THE HOSPITAL ENGINEER

THE JOURNAL OF THE INSTITUTION OF HOSPITAL ENGINEERS

Vol XIV: No 8
August 1960

# Editorial

THE first meeting of a new organisation, the Biological Engineering Society, was held on June 10th at the Royal College of Surgeons. Physicists, mechanical and electronic engineers, doctors and physiologists were among those present. The principal objects of the Society are to further the applications of engineering to medical and biological problems and the bringing together of those working in the various disciplines from hospitals, research organisations and industry.

The first president of this new society is Dr. R. Woolmer, professor of anaesthesia at the Royal College of Surgeons; the acting secretary is Dr. A. Nightingale of the Physics Laboratory, St. Thomas's Hospital. In addition, the Council is composed of Dr. Philippe Bauwens, Professor A. V. Hill, Dr. Guiseppe Pampiglione, Mr. J. W. Perkins, Mr. B. Shackel, Dr. N. Smyth, Dr. A. M. Uttley, Mr. H. S. Wolff and Dr. B. M. Wright.

This is a development of considerable potential importance to medicine and one for which the need has, over a number of years within our hearing, been foreseen by doctors and engineers who appreciate the contribution that each faculty must make towards the common cause. There will be some who, reading of this for the first time, will share our regret that it has not been possible for this step to have taken place under the auspices of the Institution, as would have seemed to us most apt. Such an activity is very much a principal aim for which the Institution was founded and this lost opportunity—for this is what this could well prove to be—ought to cause us to ask ourselves whether we have been nearly far-sighted enough in concentrating the major drive in another direction, however important that may seem to be. It could very well be argued, and has been by some, that, in following the particular path that we have, we have put the cart to too great an extent before the horse and, on balance, have lost out in the process. True strength must derive from indispensability and this is the better for being broadly based. The tremendous technical development that is taking place in this day and age simply must not be lost sight of in the desire for more personal rewards, or we shall be forever on the outside looking in. There is a moral for us, therefore, in the formation of this new society and it would be tragic after seventeen years were we not to take due note of it.

# The Application of Mechanical Stokers

By K. HOLDSWORTH, A.M.I.Plant.E.

*In the belief that most engineers today regard mechanical stoking as essential the Author discusses the selection of stokers. Mr. Holdsworth is Northern Manager of Riley (I.C.) Products Ltd. The paper was read before the Yorkshire Branch of the Institution.*

THE old conception of a mechanical stoker was in the form that it was an appliance designed to put the coal on the fire the right way up, but today a stoker is considered by most engineers to be an essential part of a boiler plant, particularly in view of the Clean Air Act, therefore, the only consideration is the type of stoker to be selected.

If the boiler is of the Sectional or Vertical type, then the choice is virtually limited to the Underfeed type of stoker, and I will make special mention of these types of boiler later in the Paper. Whatever boiler is chosen, the Underfeed stoker may also be used but, with any boiler other than vertical and sectional, there is a choice, so we will consider the various types available, together with the advantages of each and what is involved in their use.

There are four distinct methods of feeding the coal to the grate by mechanical stokers and four methods of burning the fuel.

We will first consider the Sprinkler stoker which sprinkles the coal onto the grate by means of a rotor spinning at high revolutions which deposits coal continuously over the grate area, or by a spring loaded shovel which deposits larger amounts of fuel in four operations from front to back. The first charge of fuel falls on the front of the grate, after a short time the second charge falls a little further back, and so on, until the grate is covered. Moving grates are seldom employed with the rotor type, as obviously the fuel being sprinkled at the back of the grate would be deposited in the ash pit too quickly and would not be consumed.

Moving grates are often fitted to the shovel type but, in my opinion, this method, while handling a rapid fluctuation in load perhaps more successfully and facilitating cleaning, does operate in conjunction with the shovel, consequently there is a danger that recently ignited fuel from the front of the furnace is just reaching the second zone when the second charge of fuel is deposited, resulting in uneven combustion conditions and excessive smoke. It is, therefore, essential that the speed of the grate and the stroke of the shovel be very carefully synchronised. This is not easy to do as there are several moving parts each with different loadings, some operations being adjustable and some not. If the stoker is to operate under those conditions it is essential that they be inspected and adjusted frequently. As the raw fuel with any type of sprinkler stoker is deposited into the incandescent firebed for the entire length of the grate, they do have a greater tendency towards smoke emission than other types. They handle a rapid fluctuation but if they are to maintain a reasonable efficiency, higher maintenance costs must be budgeted. These costs can, however, be reduced if a stationary grate is fitted, due to less moving parts and less burning of firebars.

The coking stoker, whilst taking various forms, has the basic principle of depositing the green coal from the hopper onto a coking plate at the front of the furnace where the volatiles are given off and are consumed in their passage over the incandescent firebed. The coked fuel, or residue, is then moved along the grate by means of ridged reciprocating firebars, the ash being deposited in the ashpit from the end of the firebars. This principle has the advantage that, due to early distillation of the volatiles, smoke is not readily emitted and the grates are self-cleaning. There are, however, disadvantages in so far as it is essential to run the stoker with a thick firebed, although the actual thickness varies with different makes, consequently the burning rate is rather low and the operation sluggish; a high draught is also required over the grates to overcome the firebed resistance, normally minus 0·5″ to 0·75″ W.G. is the requred draught and this amount should at least be calculated for. This fact alone does, of course, usually entail the provision of an induced draught fan which could increase the danger of grit emission. Like all reciprocating grate stokers, as rather wide air spaces have to be left between the firebars to facilitate air admission and allow for expansion, there is a riddlings loss when burning a coal with a fair percentage of fines. As access has to be made to the ash pit, the sealing plate should be very well fitting to prevent inseepage of excess air at the fire bridge.

The Chain Grate stoker in various forms has been applied to the larger water tube boilers for many years, although, where capital cost is of secondary importance and particularly at Power Stations, it is being superseded by pulverised fuel burners using rough slacks and slurries as a raw material.

A comparatively recent innovation for the Chain Grate stoker has, however, been its application to horizontal shell type boilers. Although it is not so easy to apply to this boiler, it has met with a large amount of success when burning the correct fuel. When applied to shell type boilers, the chain grate stoker is quite simple in design and operation and consists of an endless chain of C.I. links, sometimes carried on driving chains and sprockets and, in other designs, on rollers. The chain passes under a hopper and guillotine at the front, the coal falling by gravity onto the chain and the fuel being levelled as it passes under the guillotine beyond which ignition takes place. The length of travel after ignition is approximately 6-ft. The grate can be slowed down or speeded up either by variable speed reduction gear, variable speed motor or by timers operating on variable cycle so that the grate will move for say two minutes then stop for one minute. The depth of bed may be varied by adjustment of the guillotine. The air ducts from the forced draught fan enter separate compartments under the grate each with its own air damper so that the air supply may be zoned to supply extra or reduced air supply where needed in the firebed.

These stokers, if applied and used properly with the correct fuel, can be most efficient. It is essential, however, that a fuel having a high ash content be used, certainly more than 7% and preferably 10%–15%. The ash is a useful medium for keeping the grate links cool. There is an intense downward heat onto the chain due to the rather confined space and if one link snaps, although a new link can be inserted without withdrawing the stoker, it does mean that the stoker will have to be shut down temporarily until the repair is carried out. It is, in any event, unwise to burn a good quality fuel, as the whole purpose of the chain grate stoker being applied to shell boilers is to burn an inferior coal which otherwise could not be burned on a mechanical stoker. It is not designed to be a "jack-of-all-trades" and whilst it will *burn* a good graded fuel the advantage will diminish as the ash content decreases, due to high maintenance costs. There is a greater availability of poor coal as we know only too well and, whilst say a rough slack which the N.C.B. could not sell otherwise was available at a very attractive figure, the advent of the chain grate in the field of shell boilers has made these fuels a marketable proposition and, consequently, the difference in prices of fuel is now not so great. It is, however, still much cheaper and its use on chain grate stokers is the only way of making a chain grate an economical proposition.

The underfeed stoker differs considerably from the stokers mentioned previously in that there is no counterpart in hand-firing. At this stage it is as well to establish what an underfeed stoker is. There is an opinion in some quarters, mainly from certain chain grate stoker manufacturers, that an underfeed stoker does not employ underfeed combustion. This is, of course, ridiculous as only a stoker *feeding* coal beneath the firebed can give true underfeed combustion. It would, however, be truer to say that Coking, Chain Grate and Underfeed stokers have in common the fact that combustion commences with the distillation of volatiles. The underfeed stoker is basically simple in function and consists in the main of a hopper, a feed worm and a fire pot or retort, surrounded by an air chamber which is bridged by small, but deep fire bars or grids called tuyeres, which are really small castings containing air ports. A forced Draught fan supplies air under pressure to the air chamber. The green coal is fed from the hopper by the worm to the retort and meets air entering immediately at the top of the retort.

The tuyeres, due to their shape, form an extension to the retort, being on a vertical plane, in addition to being effective grate area due to the air ports. Under the thrust of the worm the fuel continues up and over the tuyeres, whilst still burning, where the combustion process is completed. The process is, of course, the reverse of the sprinkler or coking stoker where the green coal is fed into a red firebed. On the underfeed stoker the green coal is ignited under the red firebed. The volatiles *must* pass through the hot firebed and are consumed before reaching the combustion chamber. Smoke is, therefore, virtually eliminated. The firebed is mushroom shaped and transmits better radiation than the overfeed method. This type of stoker is very flexible and is capable of burning rates up to the equivalent of 45-lbs. per square foot of grate area on the normal firegrate, compared to the 35/40-lbs. per square foot of the sprinkler and the 30/35-lbs. per square foot of the coking stoker. There is the disadvantage that the grates are not self-cleaning and clinker has to be withdrawn over the top of the grate by hand, but on some types only the clinker has to be removed from the top of the fire, the fine ash being allowed to fall through side bars and cleaned from underneath. There is, however, no riddlings loss. As combustion takes place beneath the firebed no over fire draught is required for combustion—minus 0·1″ to 0·15″ is usually sufficient to take away the products of combustion. Consequently, induced draught fans are not normally required except on treble-pass boilers where on natural draught only, minus 0·15″ would be available at the smoke box.

An induced draught fan is, however, standard equipment with treble-pass boilers. When fitting to horizontal shell boilers, underfeed stokers should preferably have a long retort, the length varying with the size of the boiler, but comparing as near as possible to the length of firegrate in the hand fired boiler, usually between 4′ 6″ and 6′ 0″. Better results will be obtained in this way and fluctuations in load carried better as, whilst we have said before that the stoker is capable of burning 45-lbs. per square foot of grate area, like any other stoker or any other machine, it is most efficient at 80% of the maximum and, therefore, an easier and more flexible combustion process is maintained due to the greater area available.

Maintenance is extremely low, as virtually the only moving part is the feed worm. As the firegrate is stationary there is no mechanical wear on the grate but, like all firegrates, damage due to burning depends on the fuel. It is usual practice for this type of stoker to be automatically controlled when fitted to boilers. Practically any form of automatic control can be employed from a simple pressure-stat or thermostat which switches the stoker on or off according to steam demand, or operates a small pulling motor or modulator which automatically proportions the amount of air supplied to the furnace pro-rata with the coal being fed. This control is simple and, as it is not subjected to wear, may be pre-set and run for a considerable period without any attention whatsoever. As it is possible to fit a very large hopper to this type of stoker, the plant can run for long periods without the attention of a fireman.

It is as well here, I think, to mention the fuels suitable for the various types of stokers. To help in this, the Combustion Engineers' Association have published a booklet entitled "Firing Equipment and their Fuels." This booklet must, however, only be used as a guide. The booklet comments on all British coal groups available and is useful in this respect. Recommendations of individual manufacturers do vary, however, and they are the best people to contact for advice. For the purpose of this paper I will confine my remarks to the broad recommendations of the booklet regarding sizing, ash and moisture.

*Sprinkler Stoker:*

Treated or untreated.

Size up to 2″ with a maximum of 25% through ⅛″.

Free moisture 10% to 15% acceptable.

Ash up to 20% if fusion temperature above 1,350°C.

*Coking Stokers:*

Treated or untreated.

Size up to 2″ with a maximum of 35% through ⅛″.

Free moisture 10% to 15% acceptable.

Ash up to 20% if fusion temperature above 1,350°C.

