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President :
THE LORD CALVERLEY OF BRADFORD, D.L., J.P.

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Hon. Editor—R. G. ROGERS, "ELMFIELD," STONE, AYLESBURY, BUCKS.

Asst. Editor—J. Chynoweth, Martin's Farm, Graylingwell, Chichester, Sussex.

CONFIDENTIAL BULLETIN FOR THE USE OF MEMBERS.

EDITORIAL.

The quarterly meeting of the Council was held at the Westminster Medical School on Saturday, 3rd December, 1949, when the following members attended : Mr. J. H. Hargreaves (Chairman), Mr. J. Tomlinson (Vice-Chairman), Mr. R. E. Rogers (Vice-President), Messrs. H. A. Adams, A. MacGregor, J. C. Chynoweth, R. G. Rogers, W. G. Owen, A. M. Bain, L. Hunt, W. F. Graham, H. Partington, R. Chesney, E. Heald, J. D. Lewes, C. Oliver, F. H. Mills, R. H. Smith, J. Forsyth, J. W. Brodie, G. R. Thwaites, E. D. Yates, J. Green, A. J. Templeman, H. S. Clarke (Hon. Secretary).

The meeting was opened at 1.25 p.m., when the Chairman gave a welcome to Messrs. E. D. Yates, of Birmingham, and J. Green, of Notts., on their election to Council by their respective branches.

The minutes of the last meeting held at Glasgow on the 2nd September, 1949, were taken as read, and signed by the Chairman.

There being no matters arising from the minutes, the Hon. Secretary was commended on the expeditious manner in posting to members.

Apologies of absence were received from Messrs. G. Jones, Treasurer, and M. Gray, of Northern Ireland.

The death of Mr. J. Slack, of Mickleover, Derby, was reported and the members stood to order as a mark of sympathy and respect to a departed colleague.

The Hon. Secretary read correspondence as follows :—

Western Mail and Echo Ltd., on the production of the monogram die, sample notepaper had been issued and was shown, the Hon. Secretary was instructed that the design be approved.

Correspondence from Mr. H. Wright, the London Branch Secretary *re* the arrangements for the meeting.

Letter from Mr. Walkderden *re* the death of Mr. J. Slack, asking if any benefit was payable from the Benevolent Fund. Mr. C. Oliver, Secretary, informed the meeting that after inquiry has proved no hardship, his committee had declined to make a grant. (See later report.)

Acknowledgment of notification of his election to the Examination Education Sub-Committee from Mr. J. Strachan.

Sir Hector McNeill, who replied, deeply appreciating our action in making him an Honorary Member.

On leaflets, etc., from B.S.I.

Reciprocation of our cablegram extending good wishes to our New Zealand members was received from M. W. P. Bryant, Hon. Secretary of the New Zealand Hospital Engineers Association, Ashburton Public Hospital, Ashburton, New Zealand.

A letter of appreciation on his election, and kind wishes and seasonal greetings from Mr. R. Palmer, New Zealand.

A letter from Mr. W. McMahon, Hon. Secretary of the Victoria Institute of Hospital Engineers, Australia, expressing their thanks for the assistance obtained from our Rules and Status, in drawing up their own Rules. The Hon. Secretary will persue the correspondence with a view to cementing the friendship.

Mr. J. Tomlinson read correspondence relative to the negotiation with the Northern Ireland Hospital Board. Implementation has not been effected with regard to salaries and conditions. As negotiated, hospitals were being circularised and hopes were entertained of a speedy fulfilment of promises.

Mr. H. Adams read out the applications for membership and the following were approved :—

Members	8
Associate Members	5
Graduate Members....	5
Student Members	1
Referred back	1

Six applications for transfer to a higher grade of membership were approved as follows : 5 from Associate to Full Member, 1 from Graduate to Associate Member.

Mr. J. Tomlinson reported on the result of the "Sandford Premium" essay, and congratulations are extended to Mr. G. R. Barnetson, Barrow Hospital, Bristol, who was awarded 1st prize, and whose article is published in this issue, and to Mr. G. Annand, Battle Hospital, Reading, who was awarded a special £2 2s. 0d. prize, as the runner-up.

Mr. Owen, of Wales, extended the thanks and appreciation of his branch to the Vice-Chairman and Treasurer for the splendid work done on behalf of the Institution. Mr. J. Tomlinson replied on his own behalf, and the Hon. Secretary on behalf of Mr. Jones, in his absence.

The Hon. Secretary read correspondence on matters raised by N.U.P.E., and it was unanimously agreed the letters be received. The Hon. Secretary to reply on the issues arising therefrom.

The Financial report of the Treasurer, as printed, was received in his absence, and adopted.

Mr. C. Oliver, Hon. Secretary, Treasurer of the "Benevolent Fund," reported on his statement and drew attention to the falling-off of contributions during the year. It was agreed that £150 0s. 0d. be invested in the G.P.O. Savings Bank.

Arising from the question of a grant on death, raised on behalf of the widow of Mr. J. Slack, Mr. Oliver reported that his Committee had fully discussed the question of a grant at death, but were unanimous that the financial position did not warrant them advising Council that the time had yet come to recommend such payments.

Mr. R. G. Rogers gave a long and full explanation of the Legal Documents, Rules and Incorporation, drawn up by the Institution's legal adviser, and it was agreed that copies be forwarded to each branch, with an express wish that they be brought to the notice of each branch at their first meeting, with the branch's recommendations, with a view to a speedy conclusion of agreement.

Mr. R. E. Rogers, Vice-President, gave his report on the recent Whitley Council meetings and of work accomplished at the Scottish and England & Wales sub-committee meetings. His references were most optimistic and he promised to inform members of any changes without delay.

Members were advised that Income Tax relief is obtainable from the use of own motor car on hospital business.

Arising out of Whitley Council business, the Hon. Secretary announced that he had received much correspondence from the South-East Scottish Branch and the Glasgow branch, and after hearing the report of Whitley Council given by Mr. R. E. Rogers, suggested to the Council representatives of the branches named, that no purpose would be gained by raising the points at issue, and that the correspondence be received. Assent to this was agreed, the Hon. Secretary to notify Mr. Guthrie.

Resolutions were received from the London, Glasgow, Wales, Cheshire and Southern branches and accepted.

The question of Mr. Foulkes retiring, and the resolution from his branch on the matter was inadvertently omitted.

The Hon. Secretary asked Council to approve that all branch secretaries have the names, addresses and hospital of all members printed in a booklet form, and issued to each branch member and officers of Council. This was agreed to.

Arising out of any other business, the Vice-Chairman, Mr. J. Tomlinson, raised a point in regard to the working arrangements for the furtherance of the Examinations of the Institution being recognised at its highest level.

The date of the next meeting was provisionally agreed as the 4th March, 1950.

The meeting closed at 7.35 p.m. EDITOR.

