a rat ranch. The rats multiply four times as fast as the cats; if we start with one million rats, we will have three rats per cat per day, and we will feed the rats on the carcasses of the cats, from which the skins have already been taken, giving each rat one quarter of a cat. The cats will eat the rats, and the rats will eat the cats, and we will get the skins. By keeping the rats' tails, we will get the Government grant of 4d. per tail, which will be subsequently snap frozen and exported overseas. Other by-products are gut for tennis racquets, and whiskers for wireless sets and other electrical experiments.

Eventually we will cross the cats with snakes, and they will skin themselves twice a year, thus saving the men's wages for skinning, and also ensuring two skins per cat per annum.

We trust to have your prompt reply; as we feel sure you will appreciate this wonderful opportunity for a splendid investment.

Yours faithfully,

A. NONY MOUSE.

N.B.: The writer has evidently done some economics—possibly at a University. The standard exhibited would appear to be about that of Economics ½ or Economics 0.—Ed.

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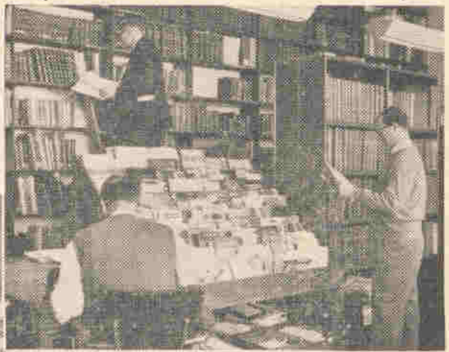
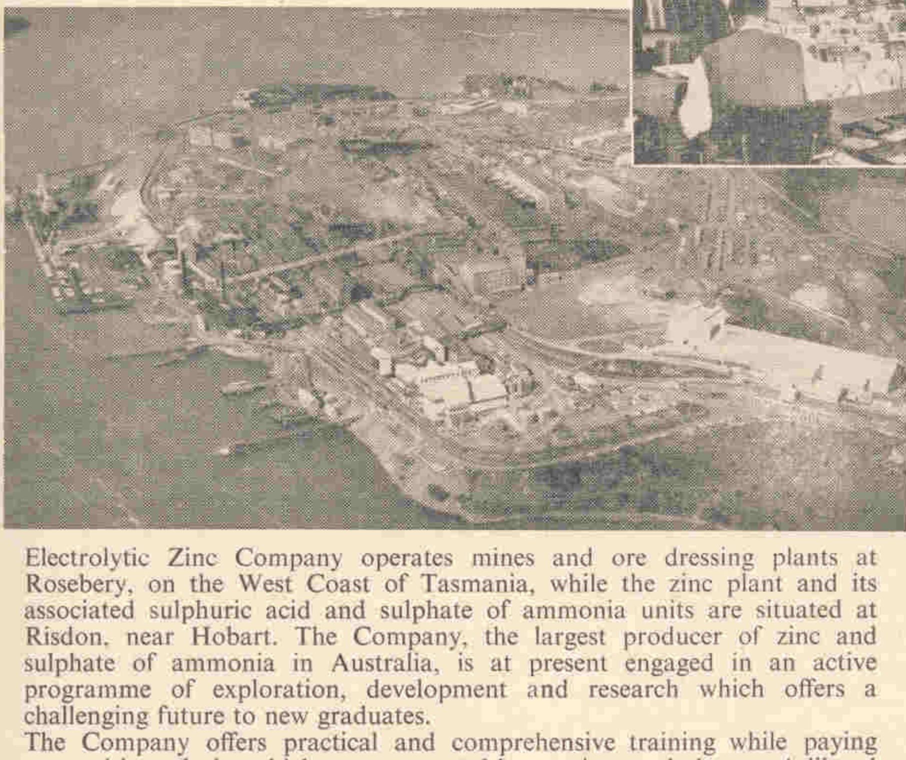


One of the Company's technical libraries



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

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

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

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

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

M6

The Pollup Gall

• FRANCIS W. JAMES

Late in second term a number of intrepid youths undertook what I believe to be the only recent attempt at qualitative assessment of opinion among engineering students. This attempt was known affectionately to its friends as the Pollup Gall. A number of questions under three general headings were distributed to students via the year representatives. These questions are reproduced below.