*Underfeed Stokers:*

Selection of fuels for this type of stoker varies according to size and application. As the smallest underfeed stoker feeds only 12-lbs. of coal per hour and the largest 1,200-lbs. per hour, this coal being fed through a tube, the maximum size varies. If automatically controlled and intended to run for long periods then the ash and fines content is important. Coal classification is, therefore, more rigid for space heating with the smaller stokers, but more flexible with the larger types where a fireman may be in attendance.

The fuel can be treated or untreated.

Upper size 1″—2″ according to stoker size—Maximum through ⅛″.

25% to 40%.

Free moisture 10%.

Ash 10% to 15% according to stoker size is acceptable, but fusion temperature should be not less than 1,350°C.

*Chain Grate Stokers:*

Upper size 1″—maximum through ⅛″ up to 100% in certain cases.

Free moisture up to 25% on certain fuels.

Ash not less than 7% or more than 30%.

Strongly caking coals should be avoided on any type of stoker, certainly if the stoker has reciprocating firebars. With stationary hand cleaned grates these coals may be used if the fireman levels the bed occasionally. With underfeed stokers certain strongly caking coals are suitable if wetted.

The caking extremes of a coal are, however, corelated to the volatile matter and ash fusion temperature, for example, a strongly caking coal of high volatile content with a low ash fusion temperature would entail a considerable amount of brute force to break up the clinker. On the other hand, if the ash fusion temperature is high, the caking can be broken fairly easily with a slice bar and, in the case of underfeed, would eventually break up of its own accord if left long enough.

All boiler and stoker calculations for estimating purposes are today based on coal having a calorific value of 12,000 B.T.U's per lb. gross as received (with the exception of chain grate stokers which are normally based on 10,500 B.T.U's per lb.). It is as well to remember this point when considering new plant or negotiating fuel supplies.

Incidentally, it is as well to remember that calorific values quoted from the N.C.B., are normally on the gross, as received, basis and this value, according to the Civil Engineers Testing Code, is the value that should be used when carrying out efficiency trials. The net calorific value can, of course, be used, but it must be remembered that a higher efficiency figure will be shown by using this value than the gross, as received. When sending enquiries to manufacturers they should be asked to state clearly the value they use in their calculations in order that their calculations conform to your estimate.

Assuming the boiler to be of the horizontal shell type which type of stoker do we select?

In view of the Clean Air Act we should remember that Sprinkler stokers will be unlikely to be accepted, at least without a fight. To comply with the general provisions of the Act smoke must not reach Ringelmann No. 2 except when cleaning out and then only for a very short period. Although I know of a few Sprinkler stokers that are well maintained and are complying with the Act, they are the exception rather than the rule. The Sprinkler stoker was criticised in the Beaver Report which led up to the Clean Air Act and there are in fact few, if any, Sprinkler stokers being made. In some cases this is regrettable, as rapid fluctuations such as one encounters in Dyehouses, etc., can be handled better by a Sprinkler stoker than by any other type.

We are, therefore, left with Chain Grate, Coking and Underfeed.

Any reputable make or type of stoker should be designed to give the highest practical percentage of $CO_2$ in the resulting flue gas after combustion in the furnace, usually between 12% and 14%. The designer, however, does not have ultimate control over the type or quality of the coal being burned, the operation of the plant or the maintenance. It is essential, therefore, that the fuel for which the stoker is designed is used, this is also essential under the Clean Air Act.

We should, therefore, first consider the fuel we wish to burn. Our choice in this direction should be governed by the cost per ton related to calorific value and any resulting charges on labour, handling and ash removal.

If we first consider a cheap fuel such as a washed small, then our choice of stoker is obviously a Chain Grate. It will then have to be established that a Chain Grate stoker can be fitted to the boiler concerned by having firing flues of adequate size with sufficient space in front of the boiler for withdrawal of the complete stoker and that there will be available a suction over the fire of at least —0·25″ W.G. If these conditions are satisfied then the price per ton delivered into the boilerhouse should be obtained, together with the analysis. The latter in most cases will satisfy the fuel recommendation for Chain Grate Stokers in the case of a washed small, but the c.v. can vary considerably. The highest c.v. one would expect from this type of fuel would be 12,000 B.T.U's per lb. on the gross, as received, basis, but the average will be found to be nearer 11,000 B.TU's per lb. The c.v. should now be compared with the c.v. of a graded coal which in this area will be at least 12,000 B.T.U's per lb., the average being about 12,400 B.T.U's per lb.

If we take as an example a washed small at 11,000 B.T.U's per lb. and compare with a washed single of 12,000 B.T.U's per lb., the cost of the washed single is 100s. per ton delivered, then the parity value for the washed small should be 91s. per ton. As, however, the cost of the Chain Grate stoker is approximately 50% higher in capital cost than Underfeed and Coking stoker, there will be 50% more capital to be reclaimed and to make good the difference in capital over a period of 5 years, excluding depreciation, the washed small will have to be purchased at certainly no more than 79s. per ton delivered.

If the washed small contains 8% of ash compared to the 4% of the washed single, then there will be double the quantity of ash to remove from the furnace. As also to achieve the same evaporation, 10% more fuel by weight will have to be fired, labour will be increased by 10% in charging the stoker and 100% in discharging, unless mechanical means are employed.

If, after taking these factors into consideration, there is a case for Chain Grate, then this should be proceeded with on its merits, but it must be remembered that no saving in labour will have been made, in fact it will increase.

If it is decided that a graded coal can be used, then the choice remains between Coking stoker and Underfeed. Both types of stoker enjoy a good reputation, but each apart from having things in common have, as I have stated earlier, advantages and consequent disadvantages, one against the other. They have first of all, in common with Chain Grate stokers, virtually smokeless combustion; they should both be capable of efficient combustion if operated correctly.

The advantages of the Coking stoker are:—

(1) It is self-cleaning.

(2) It does not require so much space in front of the boiler.

The disadvantages are:—

(1) The hopper is considerably smaller than on an underfeed.

(2) Due to the reciprocating firebars there is a greater riddlings loss.

(3) As the stoker does not have Forced Draught a strong chimney pull or Induced Draught is required.

The biggest advantage of an underfeed stoker is the ease of control and its adaptability to automatic control which is normally a standard item in this type of machine.

As the driving motor drives a fan and feed screw, it is comparatively easy to regulate the amount of air to the coal being burned, and this can be done automatically.

As all air for combustion is supplied from the Forced Draught Fan, only a minimum of chimney draught is required, merely to carry away the products of combustion.

Due to these factors a low flue gas loss can be maintained automatically and at fluctuating loads over long periods without attention. The stoker being set low, it is possible to have a large capacity hopper and most makes have a hopper of at least 600 lbs. capacity to dispense with frequent hopper filling.

As there are very few moving parts and lubrication points, maintenance is comparatively low.

There is the disadvantage that ash and clinker has to be removed from the furnace by hand as distinct from an ash pit. It is, however, unnecessary to disturb the fuel bed in doing this. Comparative capital costs of the two machines will depend to some extent on the existing plant.

On a two flued boiler having an Induced Draught fan, the Coking stoker will be cheaper, as of course there will not be an Induced or Forced Draught fan to be supplied with the stoker and only one driving unit will be required to drive the two machines.

As, however, an underfeed stoker is self-contained with individual fan and drive, the basic price of two machines will usually be greater.

On a single flued boiler without I.D. fan an underfeed stoker will normally be found to be cheaper.

On single flue boilers with I.D. and two flued boilers without, the cost will be comparative.

Labour and maintenance costs are, however, an important item in boilerhouse costs as is shown very clearly when oil fuel is being considered and these should be very carefully calculated in determining overall costs.

Whilst with all mechanical stokers it is necessary to have a fireman at least part of the time, it is certainly not necessary to have a fireman there all the time and, with automatic control and adequate hopper capacity, time spent in the boilerhouse can be reduced by at least 80%.

One cannot, however, employ 20% of a man, therefore it is a question of whether a man can be usefully employed for the 80% of his time when he is not in the boilerhouse.

There are two distinct designs of stoker for application to Sectional and Vertical boilers, irrespective of size. They are the hopper type and bunker to boiler type, the latter feeding coal direct from bunker into boiler. The bunker to boiler has the obvious advantage of dispensing with hopper filling and thereby the only labour involved is in cleaning the fire.

In applying any underfeed stoker to a sectional or vertical shell boiler it is essential that sufficient combustion volume is available. As in the case of sectional boilers the width and length are already established it follows that, to obtain required volume, the boiler will either have to be lifted or the stoker sunk if the volume above standard has to be increased. Likewise with a vertical boiler, as the diameter is established, again any variation in volume must be accounted for in the height. Apart from *volume* required for combustion purposes the height has also to be considered in relation to the danger of flame impingement which can occur at riveted seams, cross tubes; and (in cast iron sectional boilers), at nipples and also the sections themselves.

The volume of the combustion chamber determines the heat release and there is a British Standard B.S.749 for determining both volumes and heights.

For sectional boilers a heat release of 40 to 60,000 B.T.U's per cubic foot per hour is allowed with a recommended height of combustion chamber from 24″ to 39″ from top of tuyeres to combustion chamber crown depending on coal throughput. From this it will be seen that the required combustion chamber volume should first be established by multiplying the coal throughput by the c.v. of the fuel (bearing in mind that, for this purpose, efficiency is taken at 100%), dividing the result by a maximum of 60,000, the result being volume of combustion chamber in cubic feet. If this volume is not available with the boiler mounted at firing floor level, or the minimum height is not available, then the boiler should be lifted accordingly if head room is available (and mains are not interfered with) or alternatively the stoker sunk.

In all cases of bunker to boiler stokers, the bunker should be adequately drained and the fuel kept as dry as possible. It is better but not essential to have the bunker with sloping sides, but if this is not possible, then the bunker may be cubed and the coal will find its own angle of repose, but it must be remembered that, whilst the same quantity of fuel will gravitate to the pick-up worm as with a sloping bunker, there will obviously be some fuel left which will either have to be used as reserve of fuel or hand-trimmed on to the pick-up worm. Underfeed stokers of all types need not necessarily be applied to the front of a sectional boiler but can also be applied either diagonally or from either side. In the case of a bunker to boiler stoker the stoker can be applied to the back of the boiler, but, in doing this, care must be taken to ensure that, by means of extensions to the stoker body, the retort is positioned as near as possible to that which would apply with a front application, otherwise thermal efficiency will suffer. It must also be remembered that a longer cleaning rake will be required for removal of ash from the air chamber underneath the stoker.

With regard to vertical boilers a lot depends on the type. Generally with this type of boiler the stoker can be positioned through any point on the periphery and, if the plant is a projected one, then arrangements can be made with the boiler makers for skirt lengths and openings and the boiler positioned accordingly. Whether the boiler is existing or not, care should be taken that, if the stoker is of the hopper type, there is no danger of inaccessibility to smoke or water tubes or interference with cleaning out through the boiler clinker door. If the standard clinker opening is too high for reasonably easy fire cleaning, then an additional fire door should be located in the skirt or brick base. Heat release with regard to vertical boilers (and similar types such as stationary locos) may be taken as above 60,000 B.T.U's per cubic foot providing the height laid down in the British Standard is complied with. This height can be taken as a maximum of 4 ft. at 1,200 lbs. of coal per hour, which would be sufficient for the largest vertical boiler made. Where the boiler is existing, care should be taken to ensure that, if the stoker is not applied through the normal skirt openings, this opening is adequately supported either by jacks or sealing plate with angle to prevent the boiler becoming top heavy.

Having got the plant, what do we expect from it?

If an estimate of fuel savings has been obtained from the manufacturers then this saving at least should be achieved if all the conditions are carried out, but I am always astounded at the general lack of instrumentation in the average boilerhouse. These are the only means of telling you what the plant is doing. It is no use knowing what coal you are burning if you do not know what steam is being generated. It is like checking your petrol consumption on a car without a mileometer.

If only portable instruments are used this is better than nothing. It is not necessary to have elaborate instruments, but even one instrument can tell a lot. For example, on natural draught, a draught reading taken over the fire with a clear stack would give us a very good idea of the burning rate or, conversely, if we knew how much coal the stoker was feeding, and the size of the grate, we could regulate the draught accordingly and know that the $CO_2$ would be reasonable. By having $CO_2$ indication together with gas temperature indication, we can obtain what is usually the major loss in a heat balance, this being the flue gas loss. If we add 12% to this loss and subtract the total from 100 we shall have the efficiency from the gross c.v. to a small margin of error, unless there is a high riddlings loss which would, in any event, be apparent from the ash.