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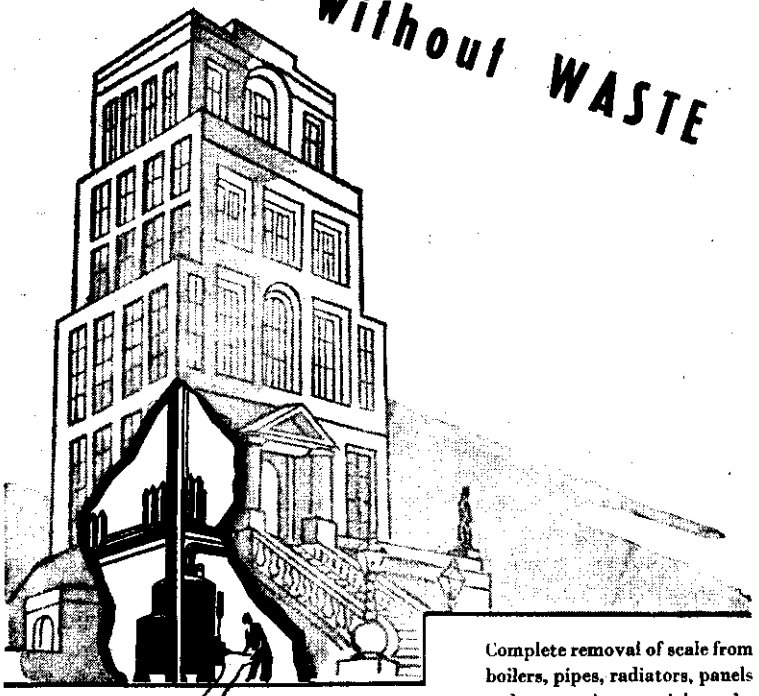

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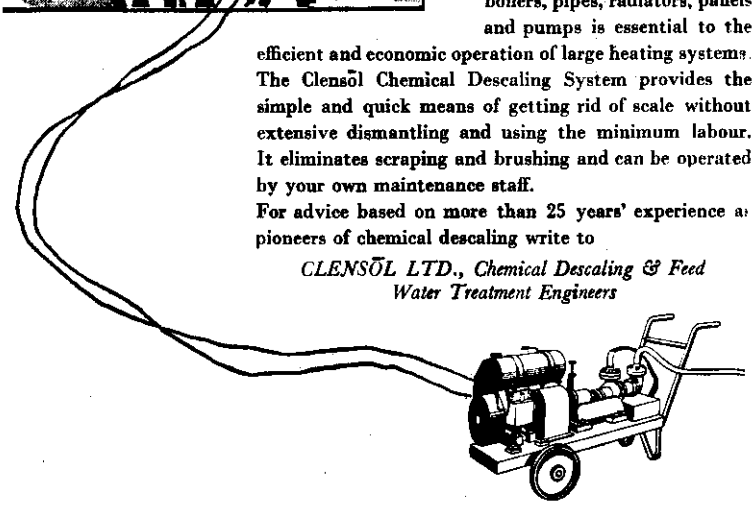

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COLOUR PLANNING FOR THE HOSPITAL

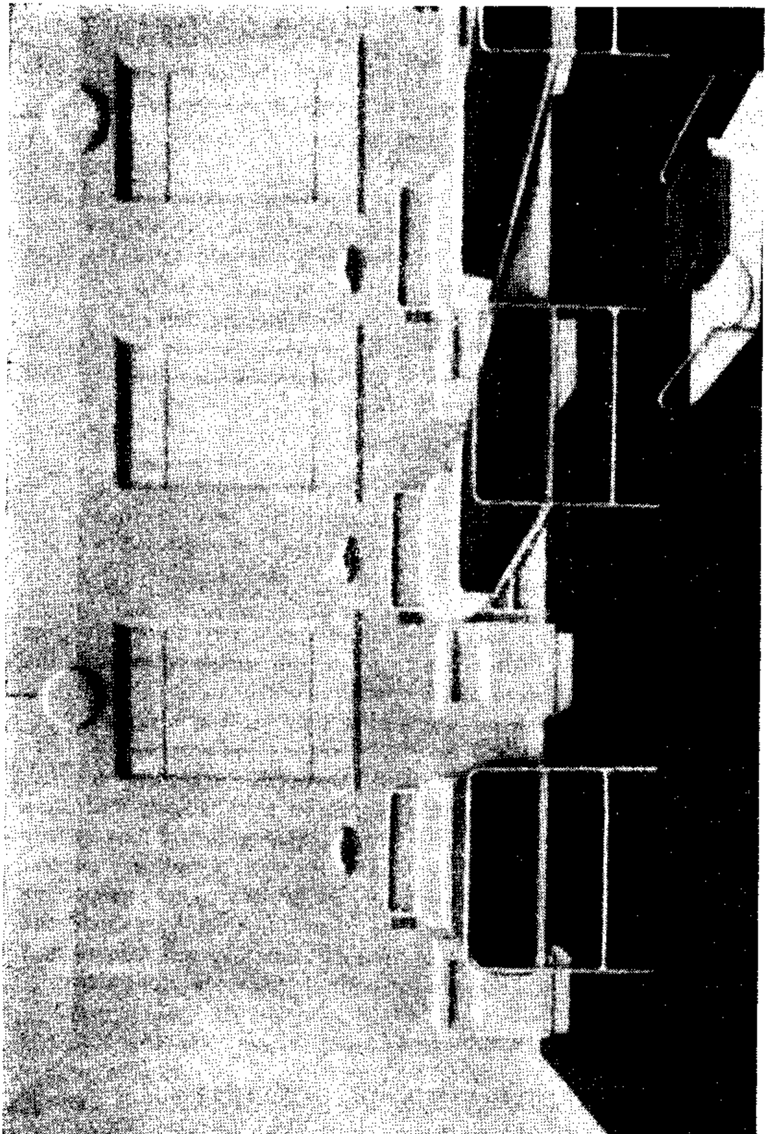
G. H. TULETT

The post-war years have seen much research in the scientific principles of colour application. Although most of this has been directed towards the factory with the aim of creating the most agreeable and efficient working conditions, there is reason for limiting the findings of the experts to the factory. Practical application has proved, beyond doubt, that where expert planning has provided the colour treatment, there has been not only greater productivity, but a considerable improvement in morale, less absenteeism through fatigue and eye-strain, and a lower minor accident rate. It is reasonable to suppose, therefore, that at least some of these benefits could be enjoyed by patients and the personnel who serve them.

The aim should be, in the first place, to create a pre-determined environment, and whether this shall be restful or stimulating will, of course, depend on the purpose for which the room or rooms will be used. The invigorating reds and violets, whilst probably admirable in certain circumstances, will have unplesant results if used in others. Colour, with its power to depress or stimulate, should never be allowed to become the vehicle by which the good-intentioned amateur " brightens up the place." An individual colour preference can often be quite unsuited to communal rooms. Colour should be the medium rather, by which the colour and lighting experts may achieve a visual and functionally satisfactory scheme.