A. YOURSELF

1. Age?

2. Year of Course: 1st ☐ 2nd ☐ 3rd ☐ 4th ☐ 5th ☐

3. Are you financially assisted by any business or government enterprise? Yes/No

4. Do you own a car or have ready access to private vehicular transport? Yes/No

5. How many times per year do you travel interstate?
   - once
   - twice
   - more than twice
   - never

6. How many times per year do you travel by air?
   - once
   - twice
   - more
   - never

7. Have you got a steady girl? Yes/No

8. Are you engaged or married? Engaged ☐ Married ☐ Neither ☐

9. Do you drink alcohol? Yes/No.

B. THE ENGINEERING SOCIETY

1. Do you consider the A.U.E.S. to be superfluous to engineering faculty life? Yes/No

2. Could it do more for you? Yes/No

3. Are you prepared to help organise activities (even if only one)? Yes/No

4. Would you appreciate and use an engineering society library of text books and periodicals? Yes/No

5. Would you help raise money for it? Yes/No

6. Is Hysteresis worth continuation? Yes/No

7. Do you attend most A.U.E.S. functions? Yes/No

8. Do you consider publicity for functions is adequate? Yes/No

9. If approached in first term, would you write for Hysteresis? Yes/No

10. (a) Do you know what "year reps." are? Yes/No

    (b) Do you know who *your* "year reps." are? Yes/No

    (c) Do you know them personally? Yes/No

11. Do you consider that the engineering course involves too much work to allow any extra-curricular activity? Yes/No

12. Do you think it is worth while having an Engineering Society Ball? Yes/No

    Would you be prepared to help with the preparation and clearing up? Yes/No

C. THE FACULTY

1. Would lectures be superfluous for you if adequate printed notes were available? Yes/No

2. In the event of the above, would you be likely to read further for your own interest and information? Yes/No

3. Are adequate text books easily available to you (other than by purchase)? Yes/No

4. Is it beyond your finances to buy the recommended texts without distinctly "feeling the pinch"? Yes/No

5. Do you consider recommended texts to be adequate in general? Yes/No

6. Do you find most lectures boring and difficult to assimilate? Yes/No

7. Do you feel the course places too much emphasis on work and not enough on ingenuity? Yes/No

8. Do you consider most subjects to be largely drudgery? Yes/No

9. Have you ever found a concept in the course that you would be unable to master without unreasonable application? Yes/No

10. Would you prefer more contact with lecturers? Yes/No

11. If you had your previous time at University over again, would you do engineering? Yes/No

12. Is the course: too broad ☐
    too specialised ☐
    just right ☐

13. If too broad, which subjects could best be eliminated?

14. Are you at University to get a degree or are you here to broaden your education? Degree Yes/No

15. Do you think a person with an engineering degree is mature generally speaking? Yes/No

16. Do you think the Faculty should turn out engineers for the sole purpose of creating for the benefit of mankind, or should they turn out the administrators that industry require?

Due to an unfortunate oversight, neither fifth year nor honours students were included in the distribution, and consequently these answers came predominantly from the lower echelons of the undergraduate body. Only about ninety replies were received, and it is left to the reader to assess whether or not the results are representative.

The results with comments by the author are given below:

SECTION A

1, 2. Everyone knew their respective ages and the year of their courses.

3. 50 Yes, 38 No.

4. 66 Yes, 24 No.

5. 50 travel interstate once per year.
   11 travel interstate twice per year.
   3 travel interstate more than twice per year.
   24 never travel interstate.

6. 28 travel by air once per year.
   4 travel by air twice per year.
   4 travel by air more than twice per year.
   53 never travel by air.

7. 56 have no steady girlfriend.
   32 have a steady girlfriend.
   1 did not know what a girl is.

8. 3 were engaged.
   3 were married
   79 single.
   2 did not know such states exist.

9. 52 do drink alcoholic beverages.
   38 don't drink alcoholic beverages.

SECTION B

1. 77 don't consider A.U.E.S. superfluous.
   14 do consider A.U.E.S. superfluous.

2. A.U.E.S. could do more for 66 people.
   A.U.E.S. could not do more for 17 people.
   Comment: Those for whom it could do more should stir up their year representatives, or better yet, become one.

3. 62 were prepared to help organise at least one activity.
   24 were not.

4. 80 would appreciate and use a library (A.U.E.S. operated). 10 would not.

5. 60 would help raise money for it.
   27 would not.

6. 79 think Hysteresis is worth continuation.
   7 do not
   Comment: most gratifying—Ed.

7. 49 don't attend most A.U.E.S. functions.
   34 do.

8. 43 consider publicity is adequate.
   38 do not.

9. 33 would write for Hysteresis.

51 would not.

Comment: please feel free to contact next year's editor or committee.

10. (a) 83 knew what "year reps." are.

5 did not know what "year reps." are.

1 did not know what the question was.

(b) 68 knew who they were.

21 did not.

(c) 57 knew them personally.

28 did not know them personally.

4 did not know.

11. 42 consider the course allows too little extra curricular activity.

46 did not.

1 did not know what extra curricular activity is.

12. (a) 77 think it worthwhile to hold an engineering ball.

11 did not.

Comment: why do only 40% of the students turn up?

(b) 52 would help clean up and prepare.

35 would not.

Comment: why do only 3% turn up.

SECTION C

1. 64 said lectures would not be superfluous if printed notes were available.

22 said lectures would be superfluous.

(—) did not know what lectures are.

2. 62 would read further for information if printed notes were available.

19 would not.

(—) do not read.

3. 51 have adequate text books available.

32 do not.

2 dont know what text books are.

4. 42 can easily afford to buy text books.

43 cannot.

5. 45 consider recommended text to be adequate.

35 do not.

5 do not consider.

6. 36 find lectures boring and difficult to assimilate.

46 do not.

3 don't find lectures.

7. 41 feel not enough emphasis is placed on ingenuity as against "work".

35 do not.

9 don't feel.

8. 41 feel most subjects are largely drudgery.

36 do not.

8 still didn't feel anything.

