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The Irish Plumber and Heating Contractor, June 1961 (complete issue)

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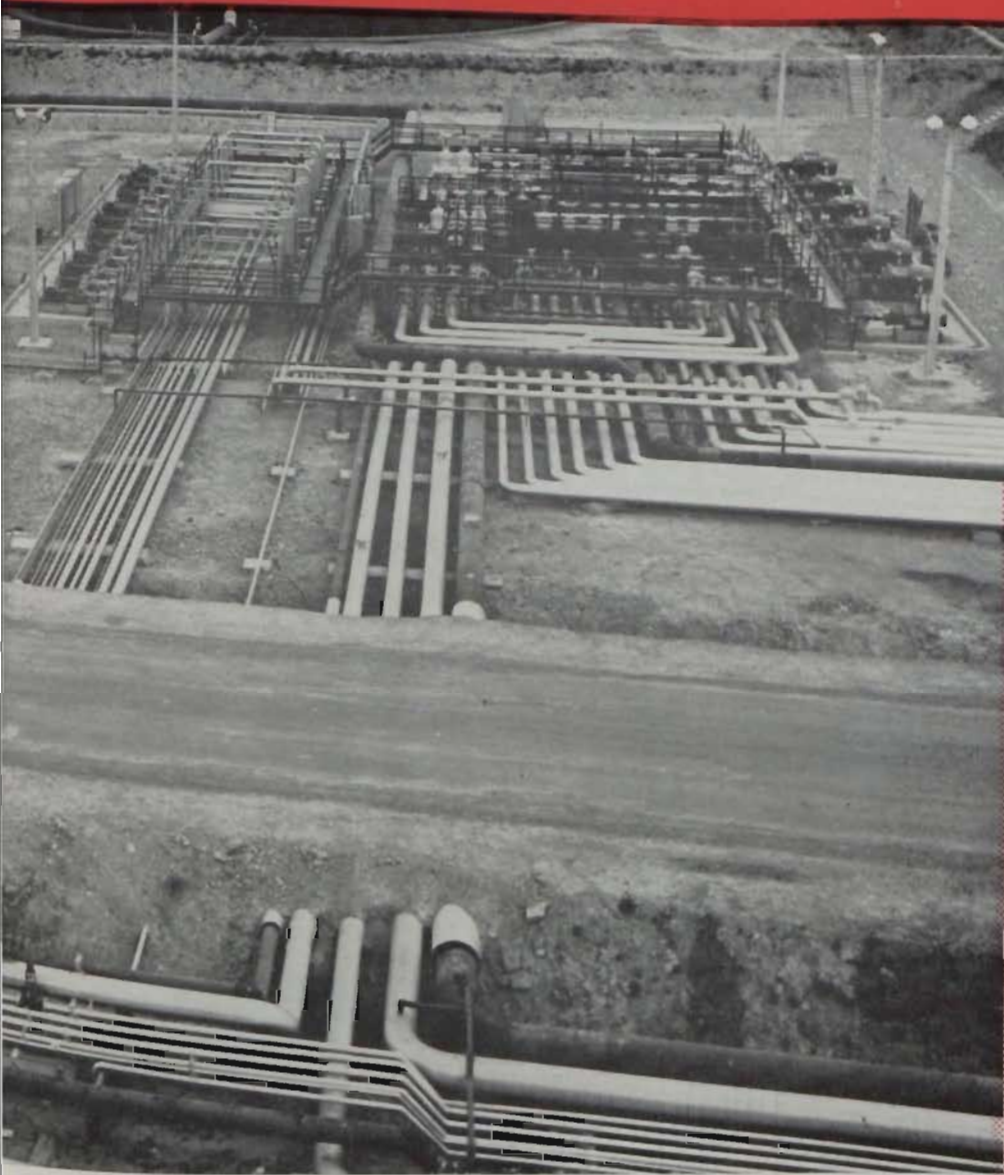
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THE IRISH PLUMBER & HEATING CONTRACTOR



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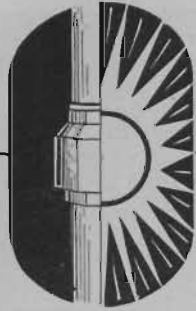
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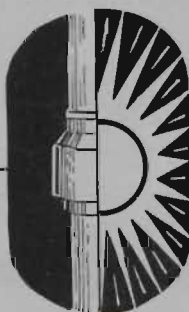
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JUNE, 1961.