There are a number of basic principles which govern any painting project. North rooms will require the warm shades of perhaps cream, peach, or sunshine yellow ; whilst rooms with a Southern aspect may require the cooler blues or blue-greens. Rooms of unpleasant proportion can sometimes be made to appear more readily acceptable to the eye, by careful colour treatment of the various wall surfaces. Small rooms can be made to appear larger, by keeping, as far as possible, ceiling, walls and woodwork in the same colour.

Some features may need to be given prominence to achieve a necessary touch of bright colour, whilst others may be camouflaged by painting them in the same colour as the background against which they are seen. Service pipes, for instance, have a tendency—particularly in the older building—to straggle across walls and ceilings, and can be irritating by being given prominence, as they so often are, by being painted silver or black. The art of camouflage, when properly used, can produce minor miracles of improvement.



But the fundamental consideration must be light, for there can be no colour without it. Some modern forms of lighting appreciably affect colour as the eye sees it, and allowance for this must always be made when preparing a scheme. In fact, choice of colour should invariably be made under forms of artificial lighting which are as near as possible to that of the room concerned. Too great an intensity of light, reflected on to a too bright wall surface, can cause as much eye-strain as low intensity with low reflection factor. Wall and ceiling colours will therefore have to be selected with strict regard for their hue and reflection factor, under existing forms of both natural and artificial lighting. Each room must be treated for the specific purpose for which it will be used, and it would be unwise to lay down any hard or fast rule as to minimum or maximum light reflection factors. For general purposes, however, ceilings should rarely exceed 75% and walls probably not greater than 60%. Where, for any particular reason, a dado is required, the reflection factor should seldom be higher than 30%.

Much can be done in respect of nursing staff quarters. The creating of the more intimate atmosphere of the small room ,and the necessity for something as a complete change from the ward in which so much of their time is spent, should be an essential part of any decorating plan.

It is an accepted fact that colour has a psychological effect upon eye and mind. Although it may be impossible to measure the degree of contribution to recovery that colour can play, it is certain that much can be done in the future that has not seriously been considered in the past.

Arthur Sanderson & Sons Ltd., Berners Street, London, W.1, have devoted much time and research to this subject, and have evolved a unique method of scheme presentation. From survey notes and photographs are built up low relief perspective panels, painted with the materials which would be used in the respective rooms. This has been found an ideal medium by which the authorities concerned may get a preview of the proposed scheme, and facilitates progress of the work for both engineer and contractor.

STERILISATION IN HOSPITALS

By A. F. Dence, M.A. (Oxon.)

A modern hospital is a complicated organisation comprising many integrated units, much expensive equipment and a great variety of human types. In simple terms, the function of a hospital is to provide facilities for the diagnosis and treatment of persons

suffering from disease or accident ; and since numerous diseases are caused directly by pathogenic bacteria or viruses, a continual stream of these organisms will flow into the hospital.

Apart from the human reactors, hospitals are as liable to invasion by bacteria as any other place where human beings congregate; they can be brought in by clothing or utensils, by air, water, food and a great number of other methods.

In a hospital, which is devoted to the curing of diseases, every precaution should obviously be taken to eliminate pathogenic infection within its walls as far as possible. There is little virtue in curing a patient of one disease but allowing him to contract another while in the hospital. Moreover, the medical, surgical and nursing staff, and personnel of all the ancillary branches of the hospital require to be protected from infection.

When the problems of asepsis were first studied, attention was chiefly focussed on the operating theatre, for where there are open wounds there lies the chief opportunity for infection. The results of the original efforts at avoidance of infection during surgical operations were spectacular. It is therefore hardly surprising that even today, when the problems of sterilisation are mentioned, the mind turns immediately to the operating theatre, and it is there that the chief efforts are still concentrated.

Indeed, it is remarkable how many hospitals in this year of grace fail to take the most elementary precautions to prevent cross-infection anywhere but in the operating theatre. There are isolation hospitals, whose sole purpose is the treatment of the more infectious fevers, which do not possess any form of steriliser for bedding, clothing or furniture ; and I have seen big general hospitals using methods of treatment of blankets, mattresses, etc., which are just as ineffective as spraying with rose-water or strewing them with herbs would be.

Even in the operating theatre, where the personnel around the table are gowned in sterile garments, masked and hooded, and where all instruments are effectively boiled, curious anomalies occur through lack of thought. Sometimes doctors and sisters are permitted to enter the theatre wearing the same footwear that a few moments previously were gathering the germs of a dirty pavement. At one hospital recently, despite all normal precautions, infections of wounds persisted in surgical cases, until it was discovered that nobody had cleaned the cords suspending the electric lamps and the hoods of the lamps in the theatre ; magnificent cultures of haemolytic streptococci were prepared from these objects, which were undoubtedly the source of the infection of the patients.

The kind of objects which tend to be overlooked in the operating theatre are the trolleys on which patients are wheeled into the theatre (particularly the rubber wheels which pick-up germ-laden dust and are extremely difficult to sterilise), blankets, stretcher covers, stretcher straps, also the wheels and legs of instrument trolleys (the glass tops are usually kept spotlessly clean, but the wheels never touched), and, as mentioned above, the wiring leads of electric lights or electrical apparatus.

Considerable research work has been carried out recently on the subject of cross-infection in wards, resulting from bedding, blankets and even the floors. Articles appear from time to time in the medical journals, and there is already a proven case that cross-infection does continually occur from these sources. But very little, beyond routine scrubbing or spasmodic autoclaving, is done to prevent it.

It is becoming a general practice to oil the floors of a ward regularly, and this has proved a fairly satisfactory method of preventing the " raising " of germ-laden dust. Some hospitals send mattresses and blankets to their sterilising room to be treated, with fair regularity, but others only do so in cases where a patient known to have been suffering from an infectious fever, has been using the bed. Even the bedding of T.B. patients is, in some cases, not sterilised as a regular drill in some hospitals.

Some of the difficulties of sterilising bedding are due to the fact that, in the past, most hospitals were only equipped with a steam steriliser. Steam is a highly efficient sterilising medium, and most hospitals have an efficient boiler and steam generating plant. A steam steriliser, however, is a big, cumbersome and costly piece of apparatus. Unless of very large size, its capacity in terms of mattresses for example, is very small, as they are nearly all round or oval in shape, and unless the temperature is very carefully controlled by a skilled operator, wastage of material can be very costly, since mattresses can easily be ruined and blankets permanently shrunk or hardened by too high a temperature. Many articles, such as leather and rubber, cannot be sterilised by steam at all, as they are ruined immediately.

The alternative process, which is steadily finding favour, is a gas or vapour process, of which much has been heard of late. The cost of installation is considerably less than that of a comparable steam apparatus, the sterilisation is equally effective, and no damage whatever is done to any materials. The cost of sterilising is far less than steam. It is an independent process depending on the vaporisation of a special fluid, a greater number of mattresses, etc., can usually be sterilised at each operation.

An important point, too, is that many hospitals, for the comfort of their patients, are nowadays installing interior spring mattresses. These become superficially infected, but usually they cannot be sterilised by steam without quickly rusting the springs.