9. 36 could not master at least one concept in the course.

46 could master all concepts in the course.

3 couldn't master the question.

10. 59 would prefer more contact with lecturers.

25 would not.

1 didn't know.

11. 69 would choose engineering again if given the chance to begin again.

13 would not.

3 don't know.

12. 39 think the course too broad.

14 think the course too specialised.

28 think the course just right.

14. 44 are here to get a degree.

25 are here to broaden and continue their education.

15 are here to do both.

1 is not here.

15. 56 think a B.E. is mature (generally).

17 do not.

8 did not comment.

It seems most people support the A.U.E.S. morally, but do not give much physical or intellectual assistance. This is probably due to shyness and the fact that they are not personally asked. Hence I would register a plea that they make themselves known without false modesty to their year reps., and that the year reps. make themselves available, active and to the forefront in the eyes of their fellow students. Many possible schemes were discarded or collapsed this year because of inadequate support and assistance. Among these were the Miss University quest, dinner dance, debate, car trial, theatre parties and so on. If you have any talent or ideas, come forward. The committee will be most grateful. It is interesting to note that nearly all who spoke against the Ball came from first year.

Most of the results in part C speak for themselves. The answers to question 13 are not published. All subjects taken outside the faculty were named in these answers, and not many internal subjects were criticised. The reasons for this can be discovered by asking almost any engineering student. Many people resented the ambiguity and inconclusiveness of questions 14, 15 and 16, and, in fact, no conclusive results could be obtained from 16. Many people elaborated on their answers, and I regret being unable to publish them. I hope that they will develop this talent for self expression by writing for Hysteresis next year.

In preparing the statistics for this article, a pattern became obvious in answers of particular types. It seems, far from being brash, hard-drinking, swearing libertines, a significant proportion of the answers don't drink, travel interstate, take part in A.U.E.S. activities, or "knock" the status quo. Could we have at last stumbled onto the characteristics of that wily beast, the "great flog".

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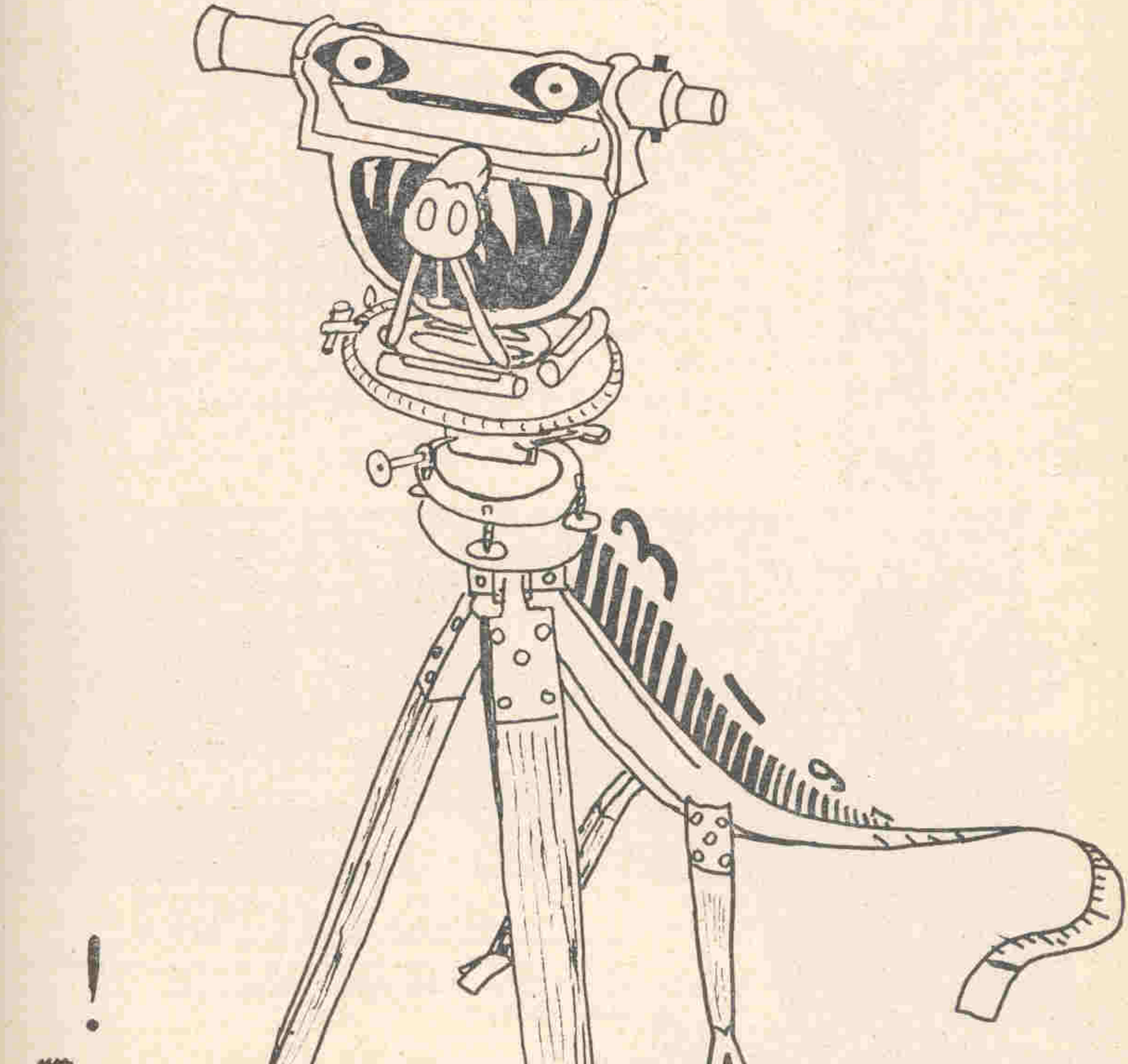
!
SURVEYOR'S
NIGHTMARE.