THE IRISH PLUMBER & HEATING CONTRACTOR

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1 PHC/1



the atmosphere

Composition of air

Properties of air

Atmospheric corrosion

Protective coatings applied to metals

THE atmosphere is a zone of air which envelops the earth, and extends for many miles above its surface. At high altitudes the atmosphere becomes rarified or "thin," and its pressure becomes less, so that high-flying aircraft have to be fitted with artificially pressurised cabins in order that passengers and crew should have air conditions near those to which they are accustomed on earth.

The Composition of Air.—Air is a mixture of gases, and for our purpose the average composition of air may be taken to be as follows:—

Nitrogen	78.09
Oxygen	20.94
Argon	0.94
Carbon dioxide ..	0.03

100.00%

Water, vapour, dust, and a very small amount of other gases will also be present.

Oxygen is a clear, colourless gas without taste or smell and, besides being essential to plant and animal life, it is chemically an active gas. It will readily combine with other elements to form chemical compounds; that is, new substances with properties quite different from those

of the original substances. The combination of oxygen with iron, for example, produces rust, a substance quite different from metallic iron.

The substance formed is the **oxide** of iron, since no other element is involved. If, however, there were three or more elements involved—perhaps iron, sulphur and oxygen—the substance formed would be called iron sulphate, the presence of oxygen being indicated by the ending "ate."

The fact that oxygen will combine with the exposed surfaces of metals, and especially that oxides are non-metals, is very important to the plumber. It is particularly significant in the welding process, and will be fully dealt with later.

Oxygen is essential to combustion, and even highly inflammable materials will not burn without it. For example, a blowlamp will not burn if used in a small, airless space such as the inside of a hot water tank.

Nitrogen is a clear, colourless gas without taste or smell. It is chemically inert, and can be obtained as a by-product of the manufacture of oxygen gas. It is compressed into grey cylinders, and is used in the welding of plastic sheet and pipe

materials. This again will be more fully dealt with later.

Argon has similar properties to nitrogen, and is used in the argon-arc method of welding aluminium by electric arc.

Carbon dioxide is clear and colourless, but has a slight, not unpleasant smell. It is about 1½ times heavier than air, and so it is found in greater quantities at ground level than in the upper regions of the atmosphere.

Produced

CARBON dioxide is produced and poured into the air by the breathing processes of animals and plants. It is also produced whenever a substance is burned, and so the atmosphere in towns may be expected to have a larger carbon dioxide content than that of country districts, because of the larger number of fuel-burning appliances that are to be found there. On the other hand, carbon dioxide is also produced by the decay of plants so that in large areas of heathland, or moorlands, the concentration of carbon dioxide from this source may be relatively high.

Carbon dioxide will not support

continued overleaf



FACULTY OF PLUMBING . . . A. L. Townsend, M.R.P., M.R.S.H., a Lecturer at the Oxford College of Technology continues here the first part of a four stage course in plumbing. The author has closely followed his own lecture programme and has paid particular attention to scientific and technological innovations.

combustion; indeed, it is well known as a constituent of some fire extinguishers.

It will, however, readily dissolve in water, producing a dilute carbonic acid which has a corrosive effect upon metals.

THE PROPERTIES OF AIR.

Air occupies space—a fact illustrated each time it is pumped into a car tyre.

Air has weight—a fact not so readily observed largely because one is accustomed to it. Air can be weighed in the craft science laboratory, but it will be sufficient to know that it is about 800 times lighter than water.

Weight exerts pressure, and atmospheric weight or pressure has considerable influence on the design and working of plumbing appliances and the systems in which they are used. It is put to advantage in the working of all syphonic appliances—for example, flushing cisterns, but it can cause trouble. For instance, it may produce air locks in plumbing systems, or syphonage may unseat traps.

Atmospheric Pressure can be measured on a barometer (**baro** means "weight," **meter** means "measure").

from previous page

the atmosphere

A simple barometer such as is shown here will illustrate just how much pressure the atmosphere exerts.