There are, in almost all hospitals, a number of sterilising problems for which there is as yet no standard or even adequate solution. Of these we might mention three, namely, the sterilisation of syringes, the sterilisation of catheters, and the sterilisation of bed-pans.

To boil for 20 minutes (the minimum time required to sterilise by boiling) will damage some types of syringes. Moreover, the needle, which is the most essential part, apart from being blunted, may not even be effectively sterilised at all. The most satisfactory method of sterilising syringes is by means of steam at 15 lbs. pressure in a small autoclave. This is thoroughly efficient, takes only 6 minutes, and does not damage the syringe. The ideal method of dealing with syringes in a large hospital is to sterilise them in a central room, under the charge of an efficient operator, to wrap the syringes in sterile lint and a greaseproof or cellophane envelope immediately, and send them to the wards or departments where they will be used as required. In this way damage is avoided and the risk of infection reduced to a minimum. Syringes are used for such a great variety of purposes and always for puncturing the skin, that every care must be taken that they are in perfect condition when required to be used.

There is at present no satisfactory method of sterilising rubber catheters. Rubber is one of the most difficult substances to sterilise, owing to the porous nature of its surface, and even a jet of hot air or steam passed through a catheter for a prolonged period does not kill bacteria which may be lying in the tiny interstices of the inside surface. The problem is receiving attention, but until a really sound method is discovered, the safest system of sterilising catheters is by immersion in a cold liquid germicide.

The bed-pan problem is complicated by the fact that usually hospitals wish to cleanse and sterilise them at one and the same time, by the same process. Normally bed-pans are subjected to a jet of steam or boiling water in the sluice room, dried with a cloth and stacked until required. It is, however, seldom that two different functions can be achieved equally efficiently by the same process, and while the cleansing is usually satisfactory by the steam jet process, the sterilising is not. This is of particular importance in gynaecological and lying-in wards, where cross-infection can and does cause serious complications.

There are still numerous aspects of sterilisation in hospitals which should receive very much greater attention than heretofore. Of these we would mention particularly sterilisation of the air in infectious wards; sterilisation of food and drinking vessels; sterilisation of letters and, indeed, of any articles which leave the hospital. As this can be regarded as a separate subject, we will deal with each in a separate article.

END OF PART ONE

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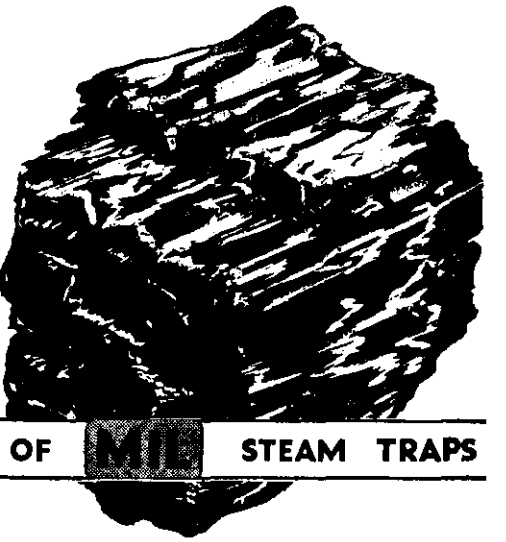

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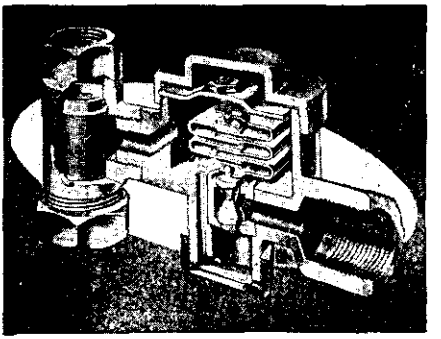

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HOSPITAL STERLISERS.

A correspondent, recently returned from Australia, raises a matter which may be of interest to readers concerned with hospitals and hospital equipment.

Apparently, the sterilisation of surgical dressings and swabs in Australia is commonly carried out in small autoclaves. These are about 6 ft. long and 2 ft. diameter and are supplied with steam at a gauge pressure of 15 psi.

The dressings and swabs are wrapped in oil silk. When the package is placed in the autoclave the corners of the wrapping are thrown off, thus leaving the top and four sides (but not the bottom) open to steam penetration.

Death of bacteria is said to take place at a temperature of 245 F. But successful sterilisation presupposes that steam at the required temperature of 245 F. will penetrate the whole of the bundle for a period of not less than fifteen minutes.

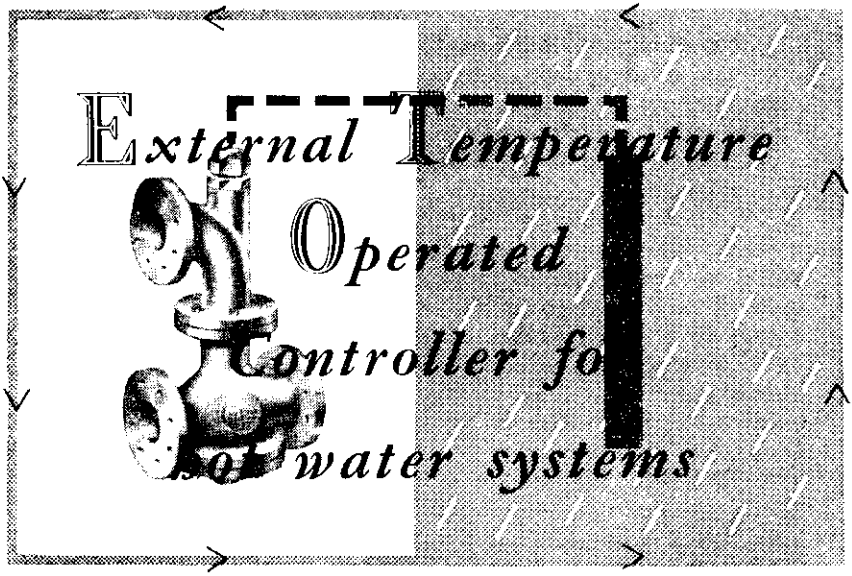
The steam pressure of 15 psi is, we understand, specified by the Factories Act in Australia, and a steam pressure exceeding that figure is not permitted.

Standard Steam Tables show that dry saturated steam at a gauge pressure of 15 psi has (ideally) a temperature of 249.8 F. If the steam in the pipe supplying the autoclave is at that pressure, then one can expect a pressure drop to something below that figure in the sterilizing chamber, with a correspondingly lower temperature. Furthermore, if provision is not made for expelling air from the chamber, the air will mix with the incoming steam and further lower the effective temperature. If, in addition, the arrangements for discharging condensate from the chamber are inadequate, this will result in a still further depression of the sterilising temperature.

Under such conditions one might reasonably expect that the required chamber temperature of 245 F. would not be reached. Indeed, in tests on one autoclave which our correspondent carried out, it was found that under the normal conditions of steriliser operation an optimum temperature of only 238.5 F. was registered. At times the temperature fell below 230 F.

It is problematical whether even those inadequate temperatures would be maintained through the whole of the bundle of dressings and swabs, especially as part of the surface was covered by the oil silk.

