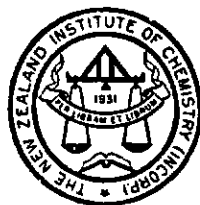


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INSTITUTE OF CHEMISTRY

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Vol. 26, No. 2

April, 1962

CONTENTS

	<i>Page</i>
Editorial	27
The Cost and Consequences of Space Heating <i>J. S. Pollard</i>	29
Salary Survey—October, 1961 <i>J. M. Mattingley, R. B. Miller and J. R. Beck</i>	46
The Royal Society and the N.Z.I.C.	54
Doctorate of Science Awards	56
International Soil Conference, New Zealand	57
The Registry	58
Council Minutes	59
Amalgamation of Wiltons with Selbys of Australia	60
Australian Symposium on Co-ordination Chemistry	61
Branch News and Notes	62
1962 Conference	62
Book Reviews	63

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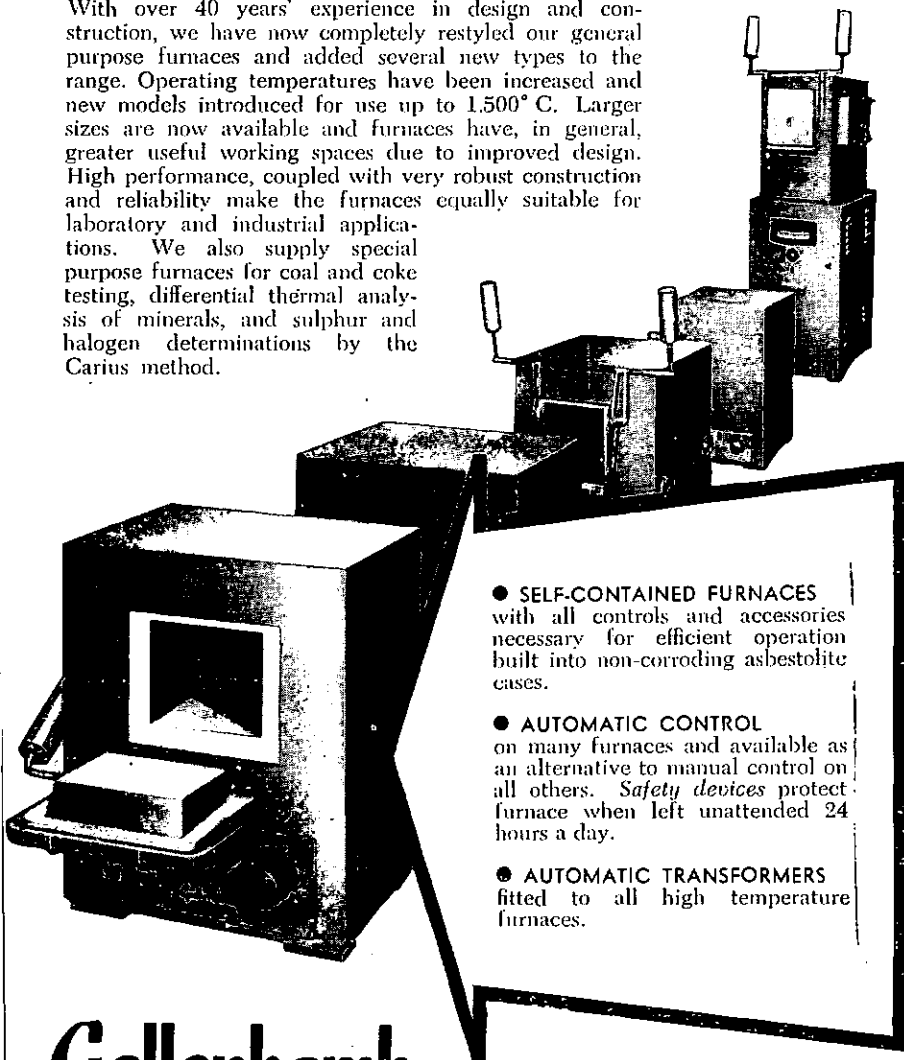


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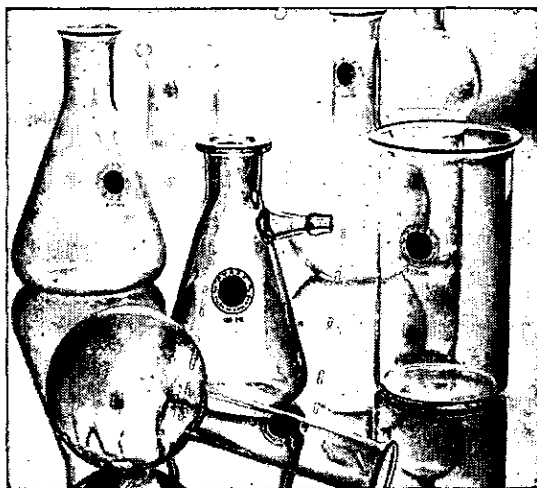
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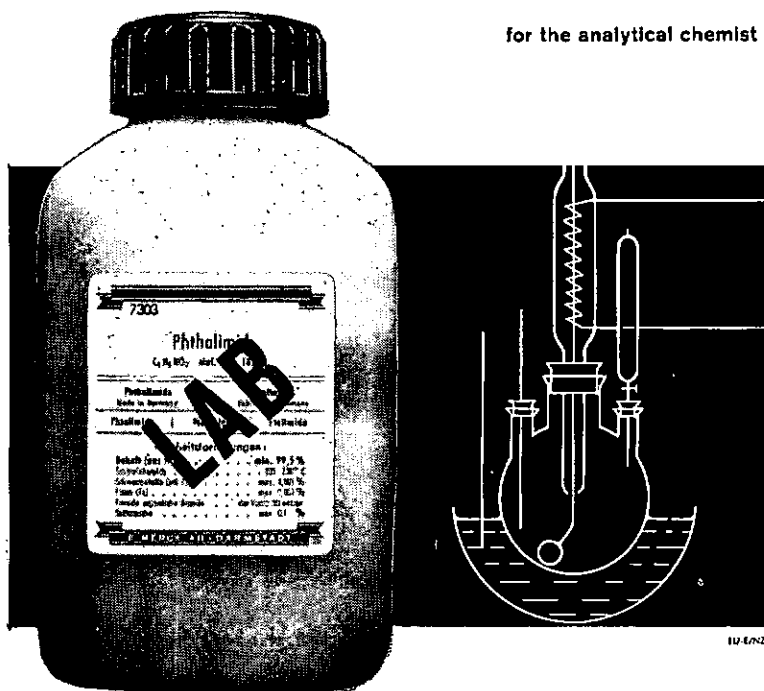
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April, 1962

EDITORIAL

Not so many years ago elucidation of the structure of organic compounds was the province of the organic chemist. His "classical techniques" included elementary analysis, fragmentation into recognizable units, selection of possible arrangements of these units by consideration of properties and reactions, and, as the final criterion, synthesis. The development of X-ray crystallography introduced a powerful weapon from the discipline of physics. More recently the entry of physics into this field has greatly increased with the perfecting of a tribe of initial-designated instruments and techniques to probe and map the molecule—UV, IR, ORD, NMR, RS, etc. With these aids, elaborate structures which had defied the classical approach can often be worked out comparatively quickly.

The cost of the instruments and ancillary services for these techniques is high. Even higher is the cost of training and retaining the specialists to operate and maintain them, and especially to interpret their results. It is obviously uneconomic for small laboratories, or laboratories whose main work is in other fields, to collect such instruments and use them only occasionally. Work on constitution and structure of unknown substances can now most effectively be carried out in specialized laboratories adequately equipped and adequately staffed.

This problem must inevitably be acute in a small country such as ours, where limited material and human resources are wastefully dispersed over an impracticably wide field of research. Yet many of our problems in agriculture, forestry and industry require the isolation and identification of organic compounds. Several organizations in New Zealand are already exploring the usefulness of newer techniques; but can we afford the duplication which will lead to several second-rate laboratories instead of one first-class one? There appears to be a need for one central laboratory capable of handling such work to which material isolated by other workers can be taken for structural studies. Such work usually starts from a comparatively stable crystalline substance or concentrate—it does not need to be located handy to the biological source, as much work of a biochemical nature must be.

The suggested arrangement may appear to deny to the chemist who has achieved a difficult isolation the intellectual satisfaction of pursuing his problem to a logical end (and of indulging in some nice "real chemistry" at the same time). This need not necessarily follow. In the previous paragraph the word "taken" was used deliberately instead of "sent". The isolator could well be seconded for a period to the specialized laboratory to take part in the work on the problem himself. He and his employer could profit from the experience he would gain and his specialist colleagues would be more intimately associated with the complete problem and others of a similar nature.

At present a number of chemists manage by enlisting the specialist services of friends overseas; but delay and the lack of close consultation make this a poor substitute for a readily accessible service. The alternative to a well-equipped "laboratory of structural chemistry" is to pass such work entirely to institutions abroad. If we accept this policy, we must resign ourselves to increased emigration of the best young organic chemists, for undoubtedly such work carries both glamour and challenge for the chemically trained mind. Conversely, a strong laboratory here could attract chemists to New Zealand.

These newer physical techniques have their limitations. They have widened the scope of organic chemistry but they have not replaced it. In his summary concluding the I.U.P.A.C. Symposium on Natural Products in Australia in 1960, Sir Robert Robinson pertinently said, "It is not to be imagined that the knowledge of molecular structure is the end of the chapter. It is rather the chemistry which we encounter, in arriving at the molecular structure and in carrying out the synthesis, which is of the greater importance."

If the day when a chemist who isolated a compound proceeded to identify it and study its constitution himself has indeed passed, let us not regret it. Laboratory cupboards throughout the world are littered with compounds whose examination defeated the particular skill and resources of their discoverers. The letters which our jargon has attached to so many of the new techniques should not be used on the gravestone of an era, but on the signpost to the future of organic chemistry.

THE COST AND CONSEQUENCES OF SPACE HEATING

J. S. POLLARD

*British Pavements (Canterbury) Ltd., Christchurch
(Formerly Chief Chemist, Christchurch Gas Company)*

The form of heating adopted in the home is largely a matter of individual choice, but it is often surprising what the individual considers cheapest. He does not get much official assistance or advice, except perhaps for the manufacturer's assurance that the appliance concerned is "very efficient", and an assurance from everyone that the open fire is the most wasteful of fuel converters.

In that respect this address is no exception, but privately I like big open fires, not poor but efficient glimmers in cast iron pots. I suspect a lot of other people enjoy such a primitive attitude, and it will take more than a slight financial advantage or gloomy smog warnings to stifle the cheery blazes. However, in the interests of our lungs, they need stifling—and soon.

HEAT UNITS

To compare one form of heating with another, it is desirable to keep the units consistent. The outputs of solid fuel heaters are usually quoted in B.t.u. per hour, whilst the gas industry prefers therms. For all that Mr Therm is a good little advertizer, I think he was conceived on the wrong side of the technical sheets; much better to have been a legitimate 10⁶ B.t.u. than 100,000. I think it much easier to visualize a 1 kilowatt radiator bar putting out 1 kilowatt-hour or unit per hour, so in most parts of this address I have kept to kilowatt-hours.