Supported

It will be seen that the column of mercury, a substance weighing 13.6 times the weight of water, stands some 30" high in the glass tube. The weight of the mercury is supported or balanced by the weight of a column of the atmosphere of same diameter as the barometer tube. The same atmospheric weight or pressure would support a column of water 13.6 times taller. That is 13.6 x 30" mercury = 408 inches or 34 feet of water column.

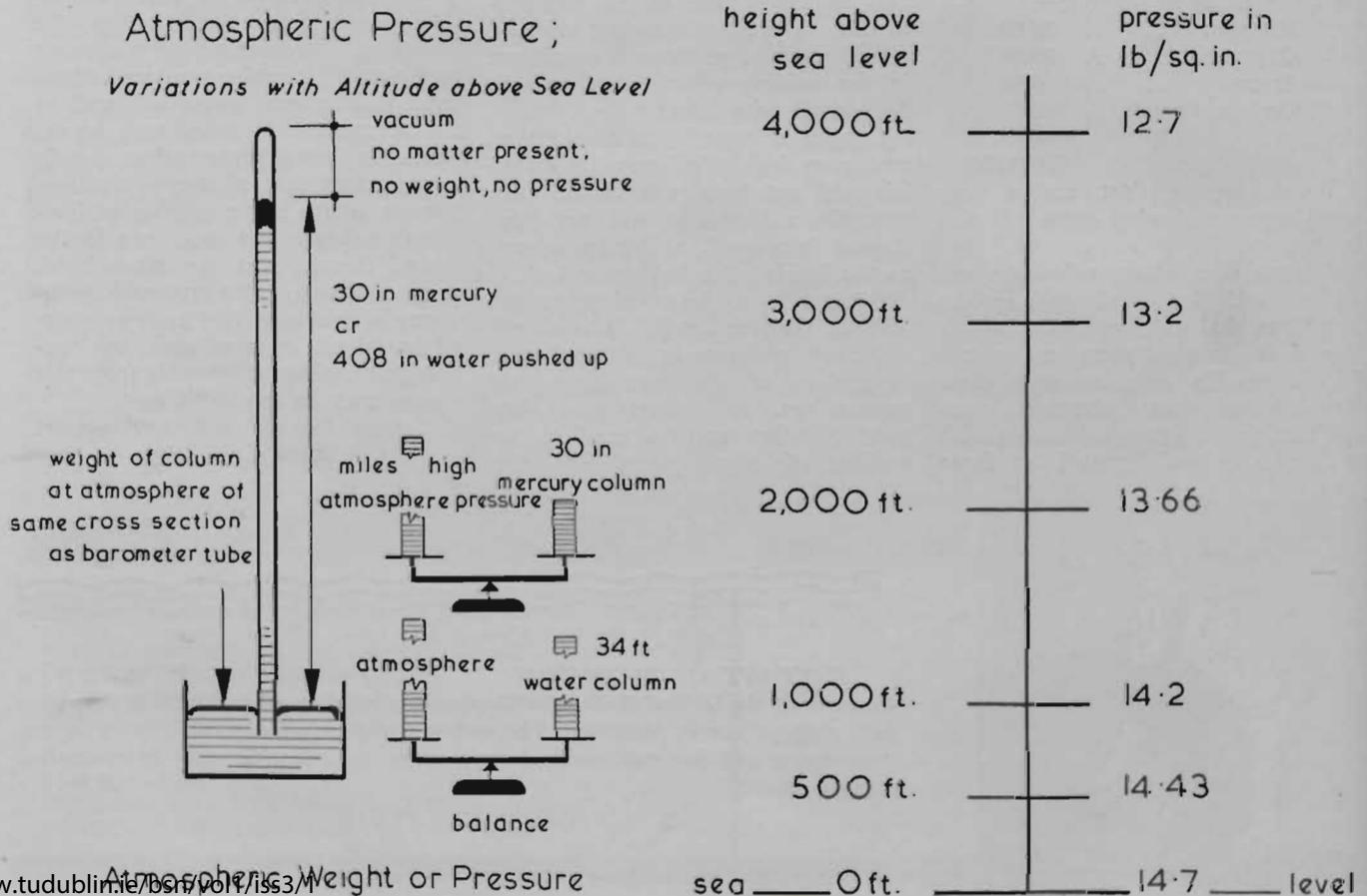
Since each foot head of water exerts a pressure of 0.434 lbs. per square inch on its base, the pressure exerted on the base of a water column 34 feet high will be 34 feet x 0.434

or 14.7 lbs. per square inch. It follows that atmospheric pressure will balance a pressure of 14.7 lbs. per square inch. Its pressure, therefore, must also be 14.7 lbs. per square inch.