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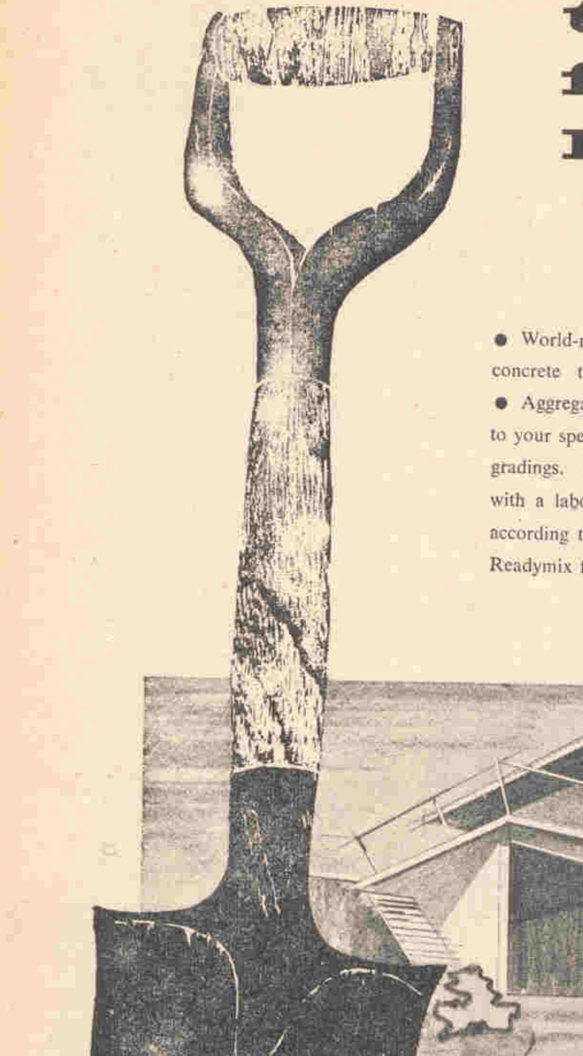

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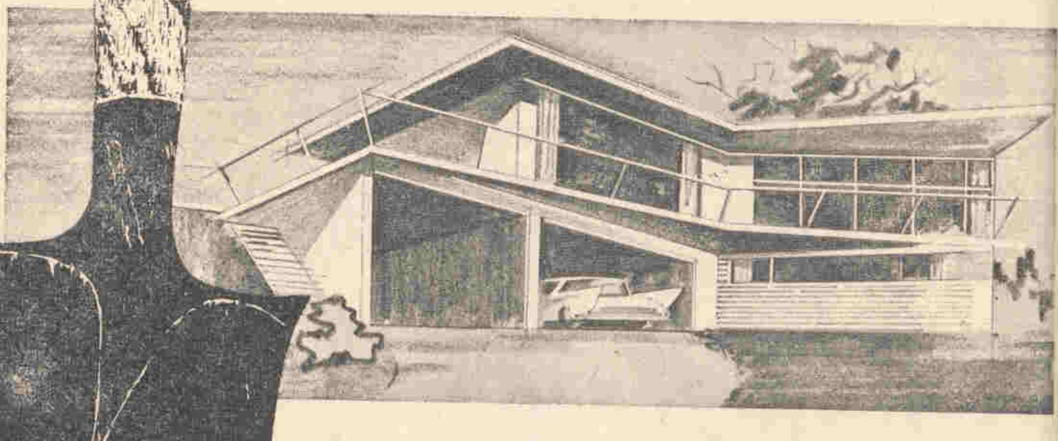

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The Kariba Dam

The Kariba Dam is situated on the Zambezi River, which forms the border between Northern and Southern Rhodesia, and will create one of the largest man-made lakes in the world. The water of this lake will then be used for an extensive hydro-electric scheme costing £80 million.

The area surrounding the Kariba Dam is heavily industrialised, as a result of extensive copper and mineral deposits, and at the present rate of progress, it was estimated that the power requirements for this industry will increase from 3,200 million in 1960 to 6,500 million K.Wh. in 1970.

Prior to the dam being built, the power requirements were satisfied by thermal power stations, but any addition in these to meet the power demand would have involved further strain on the already over-taxed railways, which carried the coal from the distant coalfields to the thermal power stations.