EFFICIENCY OF CONVERSION OF VARIOUS FUELS

It should be noted that one doesn't get many B.t.u. for a unit. Three fluid ounces of oil contains heat equivalent to one unit, and 10 lb of coke contains 35 units. The problem lies in getting them out, a thing which does not trouble electric devices. Sometimes odd claims are made that one electric heater is more efficient than another, which is rather strange as they all convert the current flowing in

EDITORIAL NOTE: Mr Pollard's paper was adapted for publication from the Chairman's Address which he delivered to the Christchurch Branch in 1960. Mr Pollard states, "Unless otherwise specified, prices and tariffs given in the paper are those current in Christchurch in 1960. They have changed since then—mainly upward—but inter-relationships have not shifted appreciably." Members may be interested to note that Mr Pollard's address, especially the concluding paragraphs anent the "uncoordinated cacophony" inspired editorial comment and commendation in the Christchurch press.

their resistance windings into heat according to the law $W = I^2R$, and the conversion efficiency is 100%. The combustion devices are less simple as much heat is rejected in the hot flue gases. In this respect the ordinary fireplace is less efficient than its medieval forebear which was a recess in the wall with the chimney proper quite high up. The flue gases heated the back slab which radiated extra heat into the room. The use of coal led to the confinement of the fire, and the addition of a frequently hideous fire surround put an end to the more efficient open enclosure.

The modern fire is a poor quality radiator cum exhaust fan, dragging on average 7,000 cu. ft of air per hour from the room, and returning between 10 to 20% of the gross calorific value of the fuel back into the room. Fuel with a high radiant efficiency such as coke helps matters, the overall efficiency being 15% to 25%. Sloping the back and sides enables a maximum of radiant brickwork to look at the room, and above all, the chimney throat should be kept narrow to restrict air entry. A narrow chimney is also desirable to prevent smoking, for if the flue is too big, cold air can descend, pushing smoke into the room. A wet back water heater at the fire level nullifies any attempt at obtaining radiation from the back brickwork, and for the same reason blocks of wood which hide the red heart of the fire from the room are not efficient sources of heat.

In an open fire coke is to be desired above coal both for efficiency and reduction of pollution, but its characteristics need understanding.

The reactivity depends both on coal type and carbonization conditions. The Mines Department does a grave dis-service when it fails to provide consistent coal blends, and it is essential for gasworks to maintain consistent carbonizing conditions. It is also essential for the final product to be cleanly graded, lumps 1 in. to 2 in. in diameter being the best for open fires.

Coke is not as easy as coal to ignite, and it takes longer to reach full incandescence, but even a coke fire can be kindled from 1 lb of wood and 4 double sheets of paper.

The fuel bed must be deep, and the fire is not easily controlled, but it radiates beautifully, and smokelessly. Two old wives' tales need dispelling; first, the chimney draught is not important—we used to light splendid test fires on grates without chimneys. Secondly, wetting coke causes the fire to remain black longer, and increases the chimney losses. Five per cent moisture should be regarded as the top limit.

One British coal authority recently commented strongly on the effort that went into making smokeless fuels, and contended that the time should be spent on making a smokeless coal, as coke, carbonettes and char were poor apologies for coal. The chief source of coal smoke

is gas seeping through the fissures in the coal structure in quantities too small to ignite. If holes are made in the coal—like Gruyere cheese—the gas collects and ignites. A pilot plant has been built to do this with red hot needles piercing the coal as it passes along a conveyor. This might sound involved, but in reality it is probably not as bad as a carbonizing process to operate.

The thermal return from solid fuel increases considerably once the excess air is brought under control, and a proper attempt is made to recover some of the heat in the flue gas. Followed logically through air control grates and convector surrounds one soon has a free standing closed combustion stove with a flue instead of a solid brick chimney. The combustion air is down to about 500 cu. ft per hour in contrast to 7,000 cu. ft. Dr L. Bastings investigated the performance of a number of stoves and concluded that at normal outputs in the region of two kilowatts, the overall efficiency was not below 45%. As output was pushed up, the efficiency fell. Successful overnight banking depends on sufficient air tightness to keep the combustion rate low, whilst the fuel must have a high enough bulk density to get sufficient weight of fuel into the firebox to last the period. Moreover the fuel must not bridge or insufficient heat will be conserved to maintain the ignition temperature. Small well-graded coke is capable of revivification after 10 hours. Coal, with a lower ignition temperature and higher bulk density, will bank longer.

I think banked operation is desirable so that the heater can be brought to full output without delay. Once the heat source ceases to be radiant, a higher air temperature is required by most people, and there is a desire for a greater comfort level throughout the house. Perhaps there is one small benefit to be gained from T.V. in New Zealand. People may be more amenable to discarding the open fire for a T.V. screen. If so, the Pollution Advisory Council should be willing to sponsor "T.V. Heaters".

If one can accept an efficient fire in a box, one might as well consider an oil heater with its high output and clean burning ashless fuel. If the efficiency is to be kept up around 65%, some time and grime is involved in keeping the unit clean. Flued gas heaters are usually designed to have a high radiant output—3 kW of radiant heat and an overall efficiency of 50%. If the combustion air is brought from outside, the efficiency can be raised to 75%. In passing, I would note that it is commonly thought that the thermal efficiency of gas devices is low, but in reality it is high. Water heaters absorb 75% of the input, whilst gas cooker burners, with an "into-saucepan" efficiency of 70% do better than many electric hot plates. Ovens at 45% are poorer than their electrical counterparts.

Both gas and kerosine are sufficiently clean burning to permit flueless operation. Kerosine in particular has become very popular, after recurrent power rationing. Toynbee estimated in 1960 that the thermal value of the kerosine sold for space heating in New Zealand would exceed that of the country's gas production in the same period.

Unflued heaters must be used with caution, as they discharge carbon dioxide and water vapour into the room. Kerosine yields nearly a gallon of water for each gallon of kerosine burned, which is 0.22 lb/kWh. Gas forms more, $4\frac{1}{2}$ gallons per thousand cubic feet, or 0.33 lb/kWh. In addition, gas forms about 0.00025 lb of SO_2 per kilowatt hour. To avoid any detectable smell of SO_2 the heat release must be kept below 1 kWh per 1,000 cu. ft of room volume, and I think $\frac{1}{2}$ kWh would be a more desirable figure. Kerosine heaters have not the same sulphur dioxide problem, but the water and CO_2 output is such that they should be regarded strictly as background heaters.

COSTS OF HEATING WITH VARIOUS FUELS

There is a great deal of confusion in people's minds as to the real cost of the fuels they burn. Many seem acutely conscious of the two-monthly power and gas accounts, but remain unmoved by the sporadic coal bill. Any comparison must take the overall energy cost into account, especially where fuel-assisted hot water systems are operated. People vary considerably in what they regard as a warm home, and they vary even more as regards the amount of hot water they think they use. The official figure for hot water consumption is 10 gal per person per day "normal", and 15 gal "generous", rising to 30 gal in hotels, which is presumably lavish. Since 26% of the electric power generated in New Zealand goes to heat water which consumes about half the total domestic power requirement, frugality or otherwise can make surprising alterations in power accounts.

Table 1 shows the overall energy costs for five Christchurch homes of moderate size. All five owners said they were warm, but obviously standards varied. Homes 1 and 2 were very similar, and warm, yet look at the variation in individual items. I have also compared Home 1 with an almost identical one both as regards family and house design. The latter house used electricity and coal, with a closed combustion stove to augment the water. The overall cost was very similar to 1 and 2.

Therefore beware comparisons out of context!

The real costs of the solid and liquid fuels are fairly simple to assess. *Good quality coal* costs £8/12/- per ton in lots below a quarter of a ton, falling to £8/8/5 in ton lots delivered into coal bin. *Coke* costs £11/3/- per ton in 56lb paper bags, falling to £8/16/3 delivered

TABLE 1: TOTAL FUEL COSTS TO FIVE HOMES FOR HEAT, LIGHT, POWER
(Christchurch)

Fuel	Home 1	Home 2	Home 3	Home 4	Home 5
Electricity	£13 15 0	£38 17 0	£21 2 0	£24 12 0	£55 18 0
Gas	£33 9 0	£7 3 0	—	—	—
Coke	£12 15 0	All	£18 13 0	—	—
Coal	—	four	—	—	—
Wood	—	used	—	£1 10 0	—
Oil	—	£14 3 0	—	—	£8 18 0
Kerosene	—	—	—	£4 16 0	—
Total	£59 19 0	£60 3 0	£39 15 0	£30 18 0	£64 16 0

in ton lots. Both have an "as-received" C.V. better than 12,000B.t.u./lb with coke as the more efficient fuel in an open fire.

Kerosine from the local bowser is 2s. 9d. per gallon, but falls to 2s. 2d. in 44 gallon drums. I have costed on the lower value. The C.V. is 20,100B.t.u./lb or 159,000B.t.u./gal. As flueless kerosine heaters do not recover the latent heat of condensation of the water formed in combustion the useful heat into the air is 93.5% of the gross C.V. Flueless gas heaters behave similarly, and return 90% of the gross calorific value of the gas. *Fuel oil* costs 1s. 6d. per gallon in 44 gallon drum lots. The calorific value is 19,300B.t.u./lb, or 170,000B.t.u./gal.

Gas tariffs are not as simple, and should be scrutinized closely. At present there is a double subsidy on gas—an indirect one in that some of the gas coal mines run at a loss and a direct one of 1s. 8d. per 1000 cu. ft. A Christchurch consumer who has an approved gas water heater, ostensibly pays 6s. 5d. per thousand. For having a gas meter he is charged 2s. 0d. per month, and for the privilege of being on such a cheap rate, he is charged 5s. 6d. per month. On the average, he actually pays around 7s. 3d. per 1,000, which is 0.66d. per kWh at 100% efficiency. Those without water heaters pay 9s. 9d. per 1,000 plus a block charge of 2s. 0d., and average about 0.98d. per kWh at 100%.

Electricity charges in the Christchurch Municipal Electricity Department's area are the same for all domestic consumers, with a high rate for the first few hundred units and a charge of 0.7d. per kWh for the remainder. People with a low consumption average about 1d. per kWh, whilst those on a high consumption pay in the region of 0.8d. per kWh. Consumers are required to have a ripple controlled water heater when on this tariff, but strangely, no control is required over under-floor heating installations. Floor heating by resistance cable

TABLE 2: HEATING COSTS

Heater	Output kW	Capital Cost per kW	Operating Cost per kWh
El. U.F. Cable	20.0	£15 10 0	0.7d
El. Convectore	2.0	£6 0 0	0.7d
Kerosene	2.2	£6 7 0	0.6d
Oil	10.0	£6 6 0	0.55d
Gas (flued)	3.6	£9 0 0	1.17d
Gas (flueless)	2.4	£9 6 0	0.65d
Coal (stove)	3.0	£17 0 0	0.55d
Coal (fire)	4.0	£10 0 0	1.8d
Insulation		£19 0 0	Nil

Costs based on Christchurch retail, 1960. Flues included where required.

set in concrete is a most attractive form of house heating, although the initial cost is high.

In compiling Table 2 I have assumed that for both gas and electricity the normal consumption has paid all the high charges and the space heating device is using fuel at the basic tariff charge.

The capital charges allow for flues or chimneys to be installed where needed, and in the case of the underfloor heating, provide for installation and switch gear, but not the concrete floor slab.

On the figures the best buy is probably an oil-fired stove, though I have a few reservations about the efficiency at the 10kW output. Equally the closed combustion stove might stand driving harder, but the operating cost would increase with the fall-off in efficiency.

In practice floor heating might cost a little over the basic unit cost as it is essentially a storage device, and on hot days, heat would be rejected through open windows.