As it is likely that some thousands of the autoclave type of steriliser are in service in Australia, and if the conditions described can be taken as fairly general, the matter might seem to have disturbing aspects.



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It is emphasised that none of the foregoing statements quoted from our correspondent's letter should be taken as a suggestion that the type of steriliser is in any respect unsuitable or inefficient. On the other hand, the conditions described do indicate a need for a close examination of the steam-using methods in relation to important equipment of this nature. The margin between a maximum of 249.8 F. and a required 245 F. is small and so easily exceeded to a perhaps dangerously low sterilising temperature where the local conditions, such as inadequate air and water removal from the steam space of the equipment, are less than satisfactory.

If those of our readers who have experience of this type of steriliser would care to add their own observations these will be welcomed.

SANDFORD PREMIUM AWARD.

The Selection and Efficient Operating of Boiler Plant for Hospital Service.

By G. R. BARNETSON, Esq.

From the earlist days of human history, it appears that the use of fire has been known, and record of it having been used to generate steam can be found in the Pneumatica of Hero of Alexandria (130 B.C.).

From this period until the 17th century, there seems to have been little progress made in the use of steam, but from then onwards many inventors entered the field, and contributed to the evolution of the boiler.

These early pioneers had little theory to guide them, but in 1800 Trevithic designed a cylindrical boiler with a cylindrical furnace, which became known as the Cornish boiler, and it is an indication of the sound principles on which he worked, that the design of this class of boiler is practically unchanged today.

The demand for higher working pressures and evaporation, coinciding with the production of stronger materials led to the development of the multi-tubular and then to the water-tube boilers.

In the selection of boiler plant there is now a very wide field to choose from, but in this paper we are concerned only with types suitable for supplying the main services of hospitals and institutions, and so it is from this view point that we must first assess the merits of the different types of boilers.

For the smaller hospital and institution, where the engineering services are not extensive, the steam demand will be small and at low pressure, therefore reliability with reasonable economy and low maintenance costs are the main consideration. This would probably best be met by small Lancashire or vertical boilers hand fired.

It is when we come to the larger hospitals, perhaps generating the whole of their electricity supply, with a laundry, etc., that there is justification for considering other things than the capital cost, although this must also be a limiting factor in any scheme.

As previously mentioned, working pressures have increased, but due to long-established principles of design, with materials with a large factor of safety it can safely be said that mechanically, one type of boiler is as reliable as any other, providing—and this is important—the boiler gets the supervision which that particular type demands. Also this supervision will materially affect the effective life of the boiler.

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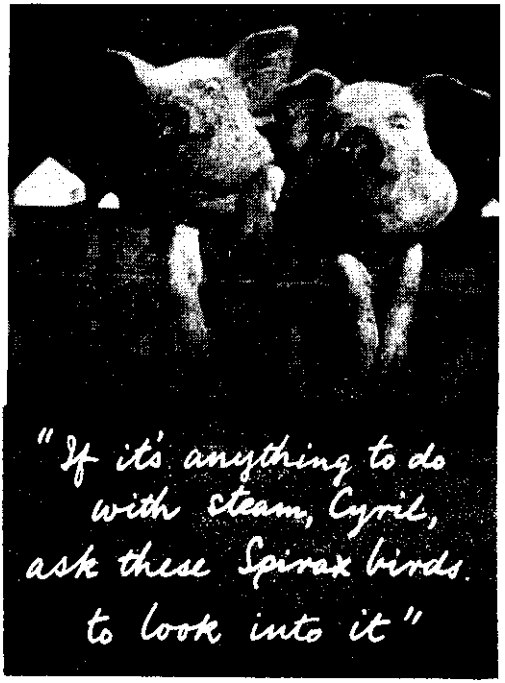

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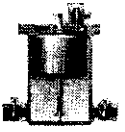

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From the foregoing we can assume that whatever boiler we select it will give us good service if it is looked after.

We must assume that there will be co-operation between the engineering and architectural sides in providing the necessary space, and that there will be no restriction to our choice on this account.

In passing, a few remarks on the siting of boilers may not be out of place here. Boiler-houses with coal-fired boilers are, by the nature of things, hot and dusty places, and from some of the existing examples it would appear that designers conspire to hide them away in the smallest space possible, often with neither ventilation or natural light.

The importance of the boiler-house has grown in proportion with the cost of fuel, and any additional cost in making it spacious and well equipped will be amply repaid in more efficient and economical operation.

We can now proceed to a brief examination of types of boilers for their suitability for our particular service. There are four main classes :—

1. The Lancashire boiler.
2. The Dry-back and Economic boiler.
3. The Scotch or Marine boiler.
4. The Water-tube boiler.

For many years the Lancashire boiler has proved to be such a reliable and economical steam generator that for industrial purposes it has come to be looked upon as a standard installation.

They are made in sixes from 6 feet diameter and 24 feet long, with an approximate evaporation of 5,000 lbs. per hour to 9 feet diameter and 30 feet long. The latter size, with a grate area of 44 sq. feet and a heating surface of 1,080 sq. feet, gives a ratio of 1 to 25 approx. Hand fired with an economiser, an approximate evaporation would be 9,000 lbs. per hour. If hand firing were replaced with mechanical stoking, the evaporation could be increased to approximately 10,000 lbs. per hour.

This boiler needs a large floor area and an elaborate brick-work setting for the flues from the two furnaces. Due to the large volume of the water space they are capable of dealing with large fluctuations in steam demand. On the other hand, steam cannot be raised quickly, hence they are not suitable for emergency work. They are very accessible for cleaning, and their maintenance costs are low.

The Dry-back and Economic Boiler.

There are many variations of this type of boiler in which the gases from the furnace pass into an external combustion chamber, and return to the uptake through tubes which run the full length of the boiler.

They are made in a large range of sizes, with single, twin and triple furnaces. The dimensions of one with two furnaces and an evaporation of 9,500 lbs. per hour are 9 feet diameter and 16 feet long, grate area 36 sq. feet, heating surface 1,700, a ratio of 1 to 47.

Also in this class is the Economic boiler, usually fitted with induced draught and mechanical stoking equipment. This type of boiler requires no brick-work setting, being mounted on cradles on the boiler-house floor. They are not so accessible for internal cleaning as the Lancashire, and where the water supply is hard, some treatment is desirable.

Scotch or Marine Type Boilers.

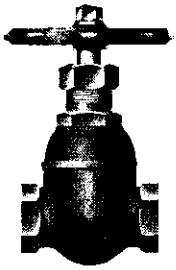
This boiler was a standard type in marine engineering for many years and is occasionally found in some land installations.

It differs from the dry-back boiler in that the combustion chamber is inside the boiler shell. They are built with one to four furnaces in the larger sizes, and sometimes have furnaces at both ends. Although there are no conditions in land practice where double-ended boilers would be necessary, in passing it may be of interest to give the dimensions of one of the 21 boilers of the R.M.S. *Aquitania*. Each has eight furnaces with their own combustion chamber, diameter of shell 17 feet 8 inches, length 22 feet, grate area 168 sq. feet, heating surface 6,600 sq. feet, a ratio of 1 to 39.