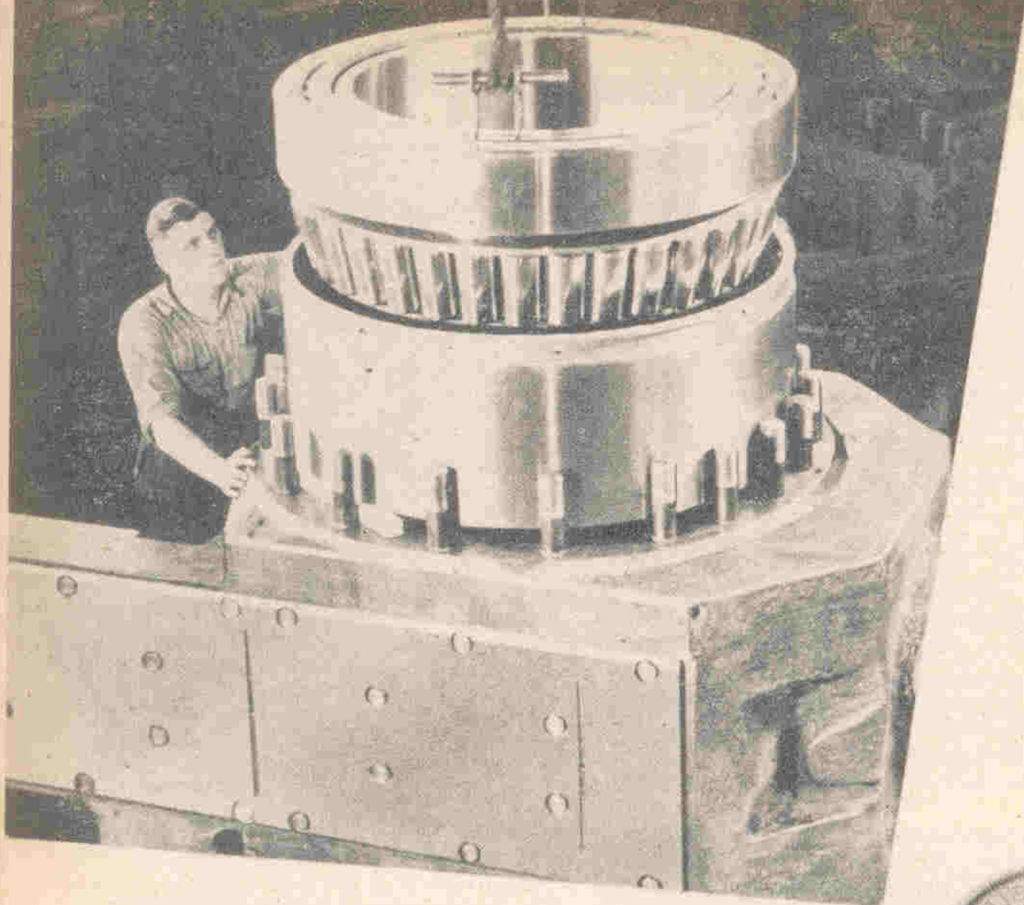
At first, nuclear power was considered for power generation, but engineers decided that this method was not sufficiently economic and they turned their thoughts to a hydroelectric scheme.

Two possible sites were considered, one on the Kafue River in Northern Rhodesia, and the other on the Zambezi River at the Kariba gorge, and in 1955 a decision was made in favour of building the scheme in Kariba gorge.

As a result of measurements made in the Zambezi River, it was found that the flow varied between 16,000 cusecs in the dry season to 200,000 cusecs in the wet season, with a maximum of 300,000 cusecs in short periods. This large seasonal variation, combined with the need to make full use of all available water for power production at a fairly even rate throughout the year, made a very large storage capacity essential.

The Kariba Gorge proved ideally suited for this requirement with its walls being up to 700 ft. in height, and drilling tests on these walls proved that sound rock existed at river bed level.

After extensive model tests had been carried out, the Kariba Dam was designed in the form of a gigantic concrete arch dam, standing 420 ft. high from its foundations, and measuring 1,900 ft. along its crest. The maximum thickness of the wall is 80 ft. as compared to about 280 ft. required for a gravity dam.



Left: *Assembling a Timken balanced pr portion back-up roll bearing in its chuck. B.S.C. supply 2½ ton bearings of this type a steel slabbing mill in Australia.*

High precision miniature bearings by Hoffmann. These weigh .004 ozs. and are used in scientific equipment where extreme sensitivity and miniaturization are required. B.S.C. has supplied many such bearings to the C.S.I.R.O

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The dam will cause the water level to rise approximately 350 ft. above the dry season level of the river, and this will create a lake 175 miles long with a surface area of 2,000 square miles, and a capacity of 130 million acre feet—which is more than four times the amount impounded by the Hoover dam, which was the largest artificial reservoir in the world. This volume of water is approximately 300 times the volume in Sydney Harbour.

To provide for spillage, there are four flood gates, each being 31 ft. wide and 30 ft. high, with the sill level about 92 ft. below normal top water level. These gates were designed to pass up to 230,000 cusecs.

Before the dam could be built, the proposed site had to be free of excess water, and in 1955 work commenced in constructing a 37 ft. diameter diversion tunnel, 13,000 ft. long, in the right bank. A channel leading through temporary openings in the dam on the left flank was also built. The portion of the dam containing the temporary openings was constructed inside a thin circular arch concrete coffer dam, which was later breached to enable the river to flow through the diversion channel.