Pressure variations may be caused by variations of temperature, for cold air weighs more than warm air. This is an important factor in the design and placing of appliances for heating buildings by convection currents of warm air. It may also be caused by variations in humidity (moisture content of air) for moist air weighs less than dry air. This fact may be shown on a barometer, where the mercury column falls a little when the atmosphere is moist and therefore suggests that rain is likely.

Finally, the weight of air is greatest at sea level, the lowest surface it can bear upon. As the height above sea level increases, so the atmospheric pressure becomes less. At sea level,

continued page thirty-one



Housewives choose our Oil-Fired Central Heating Systems



Housewives have been crowding in to see the comprehensive and up-to-date range of oil-fired central heating systems on display in the magnificent new Monsell Mitchell Showrooms. They liked what they saw there. That is why we invite all installers to come along and see for themselves just what the housewives are choosing this year. There is a complete range of equipment on display. And you can get full details of the new offer of deferred payments for summer installation.

COME AND SEE THEM FOR YOURSELF



IRISH SHELL



MONSELL MITCHELL'S

Showrooms

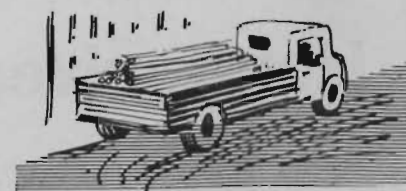
67 - 73 TOWNSEND ST., DUBLIN

HOUSEWARMING

The original scheme for oil fired central heating in the home

The Irish Plumber and Heating Contractor.

Increasingly the plumber uses plastics in his day-to-day work and this series of articles propose to deal thoroughly with their applications to the trade.



PLASTICS IN PLUMBING---2

IN the first article in this series we considered the nature of plastics and the two main plastics materials, which are of immediate interest to the plumber. It is now proposed to consider briefly the manufacture of these materials, namely, hard Polyvinyl Chloride or, as it is mostly commonly known, hard PVC; and Polythene or Polyethylene—sometimes referred to by the letters Pe.

The Production of PVC.—A number of methods are used for the production of the basic PVC material or monomer. A commercial method now widely used consists of the production of the vinyl chloride from ethylene gas, which in turn is obtained by the cracking of petroleum. The ethylene is then chlorinated by the addition of chlorine, to dichloroethane. The hydrogen chloride is removed from this material by heat treatment to give vinyl chloride. The Polyvinyl Chloride may then be prepared in a number of ways. In one of these it is obtained by heating a water emulsion of the vinyl chloride in the presence of a catalyst in closed vessels under pressure.

The PVC material thus obtained is a white rather fluffy powder rather similar to talcum powder. This powder, if hot moulded alone, turns into a hard horny mass. However, the material which is of interest to us in the form of pipes must have added to it small quantities of other materials termed stabilizers and lubricants, which are necessary to permit the carrying out of the extrusion process, that is, the production of a pipe.

It is necessary here to issue a word of warning to the plumber not to confuse hard PVC with plasticised PVC. Plasticised PVC material such as is used for covering of electrical cable has not got the high physical and chemical properties of hard PVC, and in fact may be considered as a completely different material, both from the manufacturers and the users point of view. The only source

of plasticised PVC piping with which the plumber is liable to come in contact is a cheap substitute for the traditional rubber garden hose.

Hard PVC does not contain any plasticiser whatsoever. Due to this fact it has the high tensile strength, which allows it to be used for pressure piping, and also has great resistance to chemicals.

Polyvinyl Chloride was first discovered as long ago as 1835 but was then only a white powder in a chemist's test tube and its great potential value was unrecognised. The tremendous surge forward with this material took place in the late 1920's and in the 1930's, particularly in Germany. The manufacture of PVC in Britain did not commence until 1943.