In a flue gas loss it is usually wishful thinking to expect a constant 12% to 14% $CO_2$ at all loadings without constant re-setting. In any event $CO_2$ alone is of no use to us without comparison of the gas temperature at the same point. In fact on a treble pass Economic boiler which has a very low outlet temperature, a fall in $CO_2$ is normally adequately compensated by a fall in gas temperature.

For example: $$\frac{0{\cdot}35\,(450-50)}{12} = 11{\cdot}65\%$$

$$\frac{0{\cdot}35\,(400-50)}{11} = 11{\cdot}2\%$$

In our running costs it is important to take maintenance costs into consideration as it is no use saving money on coal if we are going to spend it on repairing the appliance continuously. I find it is best to add a little to the fuel costs to cover this item at the start and after say two years running this should be compared with actual costs and, if excessive, the manufacturers should be consulted. A reasonable sum to add would be a maximum of 1s. per ton of coal burned in the case of Chain Grate stokers, but an exception should of course be made if a Chain Grate stoker has been operated with less than the minimum required ash content, as I have known cases where a complete grate has had to be replaced in a very short period due to this.

In the case of an underfeed stoker burning a free burning coal, 6d. per ton should be allowed. These are of course average figures, but are, I think, reasonable. It is, however, better to relate maintenance costs to coal throughout rather than take maintenance costs over a period irrespective of loading or operating time. On Chain Grate stokers in particular refractories can play a large part in maintenance costs. This depends on (*a*) the design of the stoker and (*b*) the type of refractory. Chain Grate stokers that have refractories along the sides of the grates can have severe slagging problems in addition to the arch maintenance.

Different makers of Chain Grate stoker have different ideas with regard to arches, some using plastic, others using pre-cast and others using a combination of the two. In my experience plastic has been the better at least on the secondary arch, which normally fits inside the firing flue. It is, however, essential that the makers of the plastic refractory should issue instructions for bedding and moulding the arch, and these instructions should be carried out to the letter.

In view of the Clean Air Act, efficiency has in some cases become secondary to smoke emission, particularly in a smoke control area, so much so that most Smoke Inspectors are, in these areas, making rules that air to coal should automatically be regulated to each other or, alternatively, the forced draught fan should run after the coal feed has stopped. This latter can, however, reduce the overall efficiency of the plant, particularly on light loads, and I feel that such cases should be argued on their merits with the Health Authorities concerned.

To conclude, if a mechanical stoker is applied and maintained properly, efficiency certainly on a par with oil can be achieved and maintained and, although the first mechanical stoker was invented 140 years ago, research is still continuing and I feel that, in spite of the advent of oil, the mechanical stoker will be with us for many years to come.

# Earth Loop Testing

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*Amendments in 1958 to the I.E.E. Regulations for the Electrical Equipment of Buildings included a new earthing test in Reg. 507 using the line-earth loop. The neutral-earth loop test has been retained and in this article a comparison is made.*

MANY people concerned with earth loop testing as prescribed in No. 507 of the I.E.E. Regulations for the Electrical Equipment of Buildings, amended in 1958, are now confronted with selecting the type of test to be carried out and the instrument which should be used. The purpose of the original regulation, which only specified a neutral-earth loop test, was to establish whether sufficient current could flow through the actual earth loop path to enable the protective fuses or overhead current circuit-breakers to operate in the event of an earth fault. While the idea was sound, a controversy arose regarding the testing method and the type of instrument to be used. The amendment, brought about by the experience gained in earth loop testing, has now clarified the position so that tests can be carried out to give correct and reliable results under all conditions met with in practice.

The amended regulation includes a completely new line-earth loop test. Nevertheless, the test in the neutral-earth loop has been retained, and is in essence the same as the original regulation apart from four main stipulations. These are that high current injection type instruments must be so designed that the effect of neutral currents flowing in the system is taken into consideration; this test cannot be carried out if a protective multiple earthing (p.m.e.) system has been installed; an instrument delivering d.c. to the circuit under test can now be used providing the polarity is rapidly and continuously reversed, so that any existing voltage drop in the neutral conductor does not affect the results obtained; and that while a maximum current of 25 A is still the preferred testing current for high current injection type instruments, no mention is now made that the testing voltage applied to the circuit must not exceed 40 V. This is no doubt due to the fact that it has now been realised that a loop value of above 1·5 Ω will not allow 25 A to flow through the neutral-earth loop when 40 V is applied to the test circuit.

The earth loops that may now be tested are shown in the two illustrations. It can be seen that an actual earth fault current would flow through the loop in Fig. 2 and not that in Fig. 1. This is the fundamental difference between the two types of test now allowed, and would seem to be one of the main reasons for the amended Regulation 507 giving preference to line-earth loop testing.

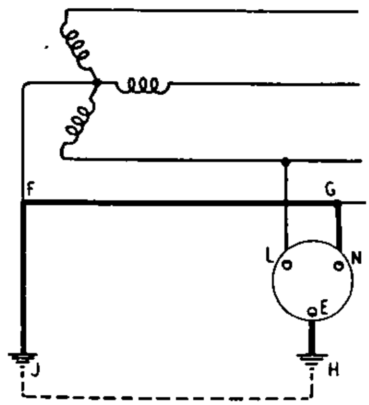


**Fig. 1. The heavy and dotted lines indicate a typical neutral-earth loop.**

### Neutral-Earth Loop Tests

Providing an instrument is designed to meet the requirements of the new amended regulation this type of test can be carried out, but it has a limited application. For example, in an area in which a p.m.e. system is installed, the neutral conductor in Fig. 1 would be connected to the consumer's earth continuity conductor, being also earthed at several points along its length. In these circumstances a test made between the neutral and earth conductors would not give correct results as the complete loop would never be measured. It is for this reason that the regulation specifies that a neutral-earth loop test cannot be carried out where such an earthing system has been installed. Moreover, even when the p.m.e. system is not used, there is always the possibility that readings obtained by the neutral-earth loop test may not be correct, due to accidental earthing of the neutral. A particular situation, for instance, which would require care when carrying out such tests on direct earthing systems, is where an electrode boiler has been installed in accordance with I.E.E. Wiring Regulation 322, which stipulates that the shell of the boiler is connected to the neutral as well as the earth continuity conductor.

* Evershed & Vignoles, Ltd.

To decide the type of earth leakage protection, i.e. fuses, overload current circuit-breakers or earth leakage trips, which must be installed in premises, the earth loop impedance or resistance is required. Where the supply is not yet available, an instrument needing no external supply must be used and a neutral-earth loop test is the only one which can be carried out.

There are instruments on the market, such as the Megger earth testers, which need no external supply and can therefore be used for such tests. Except, however, where there is no supply it would seem that no advantage is to be gained in carrying out neutral-earth loop tests now that instruments are available capable of making line-earth loop tests.

**Line-Earth Loop Tests**

This new test simulates more closely the condition which would arise should an actual earth fault occur. The instruments now used create an artificial earth fault between the line and earth conductors and the fault current, which is limited by a resistance, persists for a very short period. During this time there is a voltage drop across the resistance, its magnitude depending on the value of the earth loop (Fig. 2). This voltage drop can either be measured by suitable indicating instruments calibrated in ohms, or used to trigger off a valve when a certain value is reached.

The current passing through the line-earth loop when the test is being carried out depends on the line to earth voltage, the loop impedance and the internal limiting resistance inside the instrument. It is possible to pass a reasonably high current through the loop, and this testing current must return to the neutral point of the supply transformer. It does not matter therefore whether the neutral conductor is deliberately connected to the consumer's earth continuity conductor or earthed at several points along its length as in p.m.e. systems.

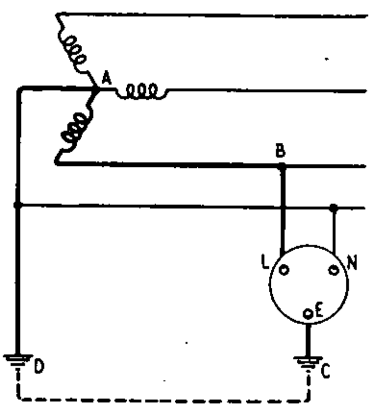


**Fig. 2. The amended Regulation 507 includes a line-earth loop, as shown, which is the true fault current path.**

Now that earth loop testing can be carried out, it is apparent from a recent interpretation of the I.E.E. Wiring Regulations that, providing such a test is made on each completed installation and the results obtained are in accordance with Regulation 406, which states that a current corresponding to 3 times the fuse rating or $1\frac{1}{2}$ times the setting of an overload circuit-breaker must flow if a negligible impedance fault occurs, there is no need to carry out separate earth continuity tests as specified in Regulation 508. One point which should not be overlooked is that the contribution of the consumer's earthing conductor to the total earth loop value should not be more than 1 Ω. This is to ensure that the voltage drop across any two points along this conductor is kept low, so that under fault conditions there is no danger to a person who happens to be in contact with it. According to Regulation 406 the maximum earth loop impedances which can be tolerated for different circuit fuse ratings on an installation having a nominal line-neutral voltage of 250 V are as follows:—

| Circuit Fuse Ratings Amperes | Impedance |
|---|---|
| 5 | 16·7 |
| 10 | 8·3 |
| 15 | 5·5 |
| 30 | 2·8 |
| 40 | 2·1 |
| 60 | 1·4 |
| 75 | 1·1 |
| 100 | 0·8 |
| 150 | 0·55 |

If, therefore, tests are made on circuits protected with fuse ratings between 30 and 150 A and the actual earth loop values are very near these figures, it is not necessary to carry out separate earth continuity tests as the total contribution of the consumer's earthing conductor is likely to be less than 1 Ω in these circumstances. This supposition might not, however, be true for actual earth loop values approaching the figures for circuits protected with fuses having ratings of 5 to 15 A, and it would certainly be advisable to carry out further tests if these conditions were found.

There are other considerations that have a bearing on the type of test to be carried out on a consumer's earth continuity conductor. Further tests have been recommended to establish the current-carrying capacity of this conductor and also whether there are any high resistance joints along its length. In practice, it sometimes happens that the consumer's earthing conductor is connected by a single strand of wire, and many people are under the impression that a test current of the order of 20 A passed through this conductor will locate the weakness by burning it out. But from recent tests it would appear that the idea is a fallacy, as a single strand of 7/·029 in.

cable ½ in. long, in air, passed 24 A for a considerable period and took about three minutes to fuse when a current of 28 A was passed. Currents of the order of 46 to 52 A were needed to fuse this strand of wire instantaneously. The figures for 7/·036 in. cable were much higher. It must therefore be realised that line- or neutral-earth loop tests are not really intended to detect this type of weakness in an earthing conductor, and the only safe method is by careful inspection.

Much has been written on testing an earth continuity conductor such as a steel conduit system for high resistance joints. The recommendations are that tests should be carried out at low-high-low current, and if the three readings agree fairly closely then the circuit may be considered sound. Marked resistance changes between each test indicate that loose joints or corrosion are present. This testing technique is sound, but it involves considerable time and staff.

The existing continuity testers only pass a low current through the earth continuity conductor, and yet any high resistance joints present are indicated. If this condition is found, further tests can establish the affected section of the earthing conductor, and all joints and connections checked and if necessary tightened or cleaned.

**Conclusion**

The type of earth loop test to be carried out in accordance with the amended Regulation 507 depends on the earthing system that has to be tested. A line-earth loop test seems the preferred method as the actual path through which a fault current would flow is tested. Moreover, this type of test is also applicable where the p.m.e. system is installed. Most of the instruments on the market have been designed to meet the requirements specified in this regulation, so that line- or neutral-earth loop tests can now be successfully carried out.

The many line-earth loop tests made by the author in the last six months have shown the real need for this type of testing, which provides means of ensuring that installations are safe in the event of an earth fault occurring. Tests have shown earth loop values ranging from 5 to 20 Ω which in many cases would not have allowed the protective gear to operate, while three-pin sockets were also found with the earth pin disconnected from the earth continuity conductor. The possibility of being able to test the complete earth loop, instead of just part of it, is reassuring to those responsible for establishing whether earth leakage protection in the form of fuses or overload current circuit-breakers will operate satisfactorily under fault conditions.