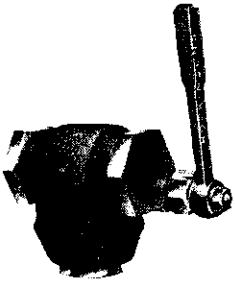
The proportions of a Scotch boiler are the opposite of the Lancashire, being short with a large diameter, thus, although requiring less floor space, do need a building where the necessary height is available. The larger sizes also present a problem in transport.

This boiler is still less accessible for cleaning than the dry-back due to the combustion chamber in the water space with the necessary staying to the shell plate. Having no brick-work, one item of maintenance is eliminated.

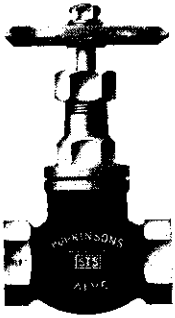
Although not in common use in land practice, they would compare favourably with other types in low running costs. As for performance, the following results of a test carried out by an Admiralty Committee on Boilers on the R.M.S. *Saxonia* under ordinary working conditions gave an efficiency of 82.3 per cent., heat transmitted per square foot of heating surface 5,416 B.T.U. per hour, the evaporation being 12.3 lbs. of steam per lb. of fuel. These results were obtained with pre-heated forced draught, and are exceptionally good.



Parallel-Slide Valve



Parallel-Slide Link Valve



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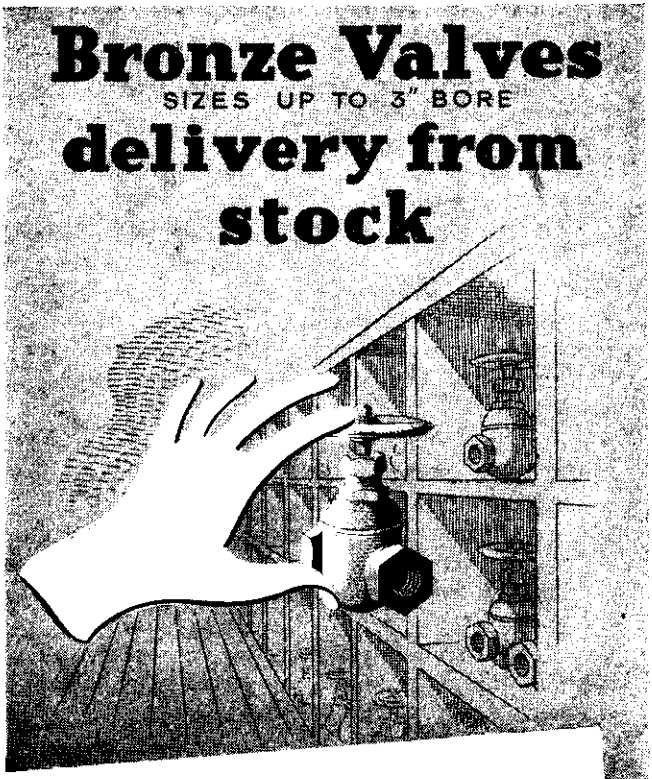

Straight-from-the-shelf delivery can be given for most types and sizes of these small bronze valves. Our new production line is now operating to manufacture in quantity still to the same high standards of design, materials and workmanship which characterise Hopkinsons' valves.

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- Parallel-Slide Link Valve. Sizes ½" to 2" bore, has many specialised uses in industrial processes. Fluid-tightness unaffected by thick heavy liquids.
- 'S.T.S.' Valve. Sizes ½" to 2" bore, with either flanged or screwed connections. A general purpose valve that can be relied on for fluid-tightness throughout a long period of service.
- 'Mac' Valve. Sizes ½" to 2" bore, with flanged or screwed connections. Suitable for steam pressures up to 250 lb per square inch.

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Water-tube Boilers.

There are many designs of this class of boiler, their distinguishing feature being that the water passes through the tubes, the furnace gases being on the outside. They hold a comparatively small amount of water, thus steam may be raised very quickly, but also because of this a temporary failure of the feed supply may have very serious results in burned tubes.

The largest part of a water-tube boiler is the steam drum, and for a given power occupies a smaller space and is lighter than other types. Also due to the small steam drum it can be constructed to work at very high pressure without thick shell plates. Today water-tube boilers with a working pressure of 650 lbs. p.s.i. and an evaporation of 300,000 lbs. per hour are commonplace in power station practice.

Even in the smaller low-pressure types, due to the rapid evaporation, the water side must be kept quite free of scale, and careful water treatment is essential.

We must now decide which of these four main types will best meet our requirements, but it is natural that the nature of our experience will, to a certain extent, be reflected in our choice, other things being equal.

The main advantages of the water-tube boiler are suitability for high working pressures, coupled with lightness of construction, and quick steam raising.

These are not essential for our particular service, and the comparatively small evaporation required can be obtained from the other types of boiler with less skilled supervision.

The main difference between the Scotch and the Economic boilers is in the combustion chambers, and there is no doubt that comparison favours the external, refractory-lined one of the latter, as it tends to improve combustion and prevent smoke.

This now narrows our choice down to the Lancashire and Economic boilers.

As it has previously been assumed that there are generators to supply, it is obvious that there should be no risk of failure in maintaining this service, and to meet any emergency it is essential that two boilers should be under steam, with one off for cleaning, etc.

The engines driving the generators may have an initial pressure of, say, 180 lbs. p.s.i., so a boiler working pressure of 200 lbs. p.s.i. would be necessary.

Before proceeding farther, it will now be necessary to make some estimate of what the steam demand will be. With generators, laundry, heating, sterilising, etc., a mid-winter demand of 14,000 to

15,000 lbs. of steam per hour at peak periods could be assumed. To meet this, with an allowance for future extension, our boilers should be of 10,000 lbs. evaporation per hour.

A Lancashire boiler installation is ideally suited for the introduction of a feed heater in the flue between boiler and chimney, utilising heat which would otherwise be wasted. The gain per cent. due to heating feed water in this way is $\frac{100\ (T-t)}{H-t}$ where T is the outlet temperature of the feed, t inlet temperature of feed, H total heat of steam at boiler pressure. This may amount to as much as 15 per cent. From this it is apparent that an economiser should be considered as an integral part of any Lancashire boiler installation.

Both Lancashire and Economic boilers can be fitted with mechanical stokers, and with artificial draught. There are several savings, both in capital and running costs, attendant on the use of artificial draught. On the capital side there is the saving in the cost of a high chimney, also a higher rate of combustion means a higher furnace temperature, and more steam generated in a given time. It follows, therefore, that with a higher draught pressure a smaller boiler will develop the same power. The saving in running costs are that a lower, and therefore cheaper, grade of coal can be burned, a less quantity of excess air is necessary, with less weight of waste gases, and, therefore, smaller loss of heat in these gases.

Another advantage of stokers with artificial draught is the flexible control of the rate of combustion.