I have included *insulation* to give some idea of the cost although it is in fact really dependent on the comfort level desired. In an ordinary house the proportion of heat lost in various ways is: floor—15%; glass—20%; walls—25%; ceiling—40%. Physically and thermally the ceiling is the most amenable to treatment. Perlite insulation in polythene bags costs 1s. 1d. per sq. ft, and cuts the overall heat transfer through a hard ceiling from 0.6B.t.u./ft²/°F/h to 0.18B.t.u. In a house with a steady input of 12 kW and an area of 1,200 sq. ft some 4.8 kW are lost through the ceiling. Insulation would cut this to 1.4 kW—a saving of 3.4 kW for a cost of £65. The saving in running cost will depend on how many kilowatt hours are fed into the house per year.

The very popular kerosene heater is a good buy. The fuel is competitive with its electrical counterpart, unless it is bought in drum lots when it is a little cheaper. There is of course the limitation of unflued

operation and kerosine is rather smelly to handle. Gas is better from the aspect of ease of handling although a little dearer and even more restricted in unflued operation. If one is not on a gas water heating tariff gas will cost 1.09d. for flueless operation and 1.95d. in a flued heater.

A closed combustion stove acting as an auxiliary water heater really can save money, although the capital cost is high.

The cost of a simple open fire is so high that it inspires drastic action. If you live in the Christchurch Municipal Electricity Department's area the cheapest simplest thing you can do to effect a saving as from tomorrow is to cut the fire to the absolute cheerful minimum and use whatever electric heater you own to provide the main source of heat. That I can advise you thus is, I think, an indication that domestic electric power is much too cheap in relation to other forms of space heating to be good for the economy of the country.

INDUSTRIAL HEATING COSTS

The industrial and commercial situation in Christchurch is quite different. The cheapest electric heat costs 0.75d. a unit, and even then is available only between 9.30 p.m. and 6.30 a.m. which presupposes hot floor or similar storage. During the day it costs 2½d. a unit with ripple control, and in excess of 3d. where there is no control.

Gas, on the other hand, is completely without restriction and at 9s. 0d. per 1,000 cu. ft is equivalent to 0.82 d. per kWh at 100% efficiency. Many shops use flueless heaters with an equivalent cost of 0.91d. per kWh. Those with flued heaters or overhead infra red gas panels still will not be paying more than 1.6d., so it is small wonder that nearly half the Christchurch Gas Company's winter load is commercial space heat.

STORAGE PROBLEMS

Users of solid and liquid fuels store a fair proportion of the fuel themselves. Gas and electricity on the other hand are expected to be instantly available at all times, all storage to be provided by the supplier. This sets the supplier a big problem in providing gas and power for space heating. I can store half a ton of coke which is equivalent to roughly 1,000 kWh of useful heat, and it is half my winter requirement. If I did not use coke it would have been some other form of fuel. Table 3 shows the amount of room the alternatives would have taken, efficiency being allowed for.

The liquid fuels are ideal—the winter requirements would go into two oil drums. The solid fuels are fair, but gas and electricity are most bulky. The gas maker can compromise by storing some gas and holding the rest as coal.

TABLE 3: VOLUME OF FUEL TO YIELD 1,000 KILOWATT HOURS
(Allowance made for efficiency)

Fuel	Cubic Feet
Kerosene	3.0
Oil	5.3
Coal (fire)	30
Coal (stove)	12
Coke (fire)	51
Coke (stove)	22
Gas (radiant)	15,000 (37 as gas coal)
Gas (flueless)	9,000 (21 as gas coal)
Electricity as water	
at Waitaki	700,000
at Coleridge	130,000

The electric generator is less fortunate. The generating plant must be sited close to an enormous amount of water storage and the generating plant must be big enough to generate the maximum instantaneous demand that will occur. At all other times there is surplus plant capacity. *Because of this the power wholesalers or supply authorities are charged for their power solely on the basis of their peak demand, at the rate of £16 per year per kVA of maximum demand. There is no charge at all for the actual number of units taken per day or per year.*

The authority has paid for the peak and gets the units for nothing, so it behoves him to keep the peak as low as possible, and sell as much power as possible in the valley region, even if at a very low price. The storage water heater is an excellent leveller. With ripple control the peak can be clipped, and the water reheated in the valley period. For the same reason the Christchurch Municipal Electricity Department is willing to sell off-peak space heat at a low rate. The peak exists and has been paid for so that any revenue in the off-peak region is welcome, and costs the supplier nothing.

There is a limit to peak shaving as a means of reducing primary power costs to supply authorities, for the New Zealand Electricity Department must maintain its total revenue from the Authorities. There is also a limit to valley filling to obtain revenue.

The hydro stations are designed to use all the water available on the present load factor (around 50%), and it is rare for water to be wasted over a spillway. If the load factor is improved greatly there will not be enough water, a situation which is familiar to us all.

Annual load factor incidentally is the average annual generating rate expressed as a percentage of the peak generating rate sustained for half an hour, and in New Zealand is in the order of 50%. This means that the average annual output of a generating station uses only 50% of the installed capacity.

Gas generating plant can store some of the finished product and therefore is free from the need to be as big as the instantaneous load. In fact the instantaneous load that can be carried depends only on the size of the mains and gas holder. Christchurch regularly carries 40 megawatts on a plant running at 22 megawatts. At present in Christchurch nearly 80% of a winter day's output is used between 6 a.m. and 6 p.m. During this 12-hour period, the generating plant has made only 50% of the output, so the gas holder is required to supply the other 30%, and is refilled when the load falls off after 9 p.m. Figure 1 shows the make, delivery, and stock situation throughout a winter day.

This stock swing represents the absolute minimum storage capacity that is needed. At 6 a.m. the holder is filling rapidly and in the late afternoon it is emptying rapidly. These shifts require some reserve holder capacity as a safety margin. More important still is reserve holder capacity to meet the mis-match between gas generating plant and daily load.

Conventional gas-making plant is a fragile mass of refractory brickwork, and the one thing such brickwork will not stand is rapid changes in temperature. The Christchurch plant is arranged in discrete settings each generating about 500,000 cu. ft per day. It takes six weeks to bring up or let down such a setting to cold.

Whilst it is idling it requires two tons of coke, a day to keep it hot. It takes 12 hours to start or stop it gas making, and once the change is made it must continue for 24 hours. This may sound ponderous, but such plant is regarded in the gas industry as highly flexible.

In practice it is rare for the load and gas make to match one another, so day by day plant must be brought on or off. To keep these changes to a minimum the gas holder is expected to receive or deliver the surplus. At week-ends the commercial space heat load falls to nothing and the gas load drops to nearly half the week-day output. Figure 2 shows the winter condition in Christchurch. There is a big drop from Friday to Saturday and an even greater rise from Sunday to Monday. This is met by shutting plant down early on Friday, deliberately losing gas stock, and using the space so gained to enable plant to be turned on early Sunday to have it fully operative with a full gas stock on Monday. If the gas holder capacity is very large it is possible to keep the plant running at a steadier rate, and lose stock through the week, building it up again during the week-end. If the holder were enormous it would be possible to shift rates no faster than month by month.

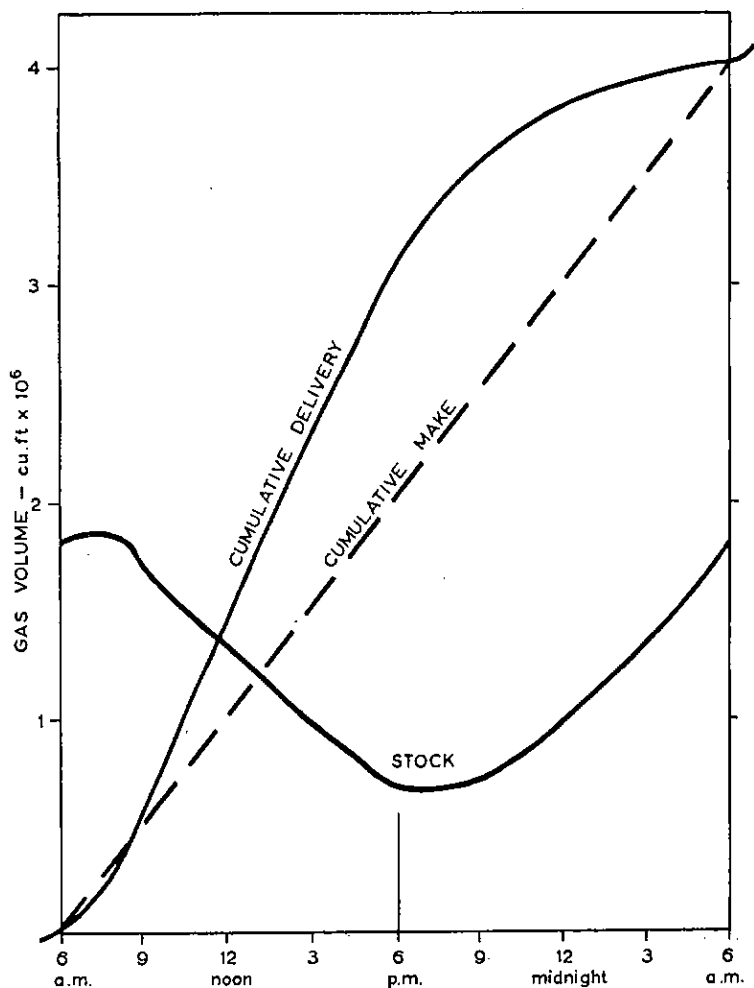


Fig. 1.

At present Christchurch is operating with less than 12 hours' peak storage, which calls for precise prediction of load and adjustment of plant. Under normal conditions it is possible to predict the day's output within 2% by noon when some 33% of the load has been sent out. This is possible from a detailed knowledge of load patterns under various weather conditions. Prediction of gas yield whilst varying plant rate is even more precise, usually $\pm 0.5\%$.

Even with these techniques handling a winter space heat load can be difficult. Fogs fail to lift, smogs blow black over the town,

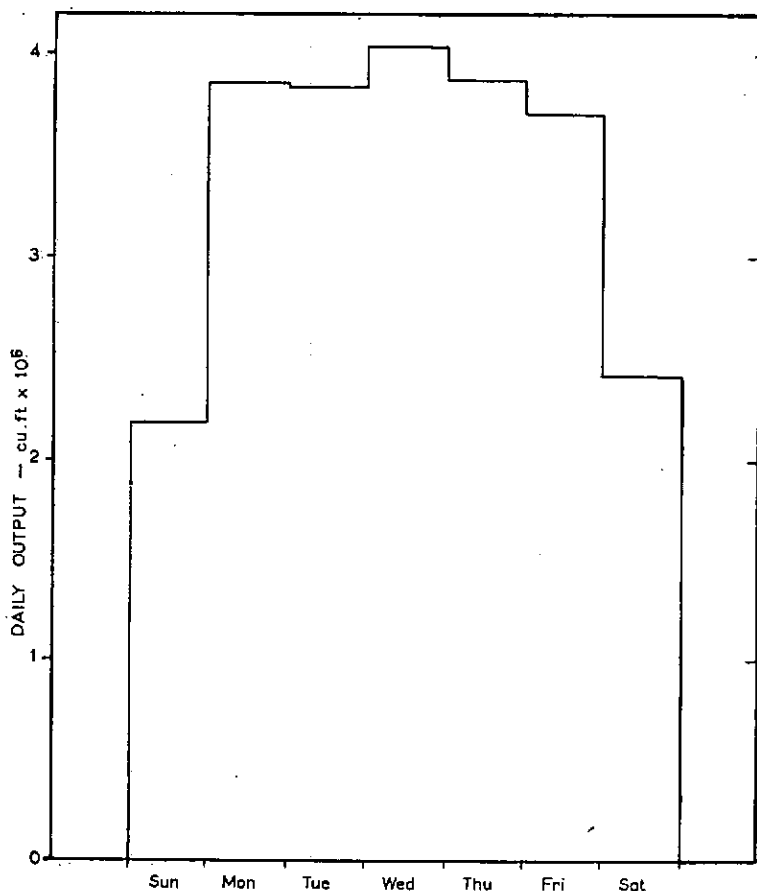


Fig. 2.

cold fronts lose their energy hundreds of miles away, or sometimes, horror of horrors, it snows without warning.