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# Explosion from a Water Tube Boiler*

*The report of a preliminary enquiry (No. 3410), held under the Boiler Explosion Acts, refers to an explosion from a Water Tube Boiler which appeared to be due to shortage of water. One attendant was killed. The boiler was not fitted with automatic feed regulators or high or low water alarms.*

THE boiler was of the Babcock & Wilcox single drum water tube type as constructed for land purposes. It consisted of one dish ended steam and water drum 4 feet in diameter and about 24 feet 6 inches in length together with ten generating elements each having nine inclined tubes expanded into sinuous headers of rectangular cross section. The inclined tubes were solid drawn and were 4 inches in external diameter by 18 feet in length, the designed thickness of the tubes being 9 S.W.G. All parts subject to pressure were made of steel. The usual boiler mountings were provided and included one spring loaded safety valve adjusted to lift at a pressure of 200 pounds per square inch. The boiler was mechanically fired with coal on a chain grate.

* Report of Preliminary Inquiry, No. 3410, H.M.S.O.

The boiler was constructed by Babcock & Wilcox Ltd. of London and Renfrew. It was installed new in its present position in 1933 and was therefore 26 years old at the time of the accident.

At the annual examination of the boiler on the 11th October, 1957, evidence of wastage was found on the third and fourth tubes in the second row from the bottom, also wastage on the fifth, sixth, seventh, eighth and ninth tubes in the bottom row. These tubes were replaced after which the boiler was satisfactorily hydraulically tested on the 25th April, 1958, when it withstood a pressure of 300 pounds per square inch for thirty minutes.

The boiler was under the inspection of The Ocean Accident and Guarantee Corporation Limited, 36, Moorgate, London, E.C.2.

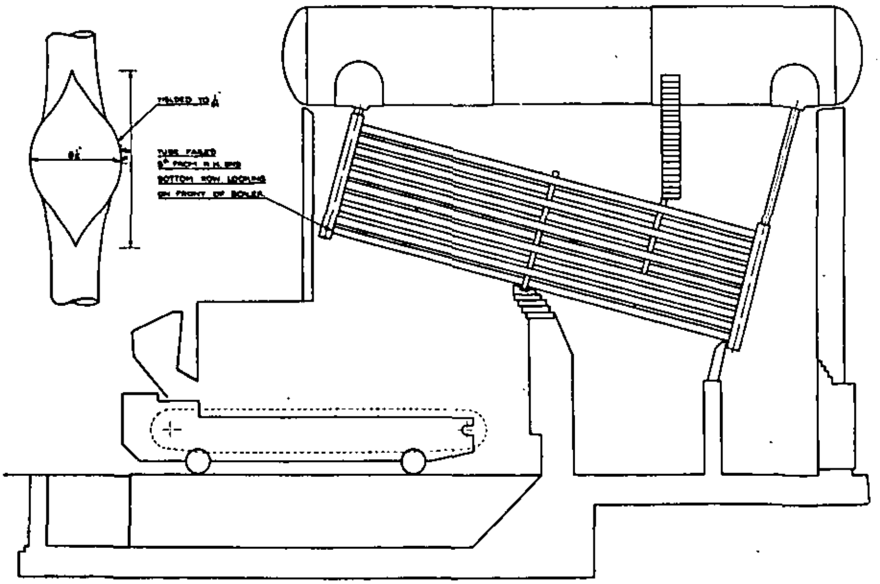

**Diagram showing the location of failure.**

An Engineer Surveyor of this Company made a thorough examination of the boiler on the 15th April, 1958, witnessed a hydraulic test on the boiler to 300 pounds per square inch on 25th April, 1958, and examined it under steam on the 13th August, 1958.

The fifth tube in the bottom row from the right hand side looking at the front of the boiler failed at a point 4 feet from the front header. It opened out along the bottom for a length of approximately 13 inches, forming an aperture $8\frac{1}{4}$ inches wide, through which the contents of the boiler were discharged. The tubes in the immediate vicinity of the rupture were distorted away from the site of the explosion and those in the bottom row had bulged from $\frac{3}{16}$ to $\frac{5}{16}$ of an inch on the diameters. All tubes in the boiler except those in the top row were sagged to varying degrees.

At the time of the explosion the ash pit door below the back end of the chain grate was open and through this opening red hot ashes and steam were discharged.

The cause of the explosion was over-heating, which caused the material of the tube to become plastic and to draw until it was unable to withstand the internal pressure and it eventually failed. The discoloration of this and the other tubes in the bottom row together with the sagging of most of the tubes and the bulging of adjacent tubes leaves no doubt that the over-heating was due to shortage of water.

The No. 2 boiler which forms the subject of this Inquiry was one of three similar boilers which formed the steam raising plant installed at these works for power purposes. The steam was utilised for process work in the manufacture of plasterboard.

The plant is operated on a three-shift system, the watches ranging from 10 p.m. to 6 a.m., 6 a.m. to 2 p.m., and 2 p.m. to 10 p.m. At the time of the explosion the deceased was serving on the 10 p.m. to 6 a.m. watch and the sequence of events leading up to the explosion appears to have been as follows. He reported for duty at 10 p.m. on the 1st April, 1959, when he relieved the boiler attendant of the previous watch. When he took over the watch the level in the water gauge was stated to have been within half an inch of a full glass and the steam pressure about 200 pounds per square inch. It is reported that the blow down valves had not been operated during the previous watch, i.e. 2 p.m. to 10 p.m., and when the deceased took over both blow down valves were closed and were not leaking. Similar conditions also appertained in the case of the No. 3 boiler which was steaming at the same time. It was reported that the whole of the plant had functioned satisfactorily during the 2 p.m. to 10 p.m. watch and nothing had arisen which gave the slightest cause for concern. It was also reported that at 8.45 p.m. on the 1st April, the feed tank was full.

Throughout the night all seems to have gone well until about 5 a.m., when the deceased staggered into the board plant and leaned against the wall. No word was spoken and he was carried by the Production Foreman to the First Aid Room, after which an ambulance was summoned. He was badly scalded and particles of coal and grit were embedded in the burns due to the force of the explosion. Before being admitted to the ambulance the injured man muttered to the foreman words to the effect, "Don't go in the boiler house, No. 2 boiler has gone up." The ambulance was quickly on the scene and he was admitted to hospital in less than ten minutes

The Production Foreman then went to the boiler house and stopped the chain grate stokers on both boilers, after which he closed the feed check valve on the No. 2 boiler which, it is reported, was three turns open at the time of the explosion. He then opened the check valve on the No. 3 boiler one additional turn and speeded up the feed pumps to feed this boiler. The steam pressure immediately after the explosion on No. 3 boiler was approximately 170 to 175 pounds per square inch, but this quickly dropped to 40 or 50 pounds per square inch, which was probably due to the fact that the steam stop valve was left open on No. 2 boiler and was not closed until the relief boiler attendant arrived at 6 a.m. The stop valves were not of the non-return type.

It is reported that throughout the night there was no occurrence of any kind indicating that anything was amiss in the boiler house until the explosion took place.

The deceased would have been relieved at 6 a.m. but the man who was to relieve him arrived at the works at 5.50 a.m. and found that the check valve on the No. 2 boiler was shut but the master valve was left open, as was the steam valve. He found steam issuing from the boiler and stated that the pressure on No. 3 boiler was 50 pounds per square inch but evidence on this latter point is conflicting. He shut the feed master valve, main stop valve and water gauge glass mountings on the No. 2 boiler, and after making sure that the feed check valve on the No. 3 boiler was fully open, he noted that water was not showing in the No. 3 water gauge glass and was unable to obtain a reading until approximately 6.45 a.m.

When questioned he confirmed that since the last overhaul of the boiler there was nothing as regards the functioning of the boiler which gave cause for concern, the boiler had worked normally as always.

On examination of the boiler after the explosion the safety valves, feed check and master valves, water gauge glass mountings and blow down valves were examined and found in satisfactory condition. The feed arrangements were also examined and nothing came to light that would account for shortage of water or a false reading in the gauge glass. In this respect the position of the baffle at the front end of the steam and water drum was considered, and this was found to have been assembled correctly. It was noted that the clearance between the baffle and the drum was such as to permit a free flow of water under all conditions. It was also noted, however, that in the case of Nos. 2 and 3 boilers, only one water gauge glass fitting was in use, the other one being shut off completely on each boiler. The boiler attendants had therefore been relying on one gauge for some considerable time before the explosion. It is considered that, initially, an incorrect reading of the water level in the gauge glass was made, which led to the explosion. This might possibly have been avoided had both gauge glasses been in use instead of one. All boilers in the factory are fitted with two independent gauge glasses which are standard fittings on this type of boiler. It was apparent that just prior to the explosion the deceased had been clearing the ashes from No. 2 boiler and was in the vicinity of the ash pit door, which was open, and through which the contents of the boiler escaped, enveloping him.

The boilers were not fitted with automatic feed regulators or high or low water alarms. Since the explosion, however, the owners have taken steps to fit a low water alarm to the No. 2 boiler in order to give ample warning should a dangerous water level arise in the future.

During my investigations it was ascertained that under normal running conditions the feed check valves on Nos. 2 and 3 boilers maintained safe working levels in each water gauge glass when the valves were kept three-quarters of a turn and full open respectively. After the explosion, as far as can be ascertained, the No. 2 boiler valve was three turns open and the No. 3 boiler valve had at least been shut one turn from the fully open position. This would seem to indicate that, for some reason, the No. 2 boiler required more feed than usual, which supports the theory of shortage of water.

The Engineer Surveyor-in-Chief to the Ministry of Transport adds :—

This explosion is typical of those in water-tube boilers caused by over-heating due to shortage of water and the Surveyor's conclusion as to the cause of the explosion is agreed.

No explanation has been given as to how the shortage of water was brought about nor could it be ascertained, apparently, if the attendant experienced any trouble in maintaining the water level or if he mistook an empty gauge glass for a full one. The report states that of the two sets of water gauge fittings provided only one set was in use and while two sets are generally to be preferred an examination after the explosion showed the glass in use to have been in good working order and so should have given correct indication of the water level.

Automatic feed control devices and low water alarms generally make for greater safety and it is noted that a low water alarm has now been fitted to this boiler.

It is regretted that the boiler attendant died as a result of injuries sustained.

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### NEW S.G.B. PREMISES

Scaffolding (Great Britain) Limited have now moved into larger, newly-built premises to meet the ever-increasing demand for their services and equipment in the Sheffield area.

The manager of the new depot is Mr. Walter Hopewell. The depot address is Petre Street, Sheffield 4. (Telephone: Sheffield 388212).

### CHANGE OF ADDRESS—NOTTINGHAM

The Cambridge Instrument Company Ltd. announces that its Nottingham Office (Resident Engineer—Mr. H. G. Starling) will operate from larger and more convenient offices. The new address is as follows:—

Cambridge Instrument Company Ltd., Century Insurance Building, Milton Street, Nottingham. Telephone: 42612.

# Floors and Floor Treatment

By P. A. HOWDEN

IT IS quite obvious that hospitals must be and are vitally interested in the maintenance of their floors. Whilst they have the same problems as others, they have additional factors to consider such as hygiene, floor safety, etc., and therefore the system of floor maintenance adopted has to be very carefully considered and planned.

The King Edward's Hospital Fund for London are at the moment carrying out extensive experiments and it would be inappropriate for me to discuss these except to say that they are being very carefully controlled and will no doubt produce most interesting results which should be of great assistance to hospitals generally throughout the country.

Firstly, I think one should consider what would be the ideal form of maintenance for a hospital floor and then see how near to the ideal certain systems can be. The following are, I think the most important points:—

(*a*) Cleanliness of the surface,

(*b*) A safe surface,

(*c*) Avoidance of disturbance to the patients,

(*d*) Minimum maintenance,

(*e*) Pleasant, attractive appearance.

There are, very broadly speaking, two groups of floors, namely the porous and non-porous. Wood and cork come under the former heading; thermoplastic and vinyl under the latter. Obviously a porous surface is more difficult to deal with because the dirt may penetrate into the floor and be difficult to remove. If untreated, it will tend to provide a " hiding place " for dirt and germs, and it will require quite a lot of work to keep it clean. It is, therefore, fairly easy to reach the conclusion that porous surfaces must be treated in some way so as to render them non-porous and there are a number of seals and lacquers which do this. These seals and lacquers also provide a safe surface, require the minimum of top treatment and, generally speaking, give a pleasant appearance to a floor. There is, therefore, no doubt in my mind at all that for hospital floors this group of finishes provides an ideal answer for wood and cork and I think they fulfil nearly all the requirements listed above. The only difficulty is that the floor must be cleaned and freed from old wax, etc., before treatment and this usually requires the ward to be vacated which I know raises difficulties but can be done by a system of rotation.