Mechanical stokers are expensive items, but if run within their capacity will well repay their running costs. Their capital cost can be provided for by the difference in cost of a smaller boiler and chimney. With regard to chimneys, there may be a number of factors which will determine what we can build, *i.e.*, the location of the boiler-house in relation to the main buildings, the height of the surrounding property, etc., but these local conditions will apply equally to whatever boilers we have.

A comparison of the cost of standard Lancashire and Economic boiler installations may now help us to a final selection.

An Economic boiler 9 feet dia., 23 feet long, with one furnace 4 feet 6 inches dia., 200 lbs. p.s.i. easy steaming evaporation 10,000 lbs. per hour, complete with all steam and water fittings, etc., delivered and erected	£3,650
Combustion chamber lining brick-work	£240
Draught fan motor and starter	£350
Stoker equipment with unit motor and starter	£560
	£4,800

A Lancashire boiler 9 feet dia., 30 feet long, 200 lbs. p.s.i. easy steaming evaporation 10,000 lbs. per hour, complete with all steam and water fittings, delivered and erected	£3,750
Brick-work setting, main flue, economiser chamber, dampers, etc.	£2,000
Vertical tube economiser of, say, 128 9-foot tubes	£1,600
Stoker equipment for two furnaces with unit motors and starters	£1,120
Draught fan, motor and starter	£350
	£8,820

It will, of course, be appreciated that these figures are approximate only, but they are sufficient to show that the saving in capital expenditure, by installing Economic boilers, is such that it must become the main factor in determining our choice in their favour.

In selecting Economic boilers the advantage of feed heating through an economiser is lost, but if the generators are designed to run against a back pressure of 10 to 15 lbs. p.s.i. to provide steam for heating, and domestic calorifiers, cooking, etc., there should be a surplus of exhaust steam during the summer months to supply a surface feed-heater. There is no saving in fuel by heating feed with live steam.

Economic boilers are often installed as independent units, complete with its own stack and fan, but with a battery of three boilers the smoke boxes should be connected to a common uptake in which is incorporated an air pre-heater, and the furnaces designed to use forced draught from duplicate fans.

The temperature of the gases at the smoke-box of an Economic boiler may be between 400/500 °F., depending upon the rate of combustion. The use of an air pre-heater is a direct saving of heat to the extent of 0.233 w (T—t) where 0.233 is the mean specific heat of the gases, w the weight of air used per lb. of fuel, T the temperature to which the air is heated, and t the temperature of the air at the inlet of the fan. An additional saving is also the advantage of a higher combustion temperature.

Forced draught fans, compared with induced draught fans, have no high temperatures to deal with, are smaller, and need less power to drive.

Economic boilers differ in detail of construction, some have double pass, some single pass tube banks, and it is difficult to assess their individual merits. A feature of the Cochran Economic boiler is their patent tube. These tubes, 2½ inches in diameter, are made to

AN OPEN LETTER TO HOSPITAL'S ENGINEERS

GENTLEMEN,

Those who, like ourselves, are in close touch with the present-day hospital scene, know what a very responsible AND arduous job the Hospitals Engineer's is. It is with pleasure, then, that we offer a means of easing your burdens.

From time to time STEAM DISINFECTORS, like other equipment, of course, wear out and, because they are vital to the running of a Hospital, they HAVE to be replaced, these days at considerable cost, if it is a steam disinfector that is installed. It may be that your Committee is contemplating installing a disinfector at a hospital where there is none at present.

In any case, gentlemen, before installing any more steam disinfectors, we invite you to consider very carefully the many money-saving and labour-saving advantages of the VAPOUR-GAS TYPE BEDDING DISINFECTORS designed by MR. J. G. SPARKHALL, M.R.San.I.

Perhaps the most important thing about these disinfectors is that NOTHING WHATEVER IS DAMAGED IN THEM, not even LEATHER OR RUBBER, which is in direct contradistinction to steam disinfectors. From the Hospitals Engineer's point of view, however, the following points are of special interest :—

(*a*) Our Disinfectors COST ONE-THIRD THE AMOUNT of a steam plant of the same c.f. capacity and take twice the number of mattresses.

(*b*) THERE IS NO STEAM TO RAISE, NO VACUUM OR PRESSURE NEEDED and they are far CHEAPER TO OPERATE AND MAINTAIN THAN STEAM DISINFECTORS.

(*c*) SPRING INTERIOR MATTRESSES can be lain in flat, springs suffering no damage.

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a slightly sinuous form, about 1 inch, at a pitch of 7 inches along the horizontal line. The makers claim an increased heat transmission due to the gases being given increased turbulence by being repeatedly directed to the walls of the tubes. This is an advance on the retarders sometimes found in plain tubes, which have the same effect of creating turbulence, but which also cause blocked tubes. Another advantage of this sinuous tube is that, due to its flexibility, it can adjust itself to any unequal expansion, which is often a cause of leakage at the tube ends.

Particular mention of the Cochran boiler is made after a number of years of operating it, and that experience supports the maker's claims as regards freedom from leakage and tube failures.

The running period between cleaning of Economic boilers is much shorter than with Lancashires. The actual time will probably depend on the class of fuel being burned. If the coal has a large percentage of " fines," partially burned particles tend to " bird-nest " round the tubes at the combustion chamber end, and the effective area for the passage of the flue gases is soon reduced.

Where this class of coal has to be burned, some form of soot blower should be installed, and used daily to keep the tube ends clean. In any case tube sweeping is a much easier job than flue cleaning in a Lancashire boiler, and it can be carried out as soon as the boiler is shut down.

Mechanical Stokers.

There is a wide diversity of types, sprinkler and ram feed, coking with moving bars, and continuous chain-grate, etc. None can claim to be the best, and the deciding factor may have to be the class of fuel which will be available.

An oil fuel installation is superior, in every way, to any mechanical stoker, but due to the present economic conditions, it is not worth while going into comparative costs.

Considering the smaller details of the plant, feed-water regulators, of which there are a number of reliable makes, should be fitted. The feed water can be maintained at the same rate at which the steam is being used. This avoids pumping large quantities of comparatively cold water, and causing localised alternate contraction and expansion, which may eventually cause seam leakage.

Feed-water Recorders.

These are useful in evaporation tests and give a visual indication of the boiler output at any time.

Temperature indicators are a useful adjunct to the operation of Economic boilers, indicating the heat drop through the tubes. They

may also serve to avoid damage to the brick-work in the event of the boiler being excessively forced.

CO_2 recorders should be installed, as they give a definite indication of the efficiency of the process of combustion.

Maintenance and Operating.

Boilers, excluding high-pressure water-tube types, are reasonably simple pieces of plant to maintain in a condition to give maximum efficiency. The efficiency of a boiler is calculated as a ratio of the heat got out in the steam, to the heat put in as fuel. The value of this ratio obviously depends on the rate of heat transmission from the furnace gases to the water side. The main factor in resisting this heat transfer is scale on the water side. A great deal of research has been done to prove the low conductivity of boiler scale, and it is said that a scale 1/16 inch thick may cause a reduction in efficiency of 15 per cent.