Where a high proportion of load is temperature sensitive it is desirable to put matters on a quantitative basis. The usual yardstick is the degree day which is the number of degrees Fahrenheit that the average temperature for a 24 hour period is below that of a selected base. In the United States it is 65°F., in the more chilly minded United Kingdom it is 60°F. At the base average temperature it is assumed that no space heat is required. If the average temperature were 35°F. the degree day deficit would be 25°.

Gas heating loads correlate very well with degree day deficits, the relation normally being linear.

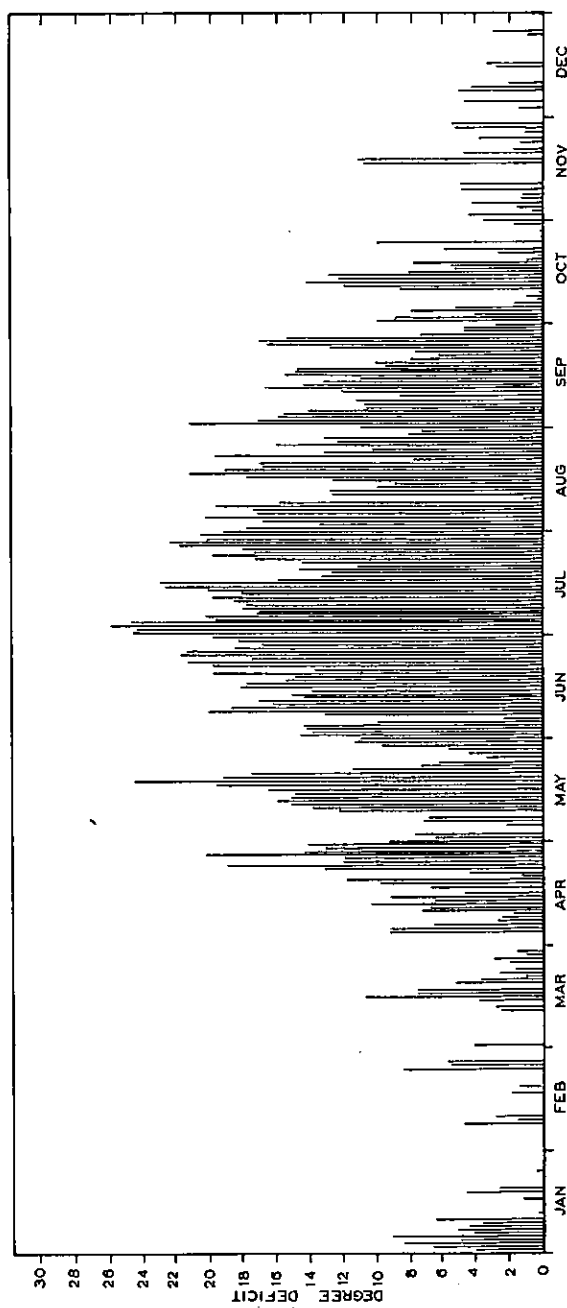


Fig. 3.

There is a base below which the load does not fall, and then an increased load as the degree deficit rises. In Christchurch the week-day base is 1.8 million cu. ft with an increase of 80,000 cu. ft per degree day deficit. If one knew the degree deficit in advance, one could predict the load.

This technique is used extensively in the United States, less so in Britain, with the exception of Liverpool where a team of Cambridge statisticians was called in to correlate all the load data Liverpool possessed. This work has enabled the area Gas Board to carry high loads with very little gas holder stock.

In Figure 3 is shown the daily degree-day deficits for Christchurch in 1958. It is in effect a measure of the space heat load that the gas and electricity systems can expect since both forms of heating can be turned on or off at whim. It is not a pretty picture. There is a most impressive cold weather demand, but it shifts rapidly from day to day, and although a lot of energy is required for a time, the total annual requirement is extremely low. The peak day has a deficit of 25°. The average day has a deficit of only 7.3°, about one quarter of the peak.

This means that although the plant must be big enough to generate the space heat peak, the space heat load is only sufficient to provide an annual load that could have been carried by a plant half the size. The situation is worst for a power generating station which must meet the half-hour peak on the peak day, better for the gas plant which has some gas holder capacity, and only needs to meet the peak day, and best for the gas plant with generous holder capacity which only needs to meet the average of the peak week. The other obvious thing to do is find a compensating summer load. The American power companies have done this so successfully that recently a section of the New York supply tripped out on an unprecedented peak caused by the mid-summer air conditioning load.

It was stated earlier that in Christchurch commercial space heat gas was much cheaper than its electrical counterpart.

Figure 4 indicates what this disparity has done to the gas load over 10 years. The peak has increased out of all proportion to the increase in the average load, partly because of the temperature swing from summer to winter, and partly because with commercial load the demand is only present 5 days in 7. For this reason, a space heat load like Cashmere Hospital is at least a 7:5 better revenue earner than the same commercial load. Moreover, there is the most wonderful steady hot water load as nurses are probably the most lavish of all hot water users.

Excluding Cashmere, the space heat load is dismal. It requires 55% of the plant capacity, and sells only 18% of the product.

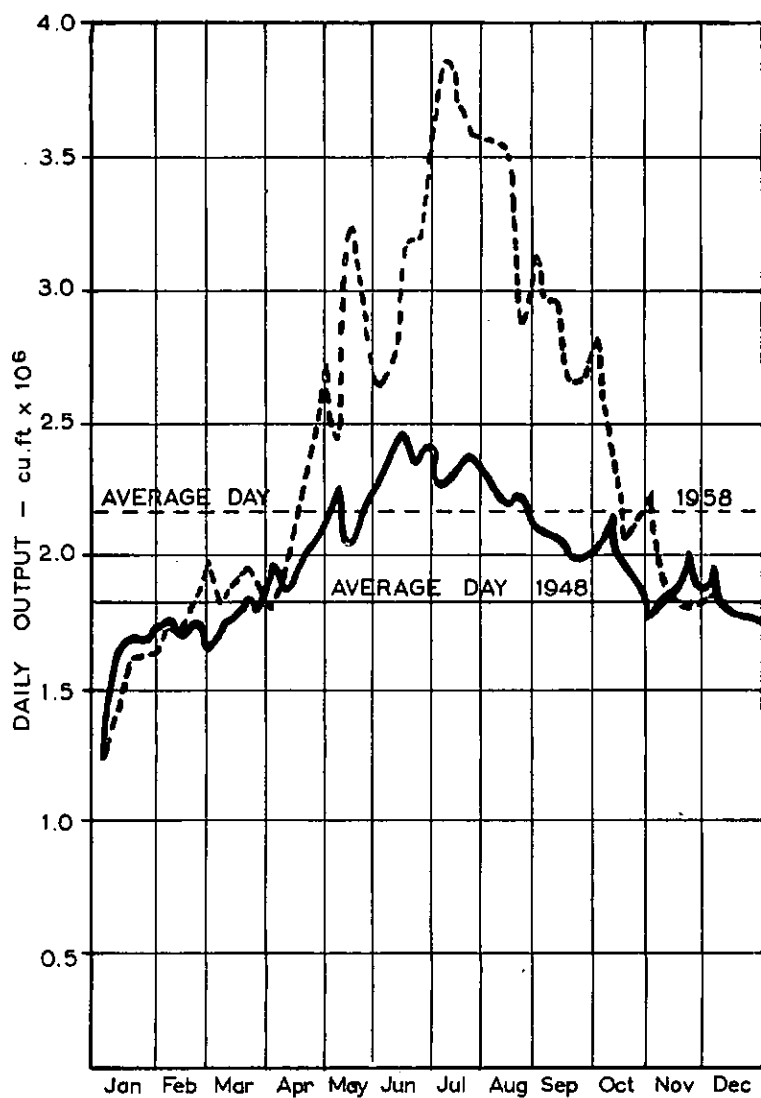


Fig. 4.

Domestic gas on the other hand uses 30% of the plant, and sells 55% of the product.

The electrical engineers now seem aware of the virtues of gas in meeting the space heat load, and I suspect there is a feeling that the New Zealand gas industry will gladly shoulder whatever space heat it is offered. It could do it but only at a price. Such a load must pay for both idle summer plant and extra storage. For the same reason, I think the electrical engineers must beware of encouraging the use of large scale domestic electric space heat unless it is completely under ripple control.

I mentioned earlier the effect of storage on plant capacity. Storage on a large scale makes spectacular reductions. In 1958 the storage of 102 million cu. ft of gas—the output for July—would have enabled the Christchurch Gas Co. to have operated with a plant half the present size. Unfortunately gas takes up a lot of space, and it would require 50 times the present holder capacity to store this amount.

Given the right conditions gas can be stored underground. In Paris, where the winter gas load is four times that in summer, engineers found underground storage in the form of an aquifer near Versailles Forest. This is a dome of water-bearing strata 2 miles long, $1\frac{1}{2}$ miles wide and 100 ft in working height. Bores were sunk and coke oven gas pumped down at 622lb/sq. in. The total capacity is 12,000 million cu. ft, about half of which is usable—about 20 days supply. Unfortunately geologists do not offer any hope of such a structure in New Zealand.

Such aquifers can go wrong. In Illinois the Herscher Dome is a huge aquifer with an ultimate capacity of 101,000 million cu. ft a day at a depth of 1,750 ft. In 1953, after four months operation, the gas leaked into a shallow zone only 100 ft down and water wells began to blow gas at a rate of $5\frac{1}{4}$ million cu. ft per day. Vent holes were bored to collect the gas and leaks in the deep cap rock located, but the engineers were last reported to be in the dark as to their cause and, worse, how to seal them.

The Americans go about collecting and burning their natural reserves so quietly that one tends to forget what a nation of gas users they are. Their total consumption is more than 30 times that of Britain and Scotland, and they use about 10 times as much per consumer.

From the six Southern States which produce 90% of the natural gas reserves, 545,000 miles of main fan out to the rest of the United States. Supply companies buy gas from the pipeline companies on a contract basis rather similar to a maximum demand charge. These store their off-peak takeage in depleted oil wells, aquifers or salt caverns owned by storage companies.

The load despatcher for such a supply company must show nice judgment when meeting any particular peak. He can shut off interruptible consumers and lose revenue. He can draw relatively expensive propane from company storage, he can draw on deep underground storage, or he can increase the supply pipeline contract and face greater rental charges when the surplus is stored underground again. The best course of action is governed by the nature and duration of the peak, and to predict this companies make the fullest use of load statistics and meteorological data. It is quite common for companies to employ their own weather experts and in addition at least two specialist firms prepare long range weather trends for use by the industry.