It would be impossible to describe all the various seals and lacquers which are at present available. The length of life is important but, also, of equal importance is the question of retreatment which is bound to be required at some time, and must be reasonably easy to carry out. Seals and lacquers

**The picture shows the floor of the Reception Hall of the new Out-Patients Department of the North Middlesex Hospital, London, which has been treated with Bourne Gleem.**


This photograph shows a corridor of the Ashford Hospital which has been treated with Bourne Seal, another Floor Treatments Ltd. product.

vary quite considerably in their composition and, therefore, in their behaviour, and it is very difficult to say how long they will last because, quite apart from the variations in the materials themselves, there are very wide variations in the use of the floor.

A considerable point in favour of these seals and lacquers is that they save labour by reducing day to day maintenance to the very minimum and also disturbance to the patients.

The surface of a seal or lacquer is hard and dirt cannot penetrate into it. It should, therefore, be possible to maintain the very highest standards of hygiene, even on the most porous surfaces. Naturally although seals and lacquers provide a surface which can be easily maintained, the dust and dirt has still to be removed. This can easily be done on a surface of this kind and impregnated mop sweepers provide an excellent method of sweeping. They prevent any dust rising into the atmosphere and are quick and easy to use, getting into awkward places, such as under beds, etc.

There are in most hospitals many other types of floor and most of these will probably come under the heading of non-porous. In these cases, it is not possible, nor is it necessary, to seal them, although lino stands so to speak halfway between porous and non-porous floors and can be very satisfactorily treated with a lacquer. To take the strictly non-porous floors, such as thermoplastic, vinyl, etc., here the problem is a different one, that of surface maintenance. Fortunately, an answer to this has been found in the all resin emulsion. This is a thin milk-like substance which, spread over a clean surface, dries to a shine without burnishing. It gives considerable resistance to wear and a safe surface. Applications of all resin emulsion finishes have to be made reasonably frequently but, as they can be applied by an applicator, there is no " hands and knees " work and, as there is no burnishing, large areas can be covered in a very short time. It is essential that the floor is cleaned regularly and this may either be done by working the floor with a cleaner or, if machines are available, by what is known as the dry cleaning method.

The dry cleaning method is very simple and effective and it has the great advantage of being able to be carried out on small areas at a time without disturbance. A little polish is sprinkled or sprayed on a few square yards at a time and an electric polisher with a steel wool or nylon pad is operated over the area. The pad and the polish remove the dirty coat of polish and leave sufficient behind to provide a finish. The cleaning and the polishing are carried out in one single operation.

I have only dealt very briefly with the principal types of floor and their treatment but I hope that at least this shows quite clearly that it is now possible for hospitals to evolve a system of cleaning very nearly ideally suited to their requirements. I am certain that, because of these products, in the near future we shall see a very great change in the system used for the maintenance of floors in hospitals. It is no longer necessary to put up with a constant round of drudgery, or floor surfaces which retain the dirt and germs. I believe that as a result of the experiments carried out by the King Edward Hospital Fund for London and by hospital management groups all over the country, we shall see a complete change in the picture of hospital floor maintenance.

# The Kelleher Rotating Respirator

THE Kelleher Rotating Respirator is a development of the well-known Smith-Clarke "Alligator" Respirator. Although the mechanical breathing characteristics remain unaltered, it differs from the "alligator" in two very important respects; these are—

(*a*) With no interruption of his breathing, the patient can be turned from the supine to the prone position (or anywhere in between) by one person.

(*b*) Once in the prone position, manual access to the whole of the patient's back can be obtained by the nurse or physiotherapist, again without interruption of his breathing.

In order to do this, the cabinet of the "alligator" has been detached from its existing chassis and strengthened so as to carry a triangular frame extension at each end. Each extension terminates in a trunnion bearing which is supported in one of the raised ends of a long U-shaped tubular framework. This framework forms a cradle for the cabinet, which is thus free to rotate on the single bearing points at each end. In turn, the tubular frame is transversely attached to a modified chassis, which includes the tilting mechanism and which is mounted on four braked castors. Although the overall length is thus greater than the standard "alligator" respirator, the width is not increased and the machine is still highly manoeuvrable.

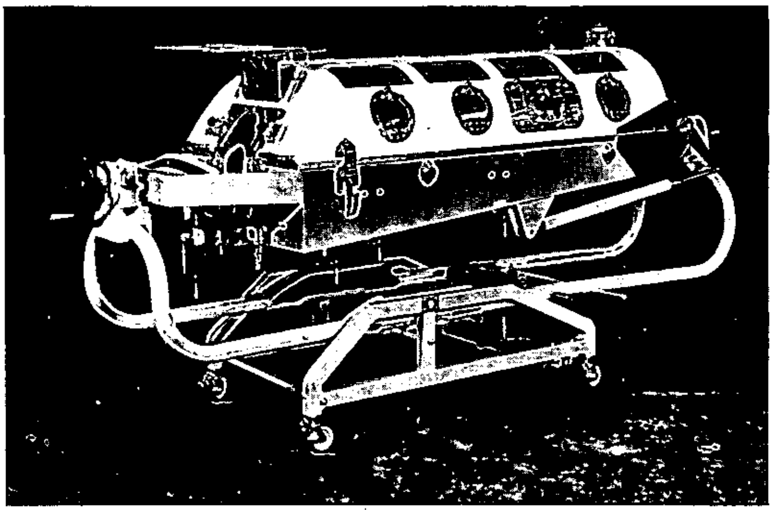
The rotating mechanism, which consists of a handwheel operated gearbox, is conveniently situated at the head end of the tubular frame; the operation is light and positive and the person turning the wheel can observe the patient throughout the manoeuvre. The cabinet can be turned through 180° from either left or right of the normal horizontal position but can only be returned through the arc that it has described. This arrangement is to simplify and safeguard the electrical connections to the cabinet. A scale, marked in degrees, indicates how far the respirator has been turned and a brake lever is located below the handwheel to the left, by means of which the cabinet can be securely locked in any position.

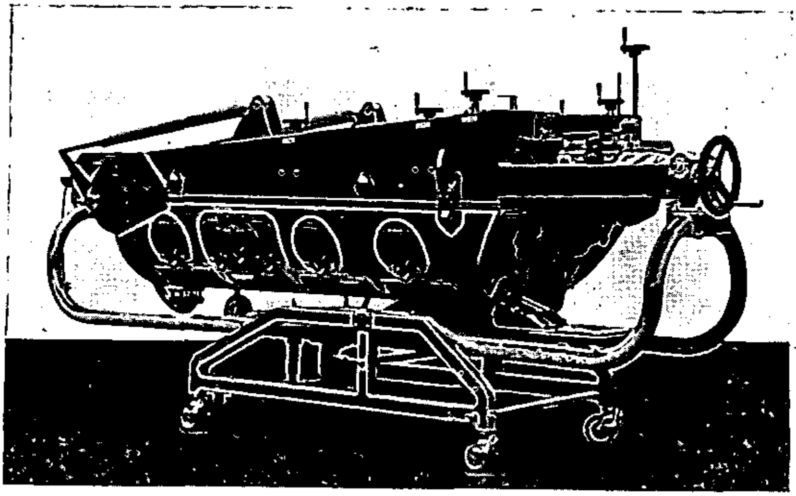
The airway between the pump and the cabinet is taken through the hollow centre of the trunnion bearing at the foot end; in this way, mechanical breathing is maintained throughout the operation of turning the patient.

Much attention was given to the method of stabilising the patient within the respirator, in the full realisation that, to be successfully turned, he must feel comfortably secure as well as be so. In the end, a form of cuirass was evolved, which when inverted and during inversion, gives support from the upper chest to below the knees. The cuirass is moulded in glass fibre and lined throughout with plastic foam; although very strong, this material does not give a feeling of complete rigidity and is sufficiently flexible to accommodate patients of differing builds. A section of the glass fibre (but not the foam) is cut away to expose the lower chest and upper abdomen; this eliminates any interference with the ventilation of the patient and no compensatory pressure adjustments have to be made when the cuirass is fitted.

When in position over the patient the cuirass rests on the mattress and encloses his arms, which

**A view of the Kelleher Rotating Respirator developed from the well-known Smith-Clarke "Alligator" Respirator by Cape Engineering.**





A view of the Respirator with the cabinet rotated through 180° so that the patient is maintained in the prone position.

are laid by his sides. (An alternative pattern excludes the arms, which are then anchored externally by wrist straps). The cuirass is held in position, and adjusted to the correct tension, by two broad straps which locate into guides and are permanently attached to the frame of the bed. These straps have non-slip, quick release fasteners of the type used on the safety belts of modern airliners.

A third strap suitably padded, passes over the ankles to secure the feet and the head is held in position by a moulded glass fibre half-helmet, lined with plastic foam. The helmet is secured to the frame of the headrest and is designed to give both frontal and lateral support. Alternatively, a plain padded strap may be used.

The underside of the cabinet (which becomes the topside when it is inverted) carries a hinged access panel with two standard armhole ports. It is secured by five lugs which are released by turning two centrally positioned handles through 90°. Once open, it hinges right back out of the way. Within the aperture revealed by the panel, a corresponding section of the bed frame can be removed by releasing two clamps, followed by a loose section of the mattress, and the whole of the patient's back is then exposed. With the panel closed, the back can be reached with the hands through the armholes; strong plastic sleeves with elastic cuffs are fitted on the inside of the armhole ports and these permit greater freedom of movement to the arms without loss of pressures within the cabinet. A flush-mounted pressure/vacuum gauge has been placed alongside the access panel.

Owing to the fact that the "alligator" (top) section of the cabinet is deeper than the lower section, the tilting control has a reduced range when the respirator is inverted. However, a tilt of nearly 15° can be obtained in the head down position when fully inverted. Since the tilting gear will operate throughout the arc of rotation, it is interesting to note that the patient can be put into a wide variety of positions, with or without the cuirass and without handling.

Synchronised positive pressure is available by facemask as and when necessary. The standard Smith-Clarke positive pressure attachment is located on the tubular frame just below the handwheel; it does not rotate with the cabinet and can be used irrespective of the position of the patient.

A refinement of great value to the shorter members of the staff is the provision of a hinged footplate on each side of the chassis, in line with the access panel and some 6 in. from the ground. When not required, these footplates fold flush with the chassis sides.

In all other respects the cabinet and fitting, alarm system and pump unit, are identical to the standard "alligator" respirator.

## NEW CATALOGUE OF ENGINEERS' BRASSWORK

A comprehensive reference catalogue describing fully the range of engineers' brasswork produced by Peglers Ltd. has just been published. It supersedes the last edition produced in 1954.

The fittings are listed under various sections—radiator fittings, globe valves, check valves, gate valves, plug and gland cocks, test and gauge cocks, etc.—and each is fully described, with dimensioned drawings and, in some cases, with sectional drawings.

The book is the most comprehensive of its type ever published by the company. To increase the reference value of the 142-page book a wealth of general data is also included, such as extracts from numerous British Standards, temperature and other conversion tables, a description of the metals used by Peglers in the production of the fittings, and an alphabetical index.

A restricted number of copies are available to engineers on application to Peglers Ltd., Prestex House, Marshalsea Road, London, S.E.1.

# B.S.I. News

*Abstracts of information supplied by the British Standards Institution*

## NEW BRITISH STANDARDS

B.S. 3243 : 1960 Hand-operated chain pulley blocks. 5/–

Applies to blocks with load chain to B.S. 3114 or to B.S. 1663, the latter chain being interchangeable as between different types of block. Specifies rating, factor of safety, materials, aspects of construction, aspects of load chain and hand chain and their associated wheels, guides, anchorage and other equipment. A declaration of effort and velocity ratio is required. A dynamic test is specified to one and a half times the safe working load with an additional optional static test twice the safe working load. Appendices cover ratings relating to conditions of service, effort relating to rating, technical information for the design of connecting links, recommendations relating to contracts, certificate of test and examination and safety recommendations.

## REVISED BRITISH STANDARDS

B.S. 204 : 1960 Glossary of terms used in telecommunication (including radio) and electronics. 35/–

Brings together into one volume all the terms previously dealt with by B.S. 204 and its supplements which were published from 1948 to 1951.

The terms have been resectionalised. Where necessary to take account of technical developments and changes in usage the definitions have been extensively revised and many new terms and definitions have been included. Notable additions are sections dealing with terminology for semiconductor devices, information theory and inductive co-ordination.