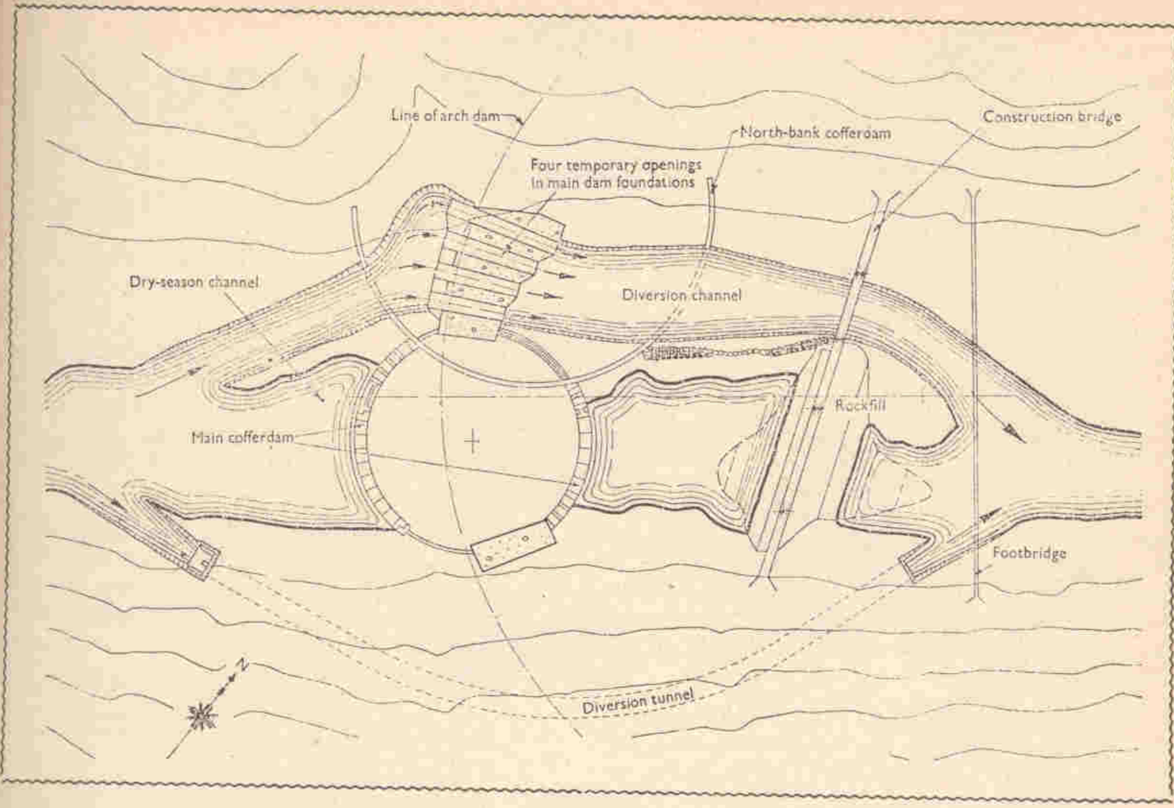
Between the channel and the right bank, the river was blocked by rock fill dumped from a temporary construction bridge. It was then possible to build the main circular coffer dam in STILL WATER; this coffer dam enclosing the centre part of the dam foundations.

Construction of the left bank coffer dam was well under way in 1957, and concrete was already being poured into the main dam in the section containing the temporary openings. In March of 1957, a flood of 290,000 cusecs occurred, which was higher than any flood registered in the 51 years of records. This caused the coffer dam to be inundated, but no serious damage occurred.

In 1958, however, a flood of 570,000 cusecs—almost twice as much as the previous year—occurred, and this was 10 ft. above the main coffer dam. Fortunately, the water level was 4 ft. below the sill of the low-level intake for the underground power station.

It is indeed remarkable that the coffer dam, and other works, stood up to this flood, the main damage occurring in erosion of roads, and the footbridge had been swept away.

After this setback, work proceeded on the main dam with the concrete being transported from the left embankment to the dam by means of a flying



Line of arch dam
North-bank cofferdam
Construction bridge
Four temporary openings in main dam foundations
Dry-season channel
Diversion channel
Rockfill
Main cofferdam
Footbridge
Diversion tunnel
N

fox system. The concrete was poured in huge concrete blocks, then adjacent blocks were grouted to ensure proper sealing. When sufficient of the dam wall had been built, the diversion works were sealed and storage of water commenced in 1958.

In June of 1959, the last of a total of 1,400,000 cubic yards of concrete was poured, and this marked the completion of the dam, ten months ahead of schedule.

Before going on to very briefly describe the remainder of the scheme, it might be pointed out that, as a result of the dam being built, a native uprising took place in late 1958.

It was mentioned earlier that storage began in 1958, and this enabled the first turbine to be put into operation on December 28, 1959. As the water built up, further turbines were set operating, until the last was set in motion in 1962. The output of these six turbines is 1,500 M.V., and this is transmitted at 333,000 volts, which is an identical voltage to that used by the Snowy Mountains Authority, and these are the only two cases in the Southern Hemisphere where a voltage of this magnitude is used.