Even with these storage aids the underground storage is sufficient for only 20% of the peak day's requirement. Fairly drastic measures are under consideration. One form of concentration is liquid propane, which enables a 24,000 gal tank to hold the equivalent of $2\frac{1}{4}$ million cu. ft of gas. Liquid propane stores well in salt caverns—in 1958 the underground storage was over 1,000 million gal—but the supply is from oil refineries and so geared to oil production, not gas consumption. Other possible methods include dissolving natural gas in liquid propane at -140°F and 200lb/sq. in., conversion to solid hydrates and adsorption on granular beds at low temperatures; but many workers believe that the storage of liquid natural gas is the only real answer.

A large plant was installed in Cleveland in 1941 for this purpose. The natural gas was compressed to 600lb/sq. in. and chilled by boiling ethylene, which in turn was refrigerated with ammonia. The low temperature gas was next passed through two Joule-Thompson expansions down to 8lb/sq. in. and -256°F at which it becomes liquid. This plant stored the liquid in three tanks holding the equivalent of 50 million cu. ft of gas. Later a more complex tank of twice this capacity was built. Certain aspects of low temperatures as they affect notch brittleness were not known at the time of design, and at 2.40 p.m. on October 20, 1944, Tank No. 4 is believed to have suffered brittle failure. Certainly it burst, releasing 2 million gal of liquid methane. It caught fire, igniting the other three tanks. The damage was seven million dollars, 400 persons were injured and 128 killed. Since then there has been a certain caginess about liquification schemes, but it is felt that they are essential in meeting United States space heating loads.

New Zealand has no troubles of that magnitude yet, but it has got uncertain weather and a rising standard of comfort, which bring in their wake space heat problems. Christchurch in particular has a fast-growing smog problem arising largely from domestic fires in frosty weather. I thought 130 ft would have been a fair estimate

of the height of the inversion layer over Christchurch, but the meteorologists said that on many occasions 50 ft would be a closer figure. This means that for the 12 night hours in winter Christchurch is one big room with a ceiling only 50 ft high. Into this room goes the smoke of every fire in the city. Small wonder it is foul and stinking by morning. Sometimes it is quite late before the room is aired and once or twice last year it did not get aired. I think that calls for action as soon as we can get it.

On a national scale there are larger issues. Can we afford the capital investment for electricity to provide smokeless heat? Should the gas industry provide more gas or coke or both? Can we afford to import oil and kerosine for space heat? Should home builders be encouraged to install efficient and nationally economic heating? Can we permit smoking chimneys? Can the mining industry overcome its depression, and seek to provide smokeless fuels of its own accord? Could we afford to buy them?

Entangled in these issues are the New Zealand Electricity Department, the Ministry of Works, the Health Department, the Mines Department, the Railways Department, the Department of Scientific and Industrial Research, the Department of Industries and Commerce, the Gas Council; gas boards, power boards, gas companies, oil companies, coal companies, planning authorities, supply authorities, interested parties, disinterested parties, and uninterested parties; but all, whether they like it or not, involved in the consequences of space heating.

I think that it is time this vast and unco-ordinated cacophany was silenced under the firm legislative chairmanship of a vigorous Ministry of Fuel and Powder.

SALARY SURVEY—OCTOBER 1961

J. M. MATTINGLEY, R. B. MILLER and J. R. BECK*

The last salary survey conducted by the Institute was in 1958. The results of that survey and references to earlier surveys were published in *J. N.Z. Inst. Chem.* 23, (3): 73-79 (1959). The questionnaire for the 1961 salary survey was similar in most respects to the 1959 questionnaire except that the salary range was extended, and the "administration or bench work" question was replaced by one covering qualifications and numbers of staff controlled by the member. The value of personal amenities supplied by the employer was included in the salary returned.

In 1961 550 forms were distributed and 385 replies were received. The percentage of replies was 70%, which was slightly less than the 76% return received in 1958 when the number of members resident in New Zealand was 470.

RETURNS

The distribution of returns is shown in Table 1. The responses from the Teaching, Local Body and Retired groups were well below those of other groups. This is understandable in the case of the latter group.

SALARY AND AGE

Table 2 shows the distribution of salaries in the different age groups for the combined occupational groups. Distribution tables for Industry, Government, University, Schoolteachers and Research Associations are also shown separately.

AVERAGE SALARIES

Table 3 shows the average salary for the different age groups in the various occupations. For the purpose of the average calculations the middle figure in each salary range has been used.

It is to be admitted that this method of salary comparison produces results of doubtful significance in many instances. This applies more so in the present survey where the distribution of salaries in particular age groups tends to be more even and wider than the 1958 survey. The true pattern can be obtained only by inspecting the data in Table 2. However, for simplicity there is some virtue in the average salary comparison. The average salaries for 1958 are included for comparison.

*J. K. Johannesson resigned from the Professional Status Committee to take up an overseas appointment during the course of the survey, and was replaced by J. R. Beck.

TABLE 1: RETURNS

Group	No. of members in Institute	No. replied	%	Males	Females
Industry	205	147	72	146	1
Government	121	103	85	93	10
University	90	68	76	62	6
Research Associations	30	24	80	22	2
Teaching	49	23	47	23	0
Local Body	15	5	33	4	1
Self-employed	8	7	88	7	0
Retired	32	8	25	8	0
Totals	550	385	70	365	20

Since 1958 there have been salary increases in all groups. Generally the increases in the Industry, Government and Teaching groups have been similar with increases of from £100 to £400, with a tendency to higher increases with increasing age. University increases have been greater, usually by about £100 to £300. Research Association salaries have increased by £350 to £700.

Figure 1 shows the data of Table 3 in graphical form. In the 1958 survey University and Industry salaries were similar. In the present survey University salaries are higher than Industry salaries by about £100 to £200 except in the higher age groups where some Industry salaries raise the average considerably. Government salaries are about £150 less than Industry in the lower age groups, and about £400 less in the higher age groups. The Research Association salaries are slightly higher than University up to the 40 age group.

HIGHER SALARIES

Table 4 shows the percentage of members of each group receiving salaries in excess of £1,800. This figure is based on the Government Statistician's "Consumer Price Index" for the period of the salary survey, and may be compared with "higher salary" figures used in previous surveys. Since the 1952 survey there has been an increasing proportion of members in the "higher salary" range. This trend has continued with the present survey. The increase in most of the occupational groups has been high.

DEGREE OF RESPONSIBILITY

In the 1958 survey an attempt was made to relate salaries to bench and administrative duties. It appeared that salaries of bench workers in Industry and Government were similar, while Industry and Government administrators received about £200 to £400 and £150 to £300 more, respectively, than bench workers.

TABLE 2: DISTRIBUTION OF SALARIES IN AGE GROUPS
(SALARIES IN £)

Age	Below £900	£900 to £999	£1000 to £1099	£1100 to £1199	£1200 to £1299	£1300 to £1399	£1400 to £1499	£1500 to £1599	£1600 to £1699	£1700 to £1799	£1800 to £1899	£1900 to £1999	£2000 to £2199	£2200 to £2399	£2400 to £2699	£2700 to £2999	£3000 to £3499	£3500 to £3999	£4000 +	Total
ALL GROUPS																				
21-25	2	5	1		2	2	1													13
26-30	1	7	6	6	4	7	6	5	6	4	3									55
31-35		1	1		1	5	6	6	11	12	15	4	3	6	2	1	1			75
36-40				2	3	2	5	9	11	8	5	5	9	7	1					71
41-45					3	2	3	6	3	7	1		8	9	3	2				47
46-50				1	1	1		5	3	5	4	5	7	7	4	3	1			50
51-55	1			2				2	3			8	2	10	5	2	1	3		41
56-60										1	2		2		2					14
61-65	1		1	1				1		1		3	1			3				14
65+	5																			5
Totals	10	13	9	13	18	20	28	36	41	41	26	22	41	26	9	11	12	3	6	385
INDUSTRY																				
21-25					1	1														2
26-30		1	2	3	1	5	2	4	3	1		1								23
31-35		1	1		3	3	2	5	6	4	2	1	2	2	1	1				34
36-40				1	1	2	3	7	8	2	1	2	2	3	1		1			34
41-45					1	1	1	1	2	2	1	3	3	3	2	1				17
46-50					1		2		4	3	1	1	4			1	2	1	2	22
51-55								1				3	2			2				9
56-60														1		2				4
61-65										1				1						2
Totals		2	3	4	7	12	11	17	23	13	8	7	12	11	4	3	6	1	3	147
GOVERNMENT																				
21-25		1																		1
26-30		3	1	1	3	2														10
31-35				1	2	3	3	4	2	4		1	1	1						19
36-40				1	1	2	3	1	2	2	4	1	1	1						15
41-45					1	1	1	4		4			2	2	1					15
46-50					1	1	2	1	1	4	5	4				1				20
51-55			1					2	3		4		3	1	1					15
56-60									1	1		2					2			6
61-65												2								2
Totals		4	1	5	6	6	6	14	9	14	9	10	10	4	2	1	2			103
UNIVERSITY																				
21-25	2	4	1		1	1	1													10
26-30			1	1			3	1	2	2		1	2							11
31-35									2	7	1	1	2							13
36-40							1	1			3	1	3	3						12
41-45													3	3		1				7
46-50												1			2					3
51-55	1												6		1	1				9
56-60																				0
61-65															2			1		3
Totals	3	4	2	1	1	1	5	1	5	9	4	4	14	6	6	1	1	1		68
RESEARCH ASSOCIATIONS																				
21-25								1	1	1		1								4
26-30								1	1	1		1	1	2						7
31-35														3						4
36-40										1										2
41-45				1											1					2
46-50																				0
51-55											1		1	1						3
56-60										1					1					2
61-65																1	1	1		2
Totals					1		2	1	2	3	2	2	6	2	1	1	1			24
TEACHERS																				
21-25																				6
26-30		3	2	1																1
31-35							1													3
36-40					1					1		1								3
41-45							1		1	1										4
46-50						1	2	1												4
51-55				1			1							2						4
56-60														1						1
61-65								1												1
Totals		3	2	2	1	1	4	3	1	2				3						23

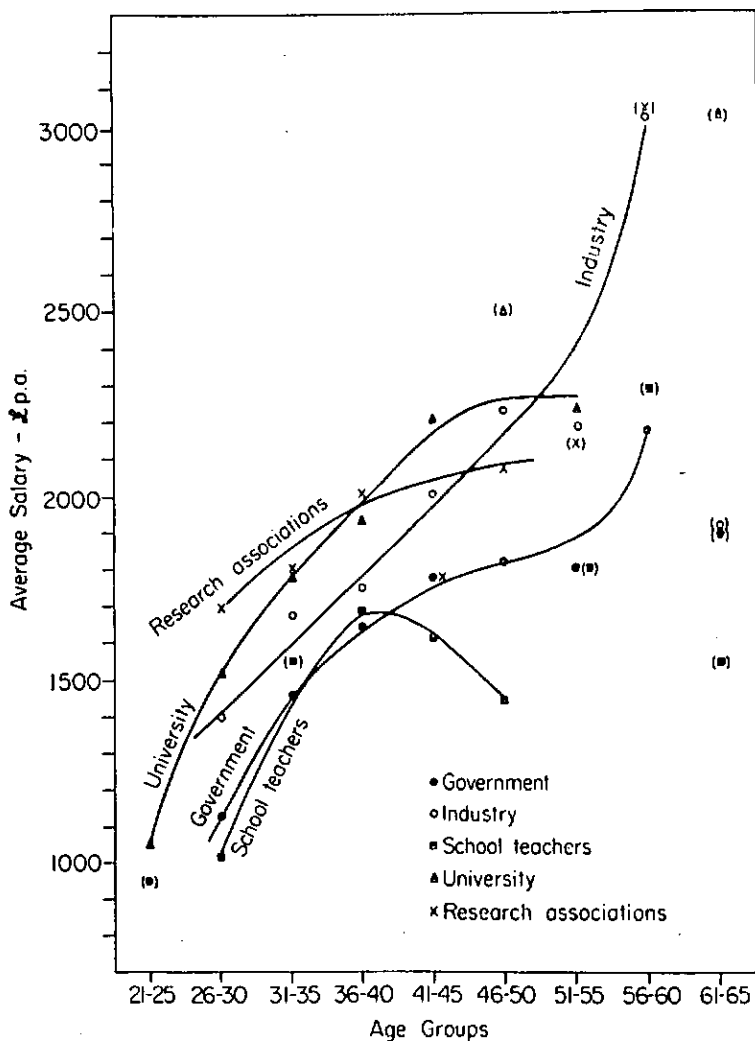


Fig. 1.