## REVIEWED AND PROPOSED FOR CONFIRMATION

B.S. 749 : 1952 Underfeed stokers (ram or screw type)

B.S. 2619 : 1955 Method of test and rating for steam-heated air-heater batteries

## AMENDMENT SLIPS

*Please order amendment slips by quoting the reference number (P.D....) and not the B.S. number.*

| | *Ref. No.* |
|---|---|
| B.S. 12 : 1958 Portland cement (ordinary and rapid-hardening). Amendment No. 1 | PD 3729 |
| B.S. 91 : 1954 Electrical cable soldering sockets. Amendment No. 2 | PD 3747 |
| B.S. 215 : —— Part 1 : 1956 Aluminium conductors for overhead power transmission purposes. Amendment No. 1 | PD 3751 |
| Part 2 : 1956 Steel-cored aluminium conductors for overhead power transmission purposes. Amendment No. 1 | PD 3752 |
| B.S. 555 : 1939 Tungsten filament miscellaneous electric lamps. Amendment No. 9 | PD 3716 |
| B.S. 825 : 1949 Mild steel shackles. Amendment No. 5 | PD 3735 |
| B.S. 1010 : 1959 Draw-off taps and stop-valves for water services. Amendment No. 2 | PD 3739 |
| B.S. 2653 : 1955 Protective clothing for welders. Amendment No. 1 | PD 3726 |
| B.S. 2655 : —— Electric lifts | |
| Part 1 : 1958 General requirements. Amendment No. 2 | PD 3722 |
| Part 2 : 1959 Single-speed polyphase induction motors for driving lifts. Amendment No. 2 | PD 3723 |
| B.S. 2746 : 1956 P.V.C. insulation and sheath of electric cables. Amendment No. 2 | PD 3731 |
| B.S. 2848 : 1957 Flexible insulating sleeving for electrical purposes. Amendment No. 1 | PD 3748 |
| B.S. 3016 : —— Pressure regulators for use with butane/propane gases | |
| Part 1 : 1958 Low-pressure regulators for use with butane gas. Amendment No. 2 | PD 3764 |
| B.S. 3208 : 1960 Methods of test and rating for hot-water air-heater batteries. Amendment No. 1 | PD 3737 |

## STANDARDS WITHDRAWN

B.S. 735 : 1944 Sampling and analysis of coal and coke for performance and efficiency tests on industrial plant

B.S. 878 : 1939 Code for comparative commercial tests of coal or coke and appliances in small steam raising plants

The essential provisions of B.S. 878 will be incorporated in the revision of B.S. 845.

B.S. 1785 : 1951 Thermal insulating materials for buildings

The subject matter of this standard is now out of date. It will be replaced in due course.

## NEW WORK STARTED

Dimensions of fractional horsepower motors (revision of B.S. 2048)

For the revision of the standard, three new frames are being considered, in addition to the present series, which will extend the range downwards. It is not proposed to introduce a specific relationship between frame sizes and motor output.

Recessed double-contact lamp-caps and lampholders for tubular fluorescent lamps

This standard will specify principal dimensions for recessed double-contact lamp-caps and lampholders for use with tubular fluorescent lamps. It is being prepared to take account of the references to this cap which are now included in the revisions of B.S. 1270 and B.S. 1853.

Reactive meters

Applies to polyphase motor-type meters which register in kVArh or MVArh.

Electrical protective systems

The work relates to the performance and testing of complete electrical protective systems for the protection of electrical plant and equipment against damage from abnormal conditions in service.

The standard will not deal with protective relays and instrument transformers which are dealt with in other B.S.I. Committees.

## REPRINTS

*B.S. 7 : 1953 Rubber-insulated cables and flexible cords for electric power and lighting. 12/–

*B.S. 138: 1948 Portable fire extinguishers of the water type (soda acid). 6/–

*B.S. 587 : 1957 Motor starters and controllers. 8/–

*B.S. 593 : 1954 Laboratory thermometers. 5/–

*B.S. 613 : 1955 Components and filter units for radio interference suppression. 7/–

*B.S. 781: 1950 Wrought iron chain slings, and rings, links alternative to rings, egg links and intermediate links. 8/6

*B.S. 826 : 1955 Adjustable steel shelving (angle post type). 8/6

*B.S. 938 : 1955 General requirements for the metal-arc welding of weldable structural tubes. 4/6

*B.S. 1567: 1953 Wood door frames and linings. 5/-

*B.S. 2004: 1955 Polyvinyl chloride insulated cables and flexible cords for electric power and lighting. 7/-

*B.S. 2788 : 1956 Fireguards for solid fuel fires. 2/6

*CP 327.102 : 1952 Telephones and telegraphs—private services. 8/6

Reprints marked * have had amendments incorporated in the text of the standard.

## DRAFT STANDARDS CIRCULATED FOR COMMENT

A(SFE)7717 Measurement of air pollution deposit gauges (revision of B.S. 1747). [11 pp.]

A(WOT)7241 Blankets for hospitals and local authorities (revision of B.S. 1681). [10 pp.]

A(SFE)7324 Large incinerators for the destruction of hospital waste. [12 pp.]

A(CHE)7355 Oil burning equipment (revision of B.S. 799 : 1953). [60 pp.]

A(BLCP)7609 Code of Practice for galvanized corrugated steel sheet roofing and siding for buildings. [24 pp.]

A(SGC)7974 Anaesthetic breathing bags made of anti-static rubber. [5 pp.]

A(CEB)8122 Ready-mixed concrete (revision of B.S. 1926). [9 pp.]

A(MECP)8240 Code of practice on domestic space heating by means of independent gas appliances (revision of CP 332.301 : 1947). [28 pp.]

### INSTRUMENT TABLES FOR USE IN HOSPITAL OPERATING THEATRES AND DRESSINGS TROLLEYS

Quicker reference to subject matter, access to data that have been brought thoroughly up-to-date—these advantages will accrue to purchasers and suppliers of hospital equipment now that B.S.I. has issued separately three specifications that were originally contained in one volume.

The standard that has been revised and "split into three" is B.S. 1938, "Instrument tables and anaesthetists' trolleys for use in hospital operating theatres, and dressings trolleys for use in wards." Its subject matter is now available in the following British Standards:

| | | |
|---|---|---|
| Instrument tables | ... B.S. 1938 | now available and |
| Dressings trolleys | ... B.S. 3236 | synopsised below. |
| General purpose trolleys for anaesthetists' use ... | B.S. 3112 (published 1959) | |

All three revised publications are based on the recommendations of the Hospital Equipment Standards Advisory Committee.

*B.S. 1938*, "*Instrument tables for use in hospital operating theatres*" provides for tables of two shapes: rectangular (4 sizes) and curved (2 sizes). It takes account of present-day requirements for finishes, design of framework, and electrical resistance of the tyres. The castor tyres are required to be of anti-static rubber tested in accordance with B.S. 2050. The range of materials permissible for the shelves has been extended to allow for the use of plastics.

The standard contains an appendix listing information which should accompany a purchaser's order or request for a quotation. The publication concludes with eight line diagrams of various types of trolley.

*B.S. 3236*, "*Dressings trolleys*" also reflects contemporary requirements for finish, general design, manufacture, and electrical safety. It provides for trolleys with shelf lengths rising in six-inch steps from 18 inches up to 24 inches.

The framework of the trolleys is of tubular steel: and plastics is one of several materials from which the shelves may be made.

The trolleys are suitable for use in either operating theatres or wards.

### CODES OF PRACTICE ON ROOF COVERINGS

**C.P. 143, Part 3: Lead roof coverings**

**C.P. 143, Part 4: Copper roof coverings**

Two extremely useful additions to the growing list of Codes of Practice for the building industry have just been published by the British Standards Institution. C.P. 143, Part 3 deals with lead roof coverings; and C.P. 143, Part 4 (a revision of C.P. 143.104 : 1951) with copper roof coverings. Both volumes are, of course, the work of two of B.S.I.'s many committees of experts.

*C.P. 143, Part 3* (31 pp., illustrated) deals with methods of covering a roof with lead sheet in accordance with established practice.

For pitched and flat roofs, this new publication provides comprehensive guidance on all coverings above the constructional base. Flashings and gutters are also dealt with in so far as they are integral parts of the roof coverings.

The design considerations deal with the types of sub-base over which lead coverings may be laid, the method of jointing on pitched and flat roofs, and the treatment of special features.

The section on laying techniques provides details of the wood-roll and the hollow-roll systems; the use of drips, laps and welts; and the treatment of intersections, abutments, eaves, hips and ridges.

The text is amplified by 17 diagrams.

An appendix to the code contains a table of weights and equivalent thicknesses, and details of the physical properties of the lead sheet.

*C.P. 143, Part 4* (illustrated) deals with methods of covering a roof with copper sheet or strip in accordance with established practice.

For pitched and flat roofs this revised code provides recommendations on all the coverings above the constructional base. Flashings and gutters are also dealt with in so far as these are integral parts of the roof covering.

The Code contains detailed information on the selection of sheeting, the laying techniques, and the preparatory work entailed for both the standing seam and the wood roll methods.

Particular attention is given to the weathering of the edges and hips; the incorporation of drips in standing seam and common roll systems; the use of double-lock welts; and finish at the eaves. These details are fully illustrated in the accompanying 20 diagrams.

The Code concludes with appendices containing tables for "Gauges, thicknesses and weights of copper sheet" and "Dimensional details for copper gutters," and there are some useful data on the properties of copper.

# On the Market

*A review of new equipment and materials and their development*

## NEW HAND TACHOMETER, MODEL ATH.24

Following the success of the four models in the Smiths Hand Tachometer range, production of a fifth model is now announced.

The new model has a range of 0-400, 0-2,000 and 0-4,000 r.p.m. The dial is calibrated with a dual scale—black figures on white—the outer scale 0-2,000 r.p.m. and the inner 0-400 r.p.m. As with the other models, the set comprises: Hand Tachometer; Male Rubber Centre; Female Rubber Centre; Extension Piece; Disc for surface and cutting speeds (feet or metre reading); and a robust case.

With this equipment, accurate checks can be made on rotational speeds, linear speeds and surface speeds. Indication is instantaneous, the instrument is not damaged by sudden acceleration, and when desired, a pointer lock device holds the reading.

The makers claim that these Hand Tachometers indicate r.p.m. or surface speeds—to an accuracy of $\pm\frac{1}{2}\%$, and are completely unaffected by position, humidity, or wide ranges of temperature.

Further details from Smiths Industrial Instruments, Chronos Works, North Circular Road, London, N.W.2.

## COOL HIGH INTENSITY BENCH LIGHT

Designed around the new miniature 12″ fluorescent tubes is a recently marketed sturdily built local lighting unit, known as the "Allen" Type A.90, by P. W. Allen & Co., 253, Liverpool Road, London, N.1.

The use of miniature fluorescent tubes has many advantages for local lighting amongst which are bright "white" light without heat, shadow or glare, and long tube life with extremely low current consumption.

The metal reflector housing two 12″ 8 watt miniature fluorescent tubes is connected to the main body by means of a 12″ stayput flexible tube and a swivel joint. This makes the reflector adjustable for height and it will swivel and tilt without heavy friction or the need of locking devices.

The control gear is contained in the body and two alternative bases are available for either fixed or universal use.

The A.90 Bench Light is strongly made in steel and is well finished in silver grey hammer stove enamel with bright chrome tubing.

Total consumption is only 20W. with a light output equivalent to 70W. of tungsten lighting. The mains cable is 8 feet long, of 3 core super flexible PVC. There are models from £8, including tubes.

## NEW FLUORESCENT FITTINGS

**Troughton & Young (Lighting) Limited** have added two new surface fittings to their range of "Tubalux" fluorescent fittings. T435 is designed for one 4′40W tube and T535 for one 5′80W tube. Both have metalwork finished stove enamelled white with diffuser in moulded opal "Perspex" which lifts out for access.

Prices:— T435 £12 5s. 0d. + £1 17s. 3d. P.T. T535 £13 12s. 0d. + £2 0s. 6d. P.T. Switchless start (Polyester filling) T435Q £13 5s. 0d. + £1 17s. 3d. P.T. T535Q £14 17s. 0d. + £2 0s. 6d. P.T.

## NEW METRICON PUMP

Many interesting features are incorporated in the Metricon type W pump, manufactured by **Metering Pumps Ltd.**, Ealing.

The pumps, of which there are 12 standard models, are of the reciprocating type and are designed for adding solutions at a constant rate. All the pumps have a fixed stroke length of 2¼ ins. Typical uses are for pumping clear corrosive liquid, alkaline suspensions, and boiler feed conditioning reagents.