From this it is apparent that where make-up feed water is hard a water softener should be installed. The capital expended will be amply repaid by preventing wasted heat, and by a substantial reduction in the cost of boiler cleaning.

Where boilers are already heavily scaled this should be removed, either mechanically or by chemical means, and until a water softener, preferably of the lime-soda type, can be installed, some scheme of scale prevention instituted.

There are numerous boiler compounds on the market allegedly for the prevention of scale, but as water treatment is a subject in itself, only a warning will be sounded against the indiscriminate use of these.

The cause of pitting and corrosion is also a subject for water treatment, but where it already exists, the affected areas should be cleaned down to the metal and painted with several coats of a suitable preparation such as "Apexior."

Air leaks and short-circuiting of the gases between the flues of Lancashire boilers can cause loss of efficiency and should be repaired as early as possible.

Furnace fire bars should be kept in good condition, and any that allow the draught to blow holes through the fire bed should be replaced.

Safety valves should be set to blow at the proper working pressure, and not allowed to "feather" at several pounds below this.

Occasional steam trials are the only means of finding the efficiency of a boiler. To carry out a full-scale trial with all the observations, about 70, tabulated in the form as recommended by the Institute of Civil Engineers, is not necessary for our purpose. If the

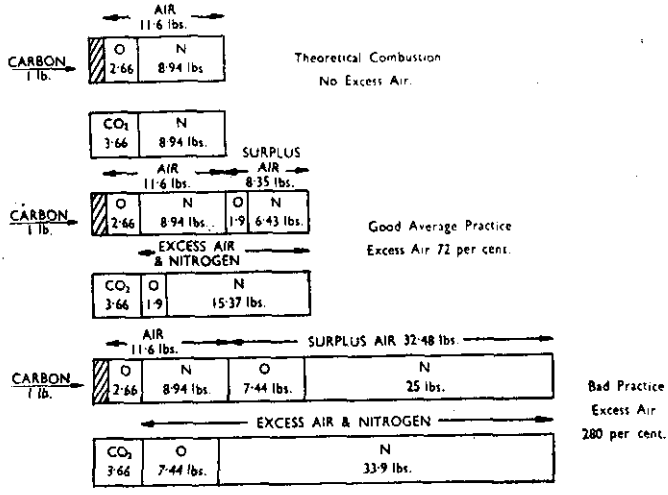
instruments, such as a feed recorder or steam flow meters, etc., are installed, snap tests can be carried out any time, burning a given weight of coal the calorific value of which must be known.

After all, it is the maintenance of a good average performance over the running period of the boiler that will prevent waste of fuel, and in hospital boiler-houses this must, to a great extent, depend on the ability of the stoker.

It can be said that the difference between a good and a bad stoker may be 10 per cent. on the efficiency of the boiler. It is a fallacy that any man who can throw coal in a furnace is an efficient stoker.

Combustion is a purely chemical process, obeying definite laws. There is a minimum amount of air required, about 11 lbs., per pound of fuel burned, but in practice an amount in excess of this must be supplied. When this excess air becomes too great an excessive quantity of waste gases is produced containing heat which is entirely lost. For this reason stokers should be impressed with the importance of regulating the air supply, and maintaining his fires to give a reasonable CO_2 reading.

The following diagrams from a paper by Mr. E. G. Hiller, then Chief Engineer of the National Boiler Insurance Company, is useful in illustrating the composition of flue gases with varying amounts of air.



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Every boiler has an evaporation at which it is at its most efficient performance, but due to the small output required from hospital boiler plants this desirable arrangement is hardly attainable.

Summarising the foregoing, there are no short cuts to boiler efficiency, and we are faced with the endless routine of cleaning and flue sweeping and attention to the smaller details of maintenance, which have been omitted, as they are only too familiar to all of us.

Perhaps in some happier distant future our successors will be relieved of all this, when the development of atomic power will hold out less threatening prospects than it does at present.

EDITORIAL NOTICE.

STEAM AND PRODUCTION COSTS.

There is a new Bulletin, just out, which will be very acceptable to a large number of firms using steam for process and heating. It offers excellent suggestions for improving the output economy of steam-heated plant.

At the beginning of the war, before the fuel efficiency campaign began, Spirax Manufacturing Co. Ltd., of Cheltenham, published their Bulletin No. 9 on "Fuel Economy." It was something of a pioneer and the forerunner of many publications on the subject as the fuel efficiency campaign was developed. Two years ago an offspring of Bulletin No. 9 made its appearance : it was Bulletin No. 16 on "Steam Economy." There was an instant demand for it and the supply went very quickly.

The present Bulletin is the latest edition, revised and brought up to date. It is concise and eminently readable, with easy-to-follow diagrams.

The Bulletin confines itself to the simple ways in which users can get more value from their steam consumption, and the suggestions can be commonly applied to all steam-using establishments. But not only do the suggestions have the merit of simplicity ; they would seem to be most effective, without involving heavy costs or extensive plant alterations.

In a number of directions the recommendations in the Bulletin, besides offering quick ways of economising steam consumption, point the way to an improved plant output efficiency with a consequent reduction in production costs.

It is noted that prominence is given to the need for more accurate measurement of steam consumption as a fundamental requirement of the costing system. It is a timely plea which ought not to be

ignored, for the measurement of process steam consumption is surely at the very root of production costs and economy. The Bulletin draws attention to the value of an indicating steam meter on the steam supply to each main department as well as at the boiler mains.

It is interesting to note also the emphasis given to the new technique of " individual steam separation " (a small steam separator in front of each process unit) as an important element of efficient heat transfer methods.

We understand that the supply of the new Bulletin No. 16 is limited and early application for copies is desirable.

South Wales Branch.

Please note that the Hon. Secretary of the above branch is now :

V. RILEY, ESQ.,
59 BRYNGLAS AVENUE,
NEWPORT, MON.

EDITOR.

INSTITUTION OF HOSPITAL ENGINEERS.

A RALLY

Dear Members, *January*, 1950.

A **Rally** has been arranged to take place at **Morecambe** on Saturday, May 6th, 1950.

The Meeting will be held in the Lounge of the Central Pier, commencing at 2.15 p.m. His Worship the Mayor, Councillor H. R. V. Addenbrooke, has promised to attend, along with many of our Council members, invitations have been sent to the Manchester, and Liverpool Regional Hospitals Engineering Staffs.

Please make a special endeavour to be present, and so help to make this our first rally—a success.

There will be a Luncheon to which Ladies are invited at the Winter Gardens, Marine Promenade, commencing at 11.45 a.m., 7/- each (Double tickets 14/-), which includes Gratuities, but not Wines.

Please send your monies along to me, not later than April 24th, 1950, so that the caterers can know exactly how many will be present.

Looking forward to seeing you, and to a very enjoyable time at Morecambe on May 6th.

On behalf of the Lancashire Branch,

I am,
Yours sincerely
C. W. OLIVER.

52 Cavendish Road,
West Didsbury,
Manchester.

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