The 1961 survey asked members to state the numbers and qualifications of staff controlled by them. Table 5 shows the average numbers of the different types of staff controlled per member in the various salary brackets. The returns are shown for the main occupational groups where considerable staff are employed, and are shown separately for the different qualifications of members. Research Associations are not included because the number of returns did not warrant separate analysis.

TABLE 3: AVERAGE SALARIES FOR AGE GROUPS
Comparison with 1958.

Age	Industry		Government		University		Research Assoc.		Teaching	
	1958	1961	1958	1961	1958	1961	1958	1961	1958	1961
21-25	(983)	(1300)	(850)	(950)	1050	1050	—	—	800	—
26-30	1291	1400	1068	1127	1070	1520	1350	1700	900	1017
31-35	1363	1680	1192	1460	1275	1790	1390	1807	1150	(1550)
36-40	1604	1754	1319	1650	1644	1940	1300	2012	1350	1700
41-45	1713	2008	1431	1780	1825	2220	—	(1775)	1300	1617
46-50	1860	2260	1424	1825	(2450)	(2510)	(1450)	2083	1317	1450
51-55	1992	2190	1550	1809	1750	2240	1838	(2150)	1700	(1800)
56-60	2120	3030	1820	2180	2233	—	2017	(3050)	1300	(2300)
61-65	(1725)	(1920)	(1500)	(1900)	(1850)	3030	—	—	—	(1550)

Increase in Average Salaries, 1958-1961.

21-25	(317)	(100)	0	—	—
26-30	109	159	450	350	117
31-35	217	268	515	417	(400)
36-40	150	231	296	712	350
41-45	297	249	395	—	317
46-50	400	401	(60)	(633)	133
51-55	198	259	490	(312)	(100)
56-60	910	360	—	(1033)	(1000)
61-65	(195)	(400)	(1180)	—	—
	£100-400	£150-400	£300-500	£300-700	£100-400

(Parentheses indicate results of doubtful value because of limited number of returns.)

TABLE 4: DISTRIBUTION OF HIGHER SALARIES, 1948-1961

Group	% receiving Higher Salaries				
	1948 £1000+	1952 £1400+	1955 £1550+	1958 £1750+	1961 £1800+
Industry	19	14	21	27	37
Government	3	1	4	12	37
University	17	18	22	29	53
Research Assoc.	—	25	17	32	63
Teaching	16	5	—	8	17
Others	—	5	18	20	75

In all the occupational groups shown there is a definite relationship between salary and all types of staff under control. In Industry the numbers of non-laboratory staff controlled are very high in many instances, and occur when members are employed in factory management. Generally there is no relation between members' qualifications and the number of staff controlled.

ACADEMIC QUALIFICATIONS

Table 6 shows the numbers of members with various qualifications employed in the different occupational groups. Universities and Research Associations employ the greatest proportion of doctors (approximately 50% of their staff), while Industry employs the greatest proportion of bachelors (44% against 23% in the Government, of chemical staff employed).

TABLE 5: AVERAGE NUMBERS UNDER CONTROL

Salary Range	<1200	1200-1800	1800-2400	2400-3000	>3000
INDUSTRY					
Doctors:					
Graduates	—	0.3	13	—	4
Technicians	—	1.0	7	—	6
Others	—	0	10	—	117
Total	—	1	30	—	127
Masters:					
Graduates	1	0.4	2	(4)	5
Technicians	2	2	4	(7)	7
Others	0.3	3	13	(30)	54
Total	3	6	19	(41)	66
Bachelors:					
Graduates	0	0.4	1	2	(3)
Technicians	0.5	2	3	6	(2)
Others	0	8	49	52	(205)
Total	1	10	53	60	(210)
GOVERNMENT					
Doctors:					
Graduates	—	1	2	—	—
Technicians	—	1	2	—	—
Others	—	0	0	—	—
Total	—	2	4	—	—
Masters:					
Graduates	0	0.6	3	—	—
Technicians	0.5	2	4	—	—
Others	4	0.3	2	—	—
Total	5	3	9	—	—
Bachelors:					
Graduates	0.5	0.5	2	—	—
Technicians	1	2	3	—	—
Others	0	0.5	0	—	—
Total	2	3	5	—	—
RESEARCH ASSOCIATIONS					
All qualifications:					
Graduates	—	0.1	1	(5)	—
Technicians	—	1	2	(8)	—
Others	—	0.1	0.3	(2)	—
Total	—	1	3	(15)	—

Totals to nearest whole number.

Parentheses denotes only two replies; single replies not recorded.

TABLE 6: ACADEMIC QUALIFICATIONS IN VARIOUS EMPLOYMENT GROUPS

Qualification	Indust.	Govt.	Univ.	Res. Ass.	Teachers	Total repl. all groups	No. in. Institute
No degree	2	4	0	0	0	8	38
Bachelor	65	24	4	7	8	112	168
Master	71	49	27	5	14	174	221
Doctor	9	26	37	12	1	89	123
Not stated						2	
Total	147	103	68	24	23	385	550

TABLE 7: AVERAGE SALARY OF MEMBERS IN VARIOUS QUALIFICATION AND EMPLOYMENT GROUPS

Qualification	Industry	Government	University	Res. Assoc.	Teachers
No degree	(1100)	(1400)	—	—	—
Bachelor	1820	1550	(1730)	1760	1270
Master	1880	1680	1620	1570	1530
Doctor	2400	1720	2010	2290	—

Table 7 shows the average salary of members with various qualifications employed in the different occupational groups. Similar and stronger objections apply to the calculation of the average salaries for this comparison as for those in Table 3. In all groups there is a tendency for higher qualifications to be more highly paid, but in a great many instances individual returns indicate exceptions to the rule.

FEMALE CHEMISTS

The number of replies received was small except in the Government and University where about 10% of the group replies were from females. There is no salary distinction between males and females in University employment. The salaries of females in Government employment are considerably below the average, in each age group.

AVERAGE AGE

Table 8 shows the average age of members in the different occupational groups and includes the averages of previous surveys.

SUPERANNUATION

The position regarding Government, University, Research Associations and Local Body employees who have the opportunity to join the Government Superannuation Scheme was discussed in the published results of the 1958 survey. Table 9 shows the situation in Industry. The table sets out the employers' contributions to subsidized superannuation schemes and the numbers of members in each contribution rate group.

TABLE 8: AVERAGE AGES IN EMPLOYMENT GROUPS

	1944	1952	1955	1958	1961
Industry	33	38	38	38	39
Government	32	—	39	42	43
University	—	—	41	40	37
Res. Assoc.	—	—	—	—	41
Teachers	—	—	—	—	42
All Groups	—	—	—	41	41

TABLE 9: SUPERANNUATION (INDUSTRY ONLY)

Employer's contribution to superannuation or insurance as percentage of salary

% Contribution	No. in Group
0	14
$\frac{1}{2}$ — $2\frac{1}{2}$	9
3 — $4\frac{1}{2}$	13
5	53
$5\frac{1}{2}$ — 7	15
$7\frac{1}{2}$ — 9	16
over 9	13
no reply	14

The numbers of members not attached to a superannuation scheme has dropped steadily from 1955 onwards. Expressed as a percentage of Industry members, the trend has been; 1955, 26%; 1958, 19%; 1961, 10%. As in 1958 the subsidy rate is generally 5%.

GOVERNMENT SALARY INCREASE

Since issue and return of the 1961 salary questionnaire there has been a Ruling Rates Adjustment for Government salaries, giving an increase up to £30 per annum on salaries between £700 and £2,000. This increase has not been included in this survey.

THE ROYAL SOCIETY AND THE N.Z.I.C.

The relationship between the Royal Society of New Zealand and the Institute of Chemistry was raised in general terms in the Editorial in the February issue. The President of the Institute, Dr Shorland, has asked Branches to consider this question more closely and to make suggestions which can assist the Council in any discussions between the two organizations on matters of common interest. To this end he has noted some of the issues involved in a circular to Branches, and for the information of members who cannot attend Branch meetings Dr Shorland has consented to publication of this memorandum in the *Journal*. It is hoped that this will make possible a more complete expression of the views of members on this important topic.

The Royal Society is the largest scientific society in New Zealand and as such is capable of exerting considerable influence. Relationship of the New Zealand Institute of Chemistry to this organization has never been defined with the result that Royal Society policies affecting chemistry might not be in keeping with the views of the N.Z.I.C., which represents the largest and probably the most experienced scientific group concerned with one scientific discipline.

Current problems affecting both Societies include the question of the New Zealand role in ANZAAS and the recent setting up of scientific committees by the Royal Society, including one on chemistry. These committees are to advise and report to the Royal Society Council. The question as to what happens after that is not made clear in the Act. Although this committee has had on it the President of the N.Z.I.C. this does not necessarily mean that views expressed by the committee meet with the majority approval of members of the N.Z.I.C. The N.Z.I.C. feels that the Royal Society of N.Z. is a suitable body to represent science as a whole but that it should not express opinions on matters relating to particular disciplines unless it has consulted the organization or institute representing that discipline. As far as the N.Z.I.C. is concerned, it is undesirable that the Royal Society of N.Z. should itself express opinions relating to chemical matters.

We feel in the Institute of Chemistry that there are probably many methods whereby collaboration between the Royal Society and the N.Z.I.C. could be achieved to the satisfaction of each organization. One such method would be for the N.Z.I.C. to affiliate with the Royal Society along the lines of the recently formed Geological Society. However, the fact that this might cost the Institute one-sixth of its income might preclude such a step. If, on the other hand, affiliation were considered under Section A. 3, whereby the Institute

expended not less than one-third of its revenue on the support of a library, it might be argued that the publication of the *Journal* falls within this scope. In any case it would be within the power of the Royal Society Council to make amendments whereby the Institute of Chemistry could be affiliated if it were so desired. While this step might meet with approval of some of the members of the Institute of Chemistry, it is too early to state whether it would be entirely supported.

By the affiliation of the Institute of Chemistry with the Royal Society there would be certain advantages to the Institute of Chemistry. The Royal Society already pays a subscription to the International Council of Scientific Unions (I.C.S.U.) and it could well be that, if the Institute of Chemistry wished to belong to the International Union of Pure and Applied Chemistry, the Royal Society might assist in making available funds for this purpose. If the Institute of Chemistry were affiliated to the Royal Society this would strengthen the Royal Society when it made statements concerning science in general and at the same time it seems most likely that our representative on the Royal Society could ensure that all matters relating to chemistry carried with them the views of the Institute of Chemistry.