Pump heads are of the ram type and rams are supplied in several diameters; either one (simplex) or two (duplex) heads may be fitted to the gear box. Suctions and deliveries of the heads can either be made together to give a greater capacity or operated separately for handling different solutions. Two solutions can thus be added in a fixed ratio by selecting pump heads with rams of different diameters. If a head which will give the exact ratio needed is not available, the strength of one of the solutions may often be varied.

Capacities of the type W pumps, at a nominal fixed output of 72 s.p.m., vary from 40 to 520 gallons per hour (simplex), and from 80 to 1,040 gallons per hour (duplex). Maximum working pressures vary from 250 to 3,000 lbs./sq. in. Reduction gears can be incorporated to give a slower stroking speed from 72 s.p.m. if required.

Pump stroking speed can be varied manually by a variable speed gear; automatic variation of speed can also be provided. A further feature of interest is that the pump may be supplied with a time switch which stops the motor after a pre-determined period. Restarting may be carried out either manually or automatically after a pre-set number of hours have elapsed. This feature is particularly *useful for the automatic "slug" feeding of* phosphate to boiler drums.

The pump, motor and reduction gears are mounted together on a bed plate and have pin-type flexible couplings.

Gears are totally enclosed and need no external lubrication and crankshaft and bearing surfaces are of ample size so that the unit will give long and continuous service with a minimum of maintenance.

Various suction and delivery valves are available for use with the various pumping heads.

Rams are completely guided and supported in the gear box fixing; they do not depend upon any part of the pump head for their alignment and it is therefore possible to use such materials as 18/8 stainless steel for all parts of the pump head.

The type of connector used depends upon the size of the pump and the pressure at which the pump will be working. It can be screwed, flanged or *consist of a compression joint.*

## NEW AUTOMATIC ELECTRIC STERILISERS

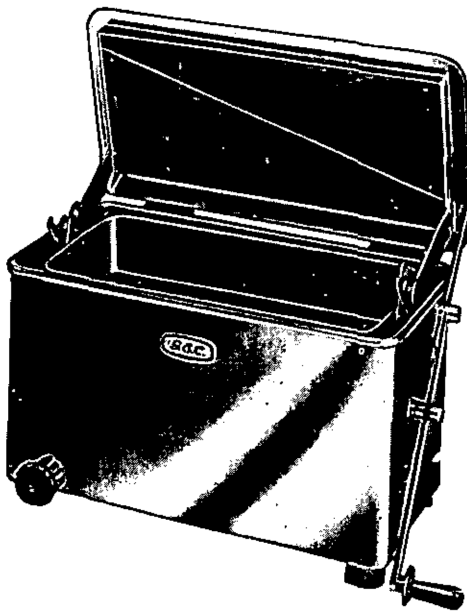
A new range of portable instrument sterilisers introduced by **The General Electric Co. Ltd.** incorporates thermostatic control, a feature previously confined to larger units. One advantage of this control is that although a high load is employed to reduce the preheating time to a minimum, the thermostat operating in a vapour tube ensures that only sufficient current (as little as 15% of the full load) is used to maintain temperature once boiling point has been reached. Another advantage is that no excess steam is produced to damage surroundings. Since little evaporation takes place, the steriliser may safely be left unattended throughout long periods of sterilisation.

The opening mechanism of the new sterilisers consists of a single action lever which opens the lid and lifts the instrument tray in one operation. At the same time it locks them in the open position. A draw off tap is fitted *at the front of each steriliser.*

The bodies are constructed of heavy gauge copper with the interiors dull nickel-plated and exteriors chromium plated. Each unit is fitted with a sheathed wire immersion heater, incorporating a water low-level cut-out with reset button. A protective perforated copper shield is fitted over the element.

Fittings provided with each unit include a perforated copper instrument tray, a pair of steel lifters and 3 ft. of white plastic cable.

The four units in the range are: (1) the HO5480 with a $1\frac{1}{2}$ kW loading, a sterilising space of 11 in. × $5\frac{1}{2}$ in. × 4 in. deep, an approximate boiling time of 28 minutes, and a price of £35. (2) the HO5401 with a 2 kW loading, a sterilising space of 14 in. × $6\frac{1}{2}$ in. × 5 in. deep, an approximate boiling time of 30 minutes, and a price of £40.




**New thermostatically controlled instrument steriliser by G.E.C. which has a single action lever that raises the lid and simultaneously lifts the instrument tray.**

(3) the HO5402 with a 3 kW loading, a sterilising space of 17 in. × 8 in. × 6 in. deep, an approximate boiling time of 30 minutes and a price of £52. (4) the HO5403 with a 4 kW loading, a sterilising space of 20 in. × 10 in. × 7 in. deep, an approximate boiling time of 40 minutes and a price of £72.

## CORRENDA "CONTINUOUS TILING"

**Corrosion Ltd.**, of Shirley, Southampton, announce an important development in connection with their Correnda "continuous tiling" system for walls and ceilings.

Hitherto the application of Correnda has been confined to their own contracting division. Recent modifications in the materials have much simplified its application, and it is now suitable for application by any qualified tradesman.

The materials comprised in the system as hitherto supplied have included the special render material, as well as the essential plastic bonding agent and the sprayed plastic finishing skin. The plastic bonding agent has now been modified so as to enable it to be added to any hardwall plaster, e.g., Keene's cement, which it considerably upgrades in respect of adhesion, hardness, flexibility and resistance to humidity. Additionally, the plastic finish to the system has been modified so as to be applicable by brushing as well as by spraying.

The Correnda unit is now therefore supplied without the special render material previously included in the unit. Each unit, however, still contains enough of the plastic bonding agent and of the plastic finishing skin to cover *20 square yards at $\frac{1}{8}$-in. thick.*

These modifications have not only vastly widened the scope of the application of the system, but has also reduced its cost. Normal trade discounts are available.

Detailed technical literature is available free on request.

# Notes for Members

*News of I.H.E. activities, etc., and items of interest from Branches*

## OBITUARY

### Mr. J. W. Crichton

We regret to announce the death of Mr. James Wilson Crichton, after a long illness, at the early age of fifty-two.

Mr. Crichton served an apprenticeship with James F. Low & Co., Monifieth. He went to sea in the Shaw Savill Line in 1935 and served throughout the last war during which he was twice torpedoed. He left the sea after ten years and was employed in the Engineering Department of Dundee Town Council before taking the post of Senior Engineer at Ashludie Chest Hospital, Monifieth, Angus, where he was serving when he died.

Having been elected an Associate Member of the Institution in 1953, Mr. Crichton took an active part in the affairs of the Mid-Scotland Branch of which he was a popular member. He will be sadly missed.

## THE SCOTTISH WEEKEND SCHOOL

We have got into trouble from several quarters north of the Border for various inaccuracies and mis-spellings in regard to the announcement contained in our July issue concerning the forthcoming Weekend School at Ailsa Hospital, near Ayr. As a mere Sassenach the Editor can do no more than accept full responsibility and offer his apologies to Scottish readers. He will now endeavour to make amends for his shortcomings!

Firstly, the venue is Ailsa Hospital, near Ayr. Secondly, the event is being organised by the Scottish Branches jointly and not as previously stated.

It is hoped that some members will wish to bring their wives and, if sufficient do, a coach tour will be arranged for them.

Members requiring accommodation in Ayr should contact Mr. R. H. Smith, Superintendent Engineer, The Bungalow, Ailsa Hospital, Ayr, who has kindly offered to make the necessary arrangements.

The registration fee for the School will be 10s. and appropriate forms can be obtained from Mr. J. Panton, 8, Bellefield Avenue, Dundee.

The programme will be as follows:—

**Friday, 16th September**

Official Welcome by the Medical Superintendent, Dr. H. J. B. Miller, B.Sc., M.B., Ch.B., D.P.M., and the Group Secretary and Treasurer, Mr. J. Manson, F.H.A. 9.45 a.m.–12 noon.

SESSION I

" Electrical Services in a Hospital " by J. K. Clark, Regional Engineer's Department, Western Regional Hospital Board.. Illustrated.

Chairman: R. H. Smith, Esq.

SESSION II

" Boiler House Instrumentation " by a representative of Messrs. Kelvin & Hughes.

Chairman: W. Guthrie, Esq. 2 p.m.–4 p.m.

**Saturday, 17th September**

SESSION III

" Organisation and Administration in Scottish Hospitals " by A. A. McIver, Esq., C.A., F.H.A., Secretary and Treasurer, Glasgow Royal Infirmary and Associated Hospitals.

Chairman: H. Adams, Esq., Chairman of the I.H.E. 10 a.m.–12 noon.

SESSION IV

" Some Factors for Maintaining Efficiency on Boiler Plant " by F. M. McLean, Esq., A.M.I.Mech.E., M.Inst.F.

Chairman: J. Crawford, Esq. 2 p.m.–4 p.m.

**Sunday, 18th September**

SESSION V

" Technical Forum."

Chairman: H. Taylor, Esq. 10 a.m.–12 noon.

## LONDON BRANCH LADIES' FESTIVAL

The Eighth Annual Ladies' Festival to be held by the London Branch will take place on Friday, 30th September next at the Hotel Rembrandt, London, S.W.7.

This happy affair, which seems to go from strength to strength, will follow the usual pattern of dinner, cabaret and dancing afterwards to the hotel orchestra.

Tickets, at £2 each, can be obtained from the London Branch Hon. Social Secretary, Mr. W. M. Woolsey, 50, Merewood Road, Barnhurst, Kent.

## EAST MIDLANDS BRANCH

A Meeting of the Branch was held at Ransome Sanatorium, Mansfield, on 16th July.

By arrangement with The Medical Supply Association, Mr. Van der Helm, a consultant of the Amsco-Europ Organisation read an interesting paper on the subject of sterilisation.

Mr. Van der Helm gave detailed descriptions of current Continental techniques and covered the basic design and personnel required for theatres, milk rooms and central supply departments. Various methods of drum, paper and muslin packings were described, together with the cleaning and sterilisation techniques for dressings, instruments and fluids. Gas sterilisation by the Ethylone Oxide process, together with the pre-requisite conditions for reliable results, were described.

Although the various processes covered were largely similar to those used in this country it was interesting to note that infra-red sterilisation did not find favour on the Continent.

The Speaker answered many questions from a most appreciative audience of Medical, Nursing, Pharmaceutical, Administrative and Engineering Officers.

Following a tea interval the domestic business of the Branch was carried out and the various items of minutes, correspondence, and membership, together with the Hon. Secretary's report of the Harrogate Council and Annual General Meeting, were considered.

There was considerable discussion on Branch procedure, and it was ultimately decided that for the next year only matters of technical interest would appear on the Agenda of Branch meetings.

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## MIDLANDS BRANCH

The Branch held a meeting at Powick Hospital, near Worcester on July 30th. This being also the Branch " Ladies' Day," Members' wives were welcomed to this beautifully sited hospital. The visitors were greeted by the Deputy Medical Officer and Deputy Matron, and the ladies made a tour of the hospital while the meeting was in progress.

Dr. L. H. Cobb of Imperial Chemical Industries gave a paper—"The Use of Plastics in Engineering." The paper was supported by slides and a film. After this Members joined the ladies for tea in the hospital canteen.

Various business matters were discussed when the meeting re-assembled and the following programme for 1961 was agreed:—

| | |
|---|---|
| January 28th | Sutton Coldfield |
| March 25th | Stratford-on-Avon |
| May 27th | Oxford |
| July 29th | Banbury |
| September 30th | Powick |
| November 25th | West Bromwich |

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Mr. Peter Scott, Senior Engineer at Murray Royal Hospital, Perth, has been appointed Superintendent Engineer to the Lanarkshire Mental Hospitals Group.

Mr. J. E. M. Carroll has been appointed Senior Engineer at St. Mathew's Hospital, London, N.1. He was formerly Assistant Engineer at German Hospital, E.8.

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Mr. J. Reddy, Assistant Engineer-in-Charge, New Hall Hospital, Scarisbrick, Southport, has been appointed Senior Engineer, Deanhouse Hospital, near Huddersfield.

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Mr. D. C. Gunn, B.Sc.(Eng.), M.Sc., Assoc. Inst. Mech.E., M.Inst.F., has been appointed as Chief Engineer to Cochran & Co., Annan, Ltd. The appointment has already taken effect.

Mr. Gunn was formerly Deputy Director of The British Coal Utilisation Research Association.