Expansion

THE production of PVC pipe commenced in Germany in the early 1930's and commercial production was under way in 1935. This piping formed a very important factor in the expansion of German industry during this pre-war period and tremendous quantities were manufactured. The piping was used not only throughout industry but also for water supplies. We find, for instance, that in 1938 some eighteen miles of hard PVC watermain was laid outside the city of Vienna. (We may note in passing that this pipeline is operating satisfactorily to-day and tests carried out in 1958 showed that the pipe had not deteriorated in any way). The physical properties of Wavin hard PVC are shown in Table 1.

The Production of Polythene.—Polythylene, or, as it is now called officially in the plastics industry, Polythene, is also produced by the cracking of petroleum. The gas ethylene is again used and is liquefied under high pressure and then put into a heated pressure vessel, where by means of a catalyst,

By

D. C. COYLE

M.E., M.I.C.E.I.

M.I.P.H.E., A.M.I.C.E., A.M.I.W.E.*

it is polymerized to a waxy solid.

The basic polythene material is thus a rigid, rather waxy and quite translucent material. It has a specific gravity of less than one and consequently will float in water. It may be noted that PVC, on the other hand, has a specific gravity of about 1.4.

Since Polythene flows readily under heat and pressure, it is used not only for the production of pressure pipes but also for the production of a multitude of consumer goods, such as kitchen utensils and toys.

Polythene was discovered in Britain and was first manufactured in 1938. It was found to be the ideal material for use in connection with the multiplicity of radar stations then being built in Britain. As a result of this fact, its use for pipes did not get under way in Britain until after World War II., as available supplies were used for special purposes only.

The British patents in connection with the production of polythene lapsed in 1956 and production of this material has grown greatly, particularly in Germany, where improved types have been produced.

The piping produced from Polythene finds its greatest use in agriculture and related spheres. This is evident from figures published in Britain, which show that of the twenty million feet of Polythene pipe produced and laid in Britain, nineteen million feet were used in connection with agriculture.

Specifications

WHEN encountering for the first time any new material, the plumber must ask himself: "How do I judge this material and satisfy my—
continued page twenty-eight

**Technical Manager, Wavin Pipes Limited, Dublin.*



Mrs. 1970 pays visit to Dublin

● Mrs. 1970 pictured on O'Connell Bridge.

✧ **JUNE GANLEY**, who represents the housewife of the future in the advertising campaign by Irish Shell Ltd. to promote oil-fired central heating in the home, opened the new Domestic Heating Showroom of Messrs. Monsell Mitchell & Co. Ltd., of 67-73 Townsend St., Dublin, last month. By pressing a switch to-start one of the five working oil-fired boilers on display, June declared open the showroom which Mr. E. K. O'Brien, General Manager of Monsell Mitchells, stated had been opened to enable the housewife not only to see the boilers themselves but also to see them working.

In reply to a speech of introduction by Mr. O'Brien, Mrs. Ganley said that the appliances on show would help to bring about a fundamental change in homes in which they were installed and oil-fired central heating was a luxury that every family could enjoy.

After the opening there was a reception for members of the trade and press which was very well attended.

✧ "Mrs. 1970" herself is gay, lively, red-haired June Ganley, who was chosen from hundreds of applicants in England to represent the "housewife of the future" in a nation-wide scheme to make the advantages of oil-fired central heating available to housewives generally.

During her brief visit to Ireland, she attended the Spring Show in Dublin and visited Cork, Killarney, Tralee and Ennis.

June has appeared on television and sound radio and her photograph is a familiar one in magazines, newspapers, advertisements and advertising panels in England and Ireland.

June thinks that being a woman in the 1970's will be better than ever before. "Women will have more free time; at least I hope they will," she added. ✧

To help homeowners meet the initial installation costs of oil-firing, Irish Shell Ltd. has developed a credit sale plan which is operated through the Merchantile Credit Co. of Ireland Ltd. through appointed installers and merchants. This has a double benefit, for it is essential, if the most economic and efficient installation is to be achieved, that the householder obtain the services of an installer who is experienced and skilled in oil-firing. The oil company's appointed installers



above...