If the step of affiliating with the Royal Society is too difficult to undertake at this stage, I still think that discussions with the Royal Society on the matters outlined should take place and at all events some understanding with the Royal Society should be achieved.

F. B. SHORLAND,
President, N.Z.I.C.

DOCTORATE OF SCIENCE AWARDS

Two Institute members have been awarded the degree of Doctor of Science by the Victoria University of Wellington on behalf of the University of New Zealand. They are Dr I. K. Walker, Director of the Dominion Laboratory, and Dr L. Hartman, Principal Scientific Officer, of the Fats Research Laboratory. These awards will be amongst the last to be issued by the University of New Zealand.

Dr. WALKER is 45, was educated at Auckland Grammar School, graduated from the University of Auckland (M.Sc. with honours in chemistry), joined the Public Service in 1936, and went to the Dominion Laboratory. During the war he was engaged overseas in radar and atomic energy studies, returning to New Zealand in 1949. Shortly afterwards he began his investigation of the spontaneous combustion of wool—a problem which had baffled all those concerned with the storage and shipping of this important product which is so vital to New Zealand's economy. As a result of his work, which was sponsored by shipping companies and freezing works, the cause of this spontaneous combustion has now been discovered and voluntary regulations drawn up within the industry have eliminated this hazard. For this work (which was the basis of his doctorate) he was awarded the Institute's Morcom Green, Edwards Prize for 1951.

Dr Walker was appointed director of the Dominion Laboratory when Mr F. J. T. Grigg retired in 1960.

Dr HARTMAN was born in Poland, graduating as a chemical engineer at the polytechnic of Lwow. He came to New Zealand at the beginning of the 2nd World War to re-organize the stearic acid industry, after which he served as a volunteer in the New Zealand army. In 1948 he joined the D.S.I.R. to work under Dr Shorland in the Fats Research Laboratory. In 1950 he obtained his M.Sc. degree in chemistry from the Victoria University of Wellington, and in 1953 won the I.C.I. Medal and Prize for outstanding research.

Dr Hartman has recently received some publicity due to his interest in stoats, weasels, and ferrets. However, his doctorate in science was not awarded for his studies of these animals but for his researches in the field of oils and fats, the results of which have been published in some 50 scientific papers which have appeared in New Zealand journals, and in many English and foreign language journals overseas.

INTERNATIONAL SOIL CONFERENCE, NEW ZEALAND

November, 1962

Planning for the first International Soil Conference to be held in this part of the world is now well advanced. The Conference will bring together, from over fifty countries, soil scientists who are interested in soil survey and classification and soil fertility, and their interrelationships. The Conference will open in early November with study tours in both islands. From November 13 to 22 there will be meetings at Massey College where a carefully designed series of discussions will consider fundamental chemical, biological, and physical processes in soils and their application in land use problems and in the solution of broader problems of society. The Conference will conclude at the end of November after further northern and southern tours.

The meetings at Massey College will cover:

- Section A: Soil Processes and Soil Fertility (7 Sessions)
- Section B: Soil Classification (4 Sessions)
- Section C: Soil Fertility and Land Use (8 Sessions)
- Section D: Soil Science and Society (2 Sessions)

In Sections A and C the one-and-a-half-hour sessions will be introduced by a world authority invited by the Organizing Committee. Some short contributions submitted by people intending to be present have also been accepted for each session. However, no papers will be read, and most of the time will be used for general discussion. For Section B, papers on methods of soil survey and classification and on the uses of soil maps have been invited from National Societies of Soil Science. From the papers of the thirty Societies which have accepted the invitation, it should be possible to obtain a very useful assessment of the methods and values of soil surveys of all kinds. In a similar way the Section on "Soil Science and Society" should point the way to more effective application of our soil knowledge.

A number of Institute members are engaged in the organization of the International Soil Conference. The Secretary is Mr R. B. Miller, Soil Bureau, D.S.I.R., Wellington.

THE REGISTRY**Fellow**

(Elected February 16, 1962)

BARNES, Fred, M.Sc., Fletcher Industries Ltd., Plywood Division, Christchurch (Chief Chemist).

Associates

(Elected February 16, 1962)

ANDREW, David Henry, B.Sc., Kiwi Fertiliser Co. Ltd., Morrinsville (Chief Chemist).

DAVEY, Colin Lester, M.Sc., Ph.D., Meat Research Institute, Hamilton (Biochemist).

ERSKINE, John Malcolm, B.Sc.(Hons.)(Liv.), Dairy Research Institute (Bacteriologist).

HUNTER, Jack Carlyle, A.R.A.C.I., James Stedman Hendersons Sweets Ltd., Auckland (Factory Manager).

MANN, Bartholomew Robin, M.Sc., G. L. Bowron & Co. Ltd., Christchurch (Research Chemist).

SINCLAIR, Roy Lanham, B.Sc., Chemistry Dept., Auckland University (Junior Lecturer).

WALKER, Robert Douglas, Bradford Dye Works, Sumner, Christchurch (Managing Director).

Leave of Absence

CARTER, D. M.; MORRISON, D. A.

Resignations

AGGETT, F. J. B.; EDMOND, C. R.

Laboratory Assistants' Certificates

(Awarded February 16, 1962)

FISHER, Amette, Soil Bureau, Wellington.

MILLS, Edward John, Wallaceville Animal Research Station.

McGRATH, Henry John Wilson, Dominion Lab., Wellington.

THOM, Norman George, Dept. of Health, Auckland.

A newly published brochure describes the industrial and specialty chemicals marketed by Eastman Chemical Ltd., subsidiary of Eastman Kodak Company. Chemical property data and shipping information are listed for all major chemical categories marketed by Eastman. These include: Acids and anhydrides, alcohols, aromatic intermediates, aldehydes, plasticizers, solvents and a group of miscellaneous chemical products. The new product index also describes Eastman's specialty products: Food grade antioxidants, low-molecular-weight polyethylene resins, petroleum additives, rubber antiozonants, dyes for synthetic textiles, and chemicals for agricultural use.

Copies of the new chemical product index may be obtained by requesting Bulletin No. PL-104 from Eastman Chemical Ltd., P.O. Box 840, Nassau, Bahamas, or P.O. Box 14050, Hong Kong.

COUNCIL MINUTES

ABRIDGED MINUTES OF A MEETING OF THE COUNCIL
HELD IN THE CONFERENCE ROOM, D.S.I.R., SYDNEY
STREET, WELLINGTON, ON FRIDAY, FEBRUARY 16, 1962.

PRESENT

Dr F. B. Shorland (President, in the chair), W. G. Hughson (Vice-President), R. W. Oliff (Auckland proxy), R. J. Lancaster (Waikato), Dr A. J. Ellis (Wellington), R. W. Cawley (Canterbury), Dr W. G. Hanger (Otago), and Dr W. E. Harvey (Hon. General Secretary).

CONFERENCE

The Canterbury Delegate reported on the arrangements being made for Conference and pointed out that members will have already received a circular outlining the organization of the Conference.

Resolved that the Conference Committee be authorized to invite Professor C. W. Shoppee to visit New Zealand for the Conference.

It was agreed that the Institute would arrange for Professor Shoppee to visit other centres either prior to or following the Conference.

SALARY SURVEY

The report on the recent Salary Survey was tabled. This report will be printed and distributed as agreed at the last Council meeting.

OVERSEAS VISITORS

The Secretary reported that arrangements for the visit of Dr and Mrs W. A. Waters were being completed. Branches have received copies of the tentative itinerary.

INSTITUTE FINANCES

A report from the Registrar pointed out that, although the Institute is reasonably well off financially at the moment, a shortage of ready cash may arise in the near future and the position should be studied.

Resolved that the Standing Committee of Council prepare a statement on the financial situation of the Institute and that this statement be circulated to Branches.

ROYAL SOCIETY OF NEW ZEALAND

The President outlined the discussions held with officers of the Royal Society of N.Z. These had been fruitful and it appears that some closer association with the Royal Society may be arranged, possibly by affiliation with that body. It was agreed that the President and Secretary should continue these discussions with a view to bringing down more definite proposals, if desirable, at the next meeting of Council.

W. E. HARVEY, *Hon. General Secretary.*

AMALGAMATION OF WILTONS WITH SELBYS OF AUSTRALIA

Messrs. Geo. W. Wilton & Co. Ltd. announced recently that their old-established business has been acquired by H. B. Selby Australia Ltd. This business merger will be of particular interest to many Institute members to whom "Wiltons" has been a familiar name for many years and who will hope that the change will increase the range and availability of chemicals and equipment in New Zealand.

Geo. W. Wilton & Co. Ltd. has existed in New Zealand for approximately the same time as Selbys in Australia (about 60 years). It is intended that the Company will continue to operate in New Zealand, with the existing management and staff, as a subsidiary of Selbys—trading under the old name of Geo. W. Wilton & Co. Limited. There will be three resident directors, including the present Managing Director, Mr I. L. M. Alderson, who will be retained in that capacity and Mr D. M. P. Hay, formerly Secretary of Wiltons. Messrs E. J. and B. A. Selby will also join the Board.

Selbys hold many valuable sole Australian agencies for British, Continental and American scientific instrument manufacturers, and some of these companies have expressed the strong wish that Selbys should extend their activities to New Zealand.

As a result of the increased industrialization of Australia, Selbys have placed great emphasis on the employment of highly qualified technical sales and service engineers—many of them trained in the factories of the overseas principals. It is felt that this nucleus of skilled personnel will prove of great assistance in expanding Wilton's sales of the more technical equipment in New Zealand, which appears to be on the threshold of considerable industrial development.

Improving the properties of petroleum waxes—adhesion, tensile strength, elasticity—by modification with polyethylene resins, is discussed in a 16-page technical brochure (*Petroleum wax modification, with Epolene resins*) now available from Eastman Chemical Limited, subsidiary of Eastman Kodak Company.

Typical properties for seven different types of low-molecular-weight polyethylenes are given. Their use as modifiers in wax formulation is illustrated in a variety of applications including paper and carton coatings, polishes, printing inks, candles and crayons. The brochure outlines the methods used to formulate blends. Performance data for both binary and ternary blends are detailed in a series of graphs and tables. Blend properties studied include melt viscosity, softening point, hardness, tensile strength, and adhesion. In addition, the test procedures used in evaluating these blends are presented.

Copies of the brochure (No. FL-109) are available upon request to Eastman Chemical Ltd., P.O. Box 840, Nassau, Bahamas, or P.O. Box 14050, Hong Kong.

AUSTRALIAN SYMPOSIUM ON CO-ORDINATION CHEMISTRY

The Australian Chemical Meetings Organizing Committee have provided the following information concerning a Symposium on Co-ordination Chemistry to be held in Sydney next August.

The Symposium will be held in the Chemistry School, University of Sydney, August 15-17, 1962, the week preceding the A.N.Z.A.A.S. Congress, August 20-24, 1962; it is sponsored by the N.S.W. Branch of the Royal Australian Chemical Institute, and the Chemical Societies of the University of Sydney and the University of New South Wales, and arranged by the Australian Chemical Meetings Organizing Committee. The Symposium Chairman will be Professor D. P. Mellor, University of New South Wales. The programme will be divided into five sections with review papers as follows:

SECTION I—THEORETICAL ASPECTS

Review: Topic to be arranged.

Dr E. A. Magnusson, Australian Missionary College.