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The Lead Development Association announce that Mr. S. A. Hiscock, M.Sc., A.I.M., D.C.T. (Batt.) joined the staff on May 1st. Mr. Hiscock comes from Enfield Cables Ltd., and will be principally engaged in duties associated with developments in the use of lead in the cable industry.

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## HOSPITAL STOKER AWARDED £782

Damages of £782 7s. 7d. were awarded at Leeds Assizes on July 6th to a 35-year-old Bradford Hospital Stoker who had the index finger of his right hand amputated after his hand and arm were dragged into a conveyor belt that he was cleaning at Bradford Royal Infirmary. The award was made against Bradford A Group H.M.C.

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## CURRENT PRACTICE IN FUEL EFFICIENCY

N.I.F.E.S. Annual Refresher Course is firmly established as the opportunity for Works Managers, Works and Plant Engineers and members of the technical staffs of industrial firms and Municipal and Public Undertakings to acquire up-to-date information and guidance on the economic use of fuel—so vital to increased efficiency and productivity.

The Seventh Annual Residential Refresher Course will be held at the Clarendon Laboratory, Oxford from 26th to 30th September, 1960. This Course covers a wide range of subjects and each of the Lectures is presented by a speaker eminent in the special field to be covered and who will pay particular attention to practical application.

Included in the subjects will be:—

Coal and the Industrial Consumer.
Role of the Central Engineering Workshop in the Maintenance Plan.
Oil Burning Efficiency.
The Efficient Use of Gas in Industry.
Recovery and Use of Waste Heat in Industry.
Improvement of Electrical Load Factor.
Automation and its Impact on the Plant Engineer.
Factors affecting the choice of Industrial Boiler Plant.
Efficiency in Drying Processes.
Industrial Application of Low Temperatures.
The Value of Instruments and Automatic Control.
Conservation of Water.

The Efficient Use of Compressed Air.
Appraisal of Atomic Energy in relation to Industry.
Incineration and Utilisation of Waste Materials.
Five Years Progress in Fuel Utilisation.

The Fee for the Course including accommodation is £15 15s., and full details may be obtained from the Course Secretary, N.I.F.E.S., Ailsa House, 181, King's Road, Reading, Berks.

## SMALL BORE HEATING SYSTEMS

Small bore heating—*not* only intended for members of the Midgets' Club—is not just fashionable: it is more and more proving its worth. Walker, Crosweller of Cheltenham announce the issue of a pamphlet describing in simple and comprehensive terms an ideal method of temperature control for this system. To quote one extract:

"... there remains the questionable, but rarely questioned validity of strict room temperature control: whether, first, it is worth aiming at an accuracy of input temperature almost beyond the limits of human perceptibility: and whether, in a room where people and air move, doors open and shut, such accuracy is achieved."

## ELCONTROL DEVELOPMENTS

Following a very successful trading year in 1959, in which total output increased by approximately 30% over 1958, Elcontrol announce a number of items of interest regarding future developments:—

(1) A factory extension has just been completed to their works at Hitchin, which provides substantially increased Machine Shop facilities and at the same time enables much needed expansion to take place in the Electronic Assembly Departments.

(2) A number of appointments have been made to the staff of the Technical Department, in connection with a new programme of product development which is now taking shape.

(3) A new Special Products Division has been formed which brings under one control the design, production and application development sections for dealing with customers' individual requirements.

This new Division, under Mr. G. S. Potter, supplements the existing Divisions for dealing with the five principal types of equipment produced by Elcontrol, i.e. level control, photo-electric control, process timers and programmers, flame failure and burner control, and automatic weight control.

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(*Continued from page A.22*)

## ENGINEER (TECHNICAL WORKS): MINISTRY OF HEALTH

**Pensionable post in London for man at least 30 on 1.9.60 for duties concerned with pricing and cost analysis of mechanical and electrical engineering services in buildings. Qualifications: apprenticeship and good experience in mechanical/electrical installation and maintenance work; technical qualifications of H.N.C. standard normally expected. Applicants must be familiar with contract conditions. Salary scale £1,375-£1,589. Write Civil Service Commission, 17, North Audley Street, London, W.1, for application form, quoting S/5199/60. Closing date 20th October, 1960.**

(*Continued on page 192*)

## LEEDS (A) GROUP HOSPITAL MANAGEMENT COMMITTEE WORKS DEPARTMENT

Applications are invited for the post of WORKS ASSISTANT in the Superintendent Engineer's Department.

Applicants should hold or be studying for the Ordinary National Certificate.

The post is a junior one and the duties involve making simple drawings and tracings, assistance in the preparation of specifications and estimates of costs; keeping records and returns of fuel, lighting and water consumption, inventories and plant inspections.

Salary in accordance with the appropriate Whitley Council Scale: at 21 years £415; at 22, £435; at 23, £455; at 24, £475; at 25, £500; at 26 years and over, £525 × 25 (4) —£625.

Applications stating age, training and experience, together with the names of three persons to whom reference may be made, should be forwarded to the Secretary of the Committee, Administrative Offices, St. James's Hospital, Leeds 9, not later than 26th September, 1960.

## THE ROYAL WESTERN COUNTIES HOSPITAL GROUP EXECUTIVE OFFICES, STARCROSS, DEVON

Applications invited for appointment of SUPERINTENDENT ENGINEER. This group appointment covers full range of mechanical and electrical engineering duties and the maintenance of services at the central and branch hospitals. Candidates must have passed an examination in engineering technology and hold one of the following qualifications:—

- First Class Certificate of Competency in Marine Engineering or equivalent Naval Certificate.
- City and Guilds full Technological Certificate in Plant Engineering (first class) from 1957.
- Higher National Certificate/Diploma in Mechanical Engineering, with heat, heat engines and electrical apparatus.

Experience in a large hospital or hospital group is desirable. Salary on scale covering higher responsibilities as defined by P.T.B. circular, £1,130 × £35 (2) × £40 (2) × £45 (1)—£1,325.

Applications must be accompanied by full details of experience and qualifications, together with the names and addresses of three referees, and sent to the Group Secretary not later than 19th September, 1960.

## DARLINGTON DISTRICT HOSPITAL MANAGEMENT COMMITTEE

### SUPERINTENDENT ENGINEER FOR GROUP

Applications are invited for the above appointment. Salary £865 × £25 (2) × £30 (3)—£1,005. Conditions of service as laid down in National Health Service Regulations. Appointment subject to satisfactory medical examination. A small house will be available at a reasonable rental.

Applications will only be considered from candidates who satisfy the following conditions, and who possess one of the qualifications listed or an approved equivalent qualification.

Candidates must have had a thorough practical engineering training with wide experience in a supervisory position of such types of mechanical and electrical engineering services as are found in institutions and as are appropriate to the responsibilities of the post.

Qualifications:

- Ministry of Transport and Civil Aviation (ex Board of Trade) First Class Certificate of Competency in Marine Engineering.
- Ministry of Transport and Civil Aviation Certificate of Service as First Class Engineer.
- City and Guilds full Technological Certificate in Plant Engineering (First Class).

Applications with full particulars, together with names and addresses of three referees, should be sent to the Group Secretary, Memorial Hospital, Darlington, by the 16th September, 1960.

## MARSTON GREEN MATERNITY HOSPITAL, BERWICKS LANE, MARSTON GREEN, NEAR BIRMINGHAM.

ASSISTANT ENGINEER required. Applicants must have completed an Apprenticeship in mechanical engineering and have sound knowledge of the principles and practice of hospital boiler plant, engineering and electrical services generally. Preference will be given to candidate who has studied for the Ordinary National Certificate or its equivalent. Salary £570 rising to £700 p.a. Post permanent and superannuable. Applications, giving full details and naming three referees, to Hospital Secretary within seven days.

## HOSPITAL ELECTRICIAN

Required by KENYA GOVERNMENT, Ministry of Works, for appointment as Inspector of Works on probation for two years with prospects of permanent and pensionable employment. Commencing salary according to experience in scale (including Inducement Pay) rising to £1,173 a year. Outfit Allowance £40. Free passages. Liberal leave on full salary after each tour of 24/45 months.

Candidates should not be over 45 years of age and must have at least 3 years practical experience of the maintenance of electrical equipment, steam autoclaves, sterilizers and other hospital fittings. Write to the CROWN AGENTS, 4, Millbank, London, S.W.1. State age, name in block letters, qualifications and experience and quote M2A/50740/HR.

## PONTEFRACT AND CASTLEFORD HOSPITAL MANAGEMENT COMMITTEE

SENIOR ENGINEER required for hospitals in the Hemsworth Sub-Group. Candidates must have a wide experience of mechanical and electrical engineering services including a sound knowledge of steam boiler plant operation and hold a recognised qualification, i.e. First Class Certificate of Competency in Marine Engineering or Certificate of Service as First Class Engineer or First Class City and Guilds full Technological Certificate in Plant Engineering or equivalent qualification. Salary scale— £715 × £25 (2) × £30 (3) to £855. Applications, stating age, experience, qualifications and names and addresses of two referees to the Group Secretary, Great Northern House, Salter Row, Pontefract, Yorkshire, as soon as possible.

# MISCELLANEOUS

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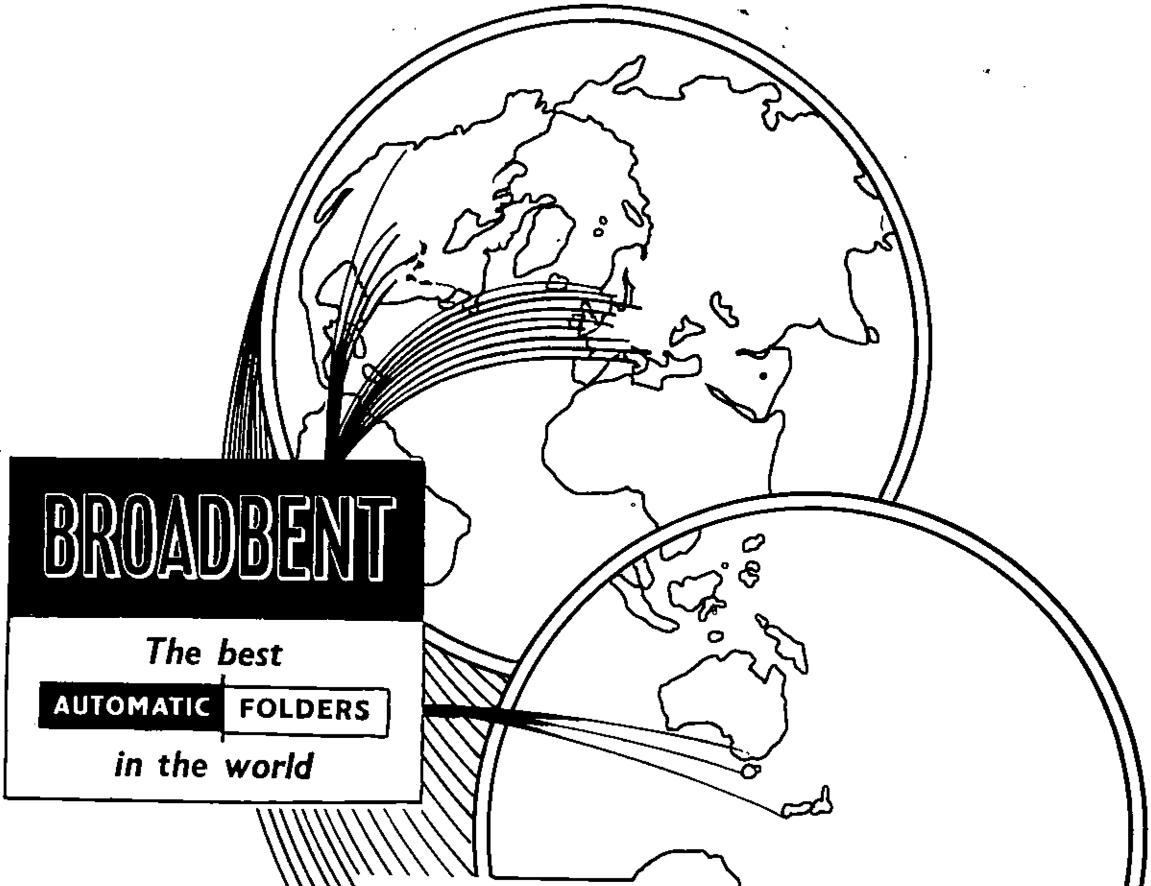


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