It is later anticipated to build a second underground power station in the left embankment, and this will provide a further 800 to 1,000 M.V.

In summing up, it can be seen that the Kariba Project is one associated with many noteworthy features, such as:

1. The dam ranking as one of the highest arch dams in the world.
2. The lake formed by the dam is the largest yet made by man.
3. It is one of two projects in the Southern Hemisphere to use 330,000 volts for transmission of power.

If a lesson is to be learned from this project, perhaps the most important point is the need for extensive information being collected on the flow of a river before a dam is designed. These results, however, must be regarded with some doubt, particularly if the flow varies widely throughout the year.

The flood of 1958 in the Kariba Gorge illustrates this point; however, in this case, the future safety of the dam has subsequently been ensured by extending the number of flood gates, and in this respect the flood may prove to be a blessing in disguise in years to come.

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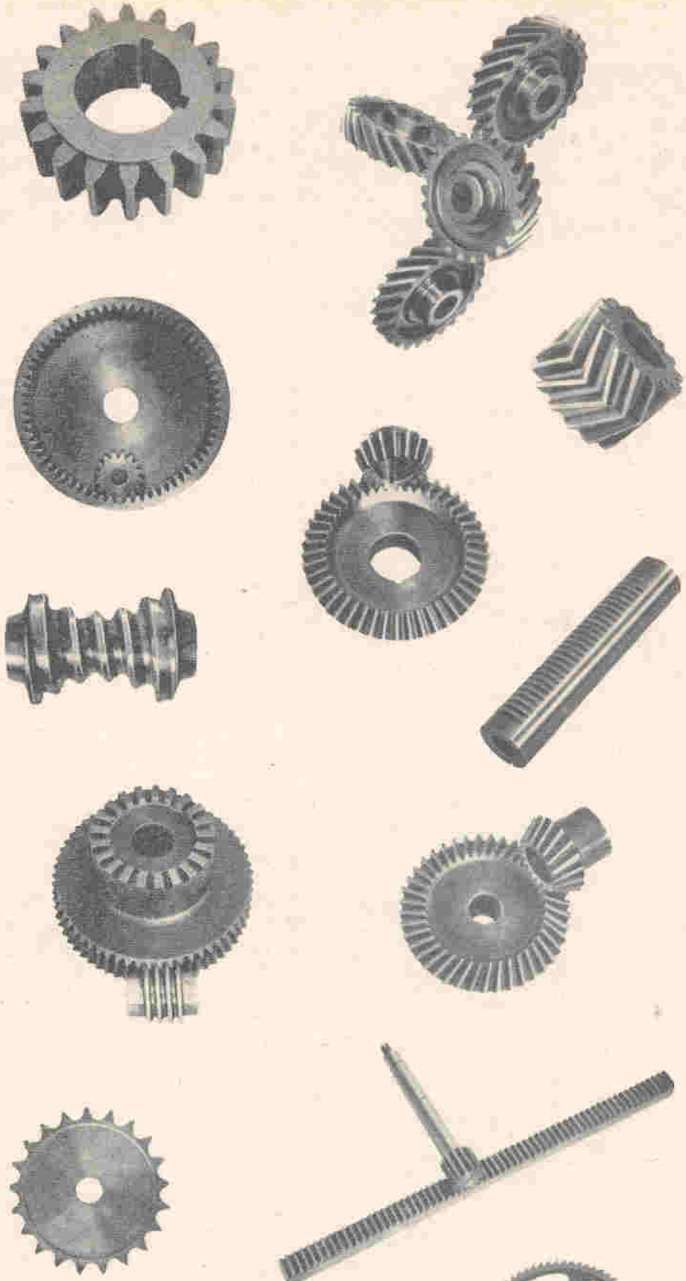

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FIELD NOTES

OCT.-NOV., 1959

from C P

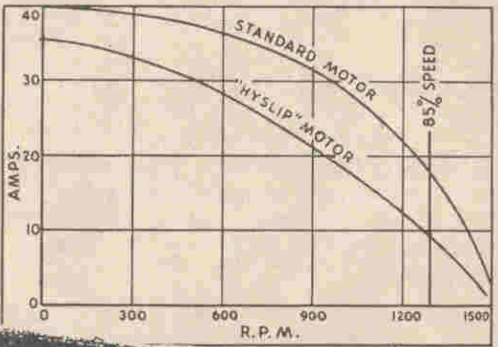
ACTUAL CASES OF ELECTRIC MOTOR USERS' TROUBLES SOLVED BY CROMPTON PARKINSON SERVICE ENGINEERS

The "Hyslip" helps out in Press Problem

The call came from a manufacturer who had just installed several stamping presses to perform an operation essential to production. The standard C.P. 5 h.p. squirrel cage motors supplied with the presses were overheating . . . and the consequences of even a partial loss of production would be serious.