SECTION II—STEREOCHEMICAL ASPECTS

Review: "Some Stereochemical Aspects of Co-ordination Chemistry."

Dr F. Lions, University of Sydney.

SECTION III—MECHANISMS

Review: "The Reactivity of Ligands bonded through Oxygen Atoms."

Associate Professor A. L. Odell, University of Auckland.

SECTION IV—EQUILIBRIA

Review: "A Comparison of Reaction Rate and Equilibrium Studies in Co-ordination Chemistry."

Dr B. O. West, University of Adelaide.

SECTION V—GENERAL (not covered in Sections I-IV).

Authors who wish to contribute to the Symposium are invited to submit titles and 2 to 3 lines indicating the probable content of the papers before April 30. It would assist the organizers if authors would tentatively classify their papers according to the above scheme.

Abstracts (150 to 200 words) of papers must reach the Hon. Secretary before June 15.

Early registration for attendance would be appreciated. Programme details, including abstracts of papers to be presented, will be forwarded to registered members at least one week prior to the Symposium. Registration fee is £1 0s. 0d.

Registration forms may be obtained from Miss B. J. Stevenson, Hon. Secretary, A.C.M.O.C., Chemistry School, University of Sydney.

INSTITUTE PRIZES

Members are reminded that the closing date for Institute Prizes is April 30. Reference to conditions governing the award of prizes was published in the *Journal* for December 1961.

BRANCH NEWS AND NOTES**WAIKATO BRANCH**

At the March meeting the recent appointment to the position of Director-General of Agriculture was discussed and two motions were passed. One of these expressed concern at some features of this appointment. The other instructed the Branch Committee to urge the Council to (a) consider the principles involved in the appointment to the control of a Department responsible for agricultural research and the application of scientific disciplines to agriculture, and employing a large number of members of the Institute; (b) make representations to an appropriate authority on any decisions resulting from their deliberations.

CANTERBURY BRANCH

Mr E. W. Hullett, Director, Wheat Research Institute, has returned after a three months' visit overseas.

Three new appointments to the Chemistry Department, University of Canterbury, are: Dr L. E. Phillips, Lecturer in Inorganic and Physical Chemistry; Mr G. R. Wright, Assistant Lecturer in Physical Chemistry; and Dr D. N. Kirk, Lecturer in Organic Chemistry. Dr Phillips and Mr Wright are graduates of the Department and Dr Kirk comes to Canterbury University from the research section of B.D.H.

1962 CONFERENCE

Arrangements are now well in hand for this year's Conference to be held at Lincoln College of the University of Canterbury from August 15 to 17. The first two circulars, dealing with papers, accommodation and enrolment have been sent out and members are asked to reply to them as soon as possible.

The guest speaker at this year's Conference will be Professor C. W. Shoppee, D.Sc., F.R.S., of the University of Sydney. His most important researches have been on the hormones of the adrenal cortex, at Basle (1939-44); on carcinogenic agents at the Chester Beatty Research Institute while holding a Readership in the University of London (1944-48); and on steroids, while Professor of Chemistry at Swansea (1948-1956) and Sydney. He will address the Institute on "The Application of Physical Methods to the Structure of Natural Products". He will also give a public lecture under the joint auspices of the N.Z.I.C. and the Tenth New Zealand Science Congress on "The Carbon Atom", in which he will consider the stereochemistry of carbon and carbon compounds, and its importance in regard to physiological activity.

BOOK REVIEWS

CHEMISTRY OF THE AMINO ACIDS, by Greenstein and Winitz; 3 vols. 2,872 pages. J. Wiley & Sons, New York. Price, 100 dollars.

In the 12 months preceding May, 1961, 426 papers dealing with the chemistry of amino acids were found in the journals taken by the Chemical Society. The time has therefore arrived when an active worker in the field cannot read all the papers relevant to his subject and at the same time continue his experimental studies. This position has been relieved by the appearance in recent years of good treatises on amino acid metabolism by Meister and by McElroy and Glass. Now there is published a 3-volume work by Greenstein and Winitz on the chemistry of amino acids. Included in these volumes is a section on nutritional aspects of amino acids that seems to have been included only because the subject was only briefly discussed by Meister. It should be left out of future editions.

The book sets out to be a comprehensive survey of the facts of amino acid chemistry and a practical manual and in my opinion largely succeeds in both aims. It is arranged in three main sections. The first deals with physical chemistry, configurational correlations and analytical methods. The second describes methods of peptide synthesis and peptide degradation, and the third is concerned with the chemistry of the individual amino acids found in protein hydrolysates and groups of amino acids found elsewhere. Inevitably, this scheme results in considerable repetition which is justified only when it leads to easy access to information. Unfortunately this is not always the case; for example the discussion of the enniatins is found under peptide degradation and not under N-methyl amino acids and there is no cross-reference; many of the important reactions of the disulphide group are found under peptide degradation and not under cystine or sulphur-containing amino acids. The index is poor and sometimes misleading. An improvement in future editions would be its extension, leading to the omission of repetitious passages and a reduction in cost.

An especially valuable feature of the treatise is the tabulation of physical properties collating information widely dispersed in the literature. The selection of illustrative procedures is good and frequently they have been checked in the author's laboratory. The only unfortunate choice in the reviewer's experience is the old Fischer method for the synthesis of sarcosine instead of Lapworth's modification (*J.* 1931, 1896).

In so comprehensive a work there are numerous sections that will delight the discerning student. The fascinating property of some dipeptides in the presence of cobaltic ion of absorbing oxygen is treated fully and is the only account known to the reviewer. Similarly the intricacy of the complexometric chemistry of cysteine is fully developed but is marred by diagrams that are misleading to the unsophisticated. This section on complexometric chemistry is also spoilt by a jejune treatment of the theory of instability and the omission of an account of Schwarzenbach's work. The treatise is somewhat out-of-date, there being few references after 1957. This leads especially to a lack of balance, particularly in the section on peptide synthesis, for there is no mention of Russell and Elliott's work on the preparation of *p*-nitrophenyl esters.

I have found only three misprints in the book (on pages 628, 1019, and 1563) but the setting out of formulae leaves much to be desired as a com-

parison of the same sequence of formulae on p. 71 and p. 2671 illustrates. There are many examples of verbosity in the tract (*e.g.*, p. 1583) and the authors seem unaware of the meaning of "mediated", "implicated" and "evolution". There is also no excuse for the mediaeval usage of "condensation" by organic chemists. How is it that so few emulate the Fiesers in the art of writing interesting chemistry in English? —A.T.

ESSENTIALS OF CHEMISTRY IN THE LABORATORY (Teachers' Edition), Harper W. Frontz and Lloyd E. Malm; W. H. Freeman and Company, 1961. 308 pages. Price, 3.30 dollars.

Written for the American one year chemistry course this manual covers work normally dealt with over three years in New Zealand schools. The subject matter is dealt with under nine main headings, subdivided into forty-three experiments, as follows: (i) Introductory Measurements, Properties, structure (7 experiments); (ii) Introductory descriptive chemistry (4 experiments); (iii) Weight and Volume Relations (5 experiments); (iv) Chemical Bonding and Electron Behaviour (3 experiments); (v) Chemistry of some group 5, 6, and 7 non metals (5 experiments); (vi) Solution chemistry (5 experiments); (vii) Reaction Rates and Equilibrium (6 experiments); (viii) Metal ions (5 experiments); (ix) Organic chemistry (3 experiments).

In addition there are sections dealing with apparatus, laboratory management, including quantities of chemicals required for 100 students, chemical mathematics and an appendix with various tables of data. The strengths of bench reagents are expressed as formal instead of the more usual molar or normal solutions, and as recommended, are stronger than those normally used.

The approach is pre-study, experiment (confirmation of the theory), recording (on a standard report sheet), followed by problems and study assignments. The theory is presented in a clear, concise fashion but several of the experiments would have to be modified to meet with New Zealand Education Department safety regulations.

The pages are perforated for removal, and stamped for inclusion in a ring folder, and if made available in this form in the laboratory it could be a useful teaching aid.

—R.C.M.

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- 1) *Chem. Eng. News*, 1960, **38** (16), 115.
- 2) Callear, A. B. and Cveticovic, R. J., *Canad. J. Chem.*, 1955, **33**, 1256-67.
- 3) Hshta, C., et al., *Anal. Chem.*, 1960, **32** (7), 880.

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- 1) Pollard, F. H., Hanson, P., and Geary, W. J., *Anal. Chim. Acta*, 1959, **20**, 26-31.
- 2) Wehber, P., *Z. anal. Chem.*, 1959, **166**, 186-9.
- 3) Busev, A. I., and Kanaev, N. A., *C.A.*, 1959, **53**, 18747c.

'pH VALUES and their DETERMINATION'

A new edition

During the last thirty years many thousands of copies of this B.D.H. booklet on pH values have been distributed in the United Kingdom and abroad. The seventh edition entitled "pH Values and their Determination" is now available. It has been completely re-written in relation to current theory and practice, and includes a discussion of electrometric methods. Copies are free.

'PHOSPHATE ESTERS IN METABOLISM': A new publication

An up to date account of some of the most important phosphate esters is given in this new B.D.H. booklet, including the hexose, pentose and triose phosphates and ATP, DPN, TPN, uridine diphosphoglucose, phospho-enol-pyruvic acid and phytic acid. References are given to methods of preparation and analysis, and a useful feature is a metabolic chart showing the inter-conversions of hexose and hexose phosphates. A large amount of information has been gathered together from various sources and the booklet should be of use to workers in many fields. Copies are free and will gladly be sent on request.

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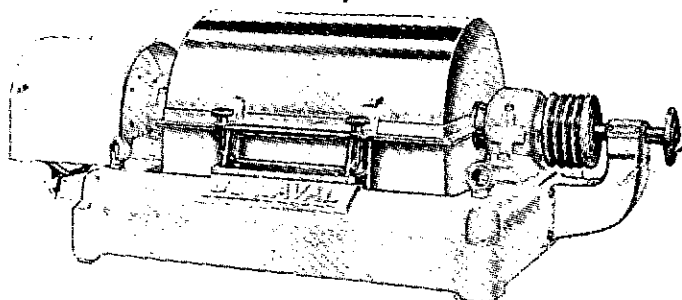
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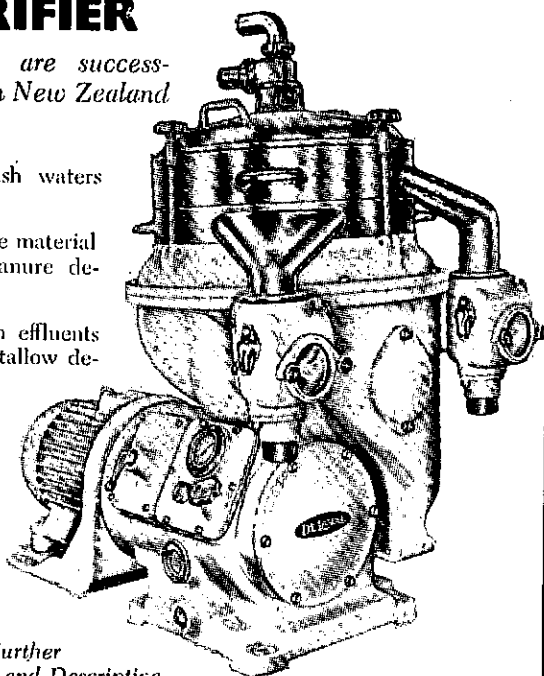
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