Our service engineer quickly established that the motors were overheating because the presses were employed on a duty in excess of the designed capacity. A stamping press being a machine dependent upon the kinetic (or stored) energy of its flywheel to carry it through the duty stroke without detrimental loss of speed, the obvious requirement in this case was heavier presses. **But the manufacturer had to keep going with the machines on hand, or suffer severely.**

Fortunately, we could, and did, help out . . . by supplying our C.P. "Hyslip" squirrel cage motors to replace the stan



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On Passing Exams

With apologies to J. Milton.

When I consider how my knowledge went
Ere half my time in this great barn and wide,
And that one subject which I dare not fail
Now in the balance, though my mind once bent
To earn therein distinction, and present
A good attempt, lest clause 4C prevail,
"What clumsy poems hath this Milton wrote!"
I vaguely muse: but Wayville doth not wait
On musing students' whims. They aren't so short
Of grads. that they must pass us all. Who best
Impress examiners, his future hopes
Are rosy: thousands at his word shall speed
And post o'er land and ocean without rest;
They badly fail who only sit and muse.

ANON.

A naughty-type joke (nothing to do with Milton):

Confucius, he say: Woman who easy to catch not usually chaste, er, chased. Sorry.

Once more Unto Ye Limerick, Dear Friends.

A young engineer with ambition,
Did a project on nuclear fission;
His tests overloaded
The pile, which exploded,
And ended the S.C.M. mission.
There once was a fellow called Jack,
Who never could stand workshop prac;
He ruined a drill,
And it gave him a thrill.
When the lathe he used went to the pack.
A feller in first year B Tech.,
Decided to change to elec.;
He went to Prof.,
And was told to —— off,
So now he's decided on mech.
A cunning young student called Ned,
Built a go-kart of tubular lead:
To make up for the weight,
He used a V-8,
So no wonder he finished up dead.

"Denise is a nicely reared girl, isn't she?"
"I should say so. Not bad from the front either."

☆ ☆ ☆

A certain famous car manufacturer advertised that he had put a car together in seven minutes. The next evening he was called to the phone at dinner time and asked if it were so.

"Yes," was the reply, "Why?"

"Oh, nothing, but I believe I've got the car."

☆ ☆ ☆

Mary had a little wolf, and fleeced him white as snow.

☆ ☆ ☆

The old-fashioned girl who stepped out fit as a fiddle, now has a daughter who comes home tight as a drum.

A bachelor is a man who goes to work every day from a different direction.

☆ ☆ ☆

King Arthur: "I hear you've been misbehaving."

Sir Galahad: "In what manor, sir?"

☆ ☆ ☆

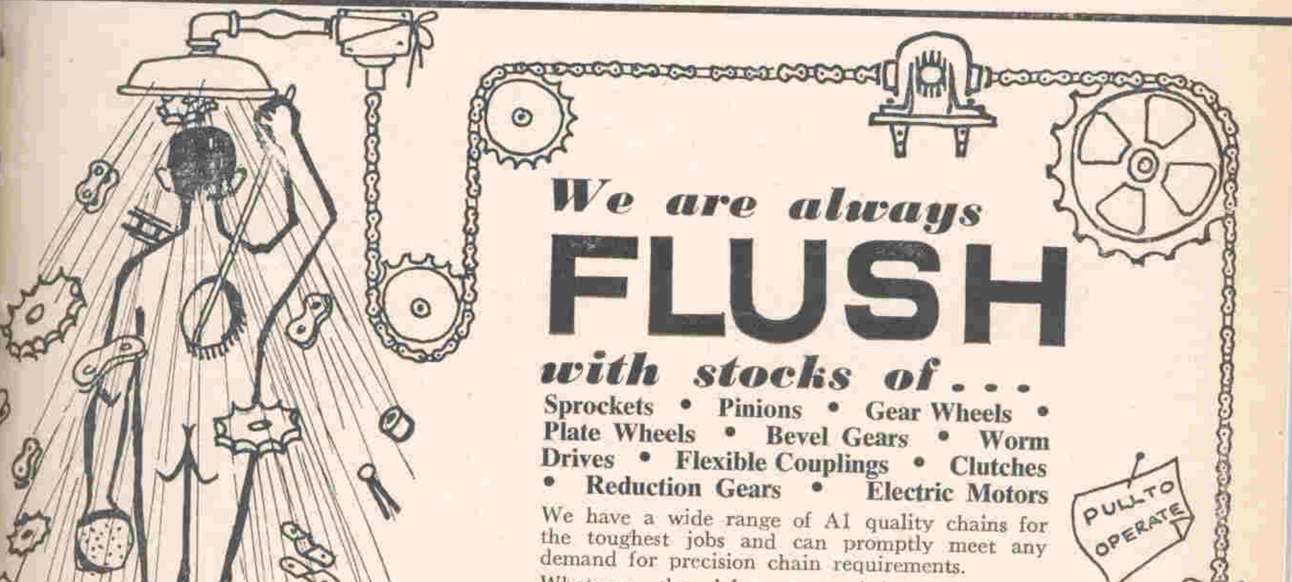
Define a "Singing Fool".—A street singer in Aberdeen.

☆ ☆ ☆

Two stenos. were discussing the handsome salesman in their office.

"He's so good looking and dresses so well."

The other one added happily, "And so quickly, too."



NOTES

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