● Mr. E. J. O'Brien, General Manager of Monsell Mitchell and Co. Limited.

below...

● At the reception: Mr. J. F. Dixon, Assistant General Manager, Irish Shell Limited, and Lord Killanin, Director, Irish Shell Limited, talk to Mrs. 1970.



Nine

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from previous page

New M. M. domestic heating showrooms

● A general view of the new showrooms.

have been chosen because they can give the customer the best possible service both by ensuring satisfactory installation and providing the credit facilities through which the total cost involved can be spread over five years. In this way, for example, an installation costing £350 can be paid for with no deposit and monthly payments of £7 over the five years.

There is also a "planned delivery" system through which the authorised distributor estimates the customer's fuel needs and notifies him when the tank will need replenishing. The distributors use vehicles giving metered delivery, so that the customer receives a note on which is printed the exact gallonage supplied.

The new showrooms provide a wonderful opportunity to study the advantages of Irish Shell Housewarming at first hand.

On display are all the latest types of burners, cleanly and compactly designed to blend perfectly in your kitchen, and a wide range of modern radiators, styled for both beauty and efficiency.



MEN are rarely killed outright by electric shock from 230/250 volt A.C. supplies. Even when accidental electric shock does result in respiratory derangement, immediate first aid will often restore the victim.

Speedy removal of the victim from contact with "live" equipment is essential—and obviously in such a way as not to cause conduction of current from victim to would-be rescuer. The recommended system of

ELECTRICITY — friend and foe

artificial respiration and after-care needs to be carefully understood and practised.

No doubt your local supply undertaking would help in advising on these matters, though of course they might be inclined to point out that prevention of accidents involving electricity is better than their cure.

The general indifference to the dangers of electric shock are frightening to those who have seen the gruesome results of careless indifference and failure to observe the simplest safety rules.

FUSES are simple things with a simple function. They comprise a fine wire capable of carrying their rated

load of electric current. If the load is increased, possibly through a short circuit fault in an appliance, the wire will fuse or melt, so breaking the electric circuit and stopping current flow.

FUSES ARE SAFETY DEVICES. —But there is little safety in using 5 amp. equipment, or less, on a circuit protected by a 15 amp. fuse. An appliance fault in such instance could render the appliance electrically "alive" yet still not blow the high rating fuse.

The present trend toward standardised fused plug outlets can add to this danger. These are commonly sold, fused to the maximum rated load that the plug is designed for, say, 13

continued page twenty-one

Eleven



The concluding article in a short introductory series

by **JAMES M. HAIG, A.M.I.W., A.M.I.P.**

SMALL BORE HEATING

THERE IS now only the boiler to consider. Whether it be gas fired, oil or solid-fuel burning, depends on the householder; but it must be capable of meeting the maximum demand that could be imposed by the heating system, plus an adequate allowance to cover the needs of the domestic hot water supply. A minimum of 12,000 B.Th.U./h. should be allowed for this latter, over and above the total central heating needs. Further, the boiler must be fitted with a thermostat that is reliable in action, thus ensuring good control of the burning rate. It is recommended that the boiler manufacturer should be consulted regarding any particular appliances.

Since the introduction of small-bore heating systems a number of boiler manufacturers have devoted considerable attention to reducing even further the running costs of such heating systems. The result is that to-day there are on the market clock-controlled boilers that are so arranged as to operate separate circuits for day or night only as required. This is achieved by having two separate flow connections, one running to the bedrooms or night areas, and the other to the living-rooms or day areas. By pre-setting the separate clocks on each of these circuits they may be automatically switched on or off, thus providing heat in the required places at the appropriate times. The result is that with such installations a much smaller boiler is used and it therefore operates at a constant and high efficiency. As a case in point, where under ordinary conditions a boiler

of 45,000 B.Th.U. would be necessary, a clock-controlled boiler of 33,000 B.Th.U. only would be called for.

Small-bore copper tube forced circulating systems can only work if the correct type of pump is used. There are a number of suitable makes available, and all of these are of the 'canned rotor' type, without glands between the motor and the impeller. The advantages of this form of construction are: (1) no possibility of water leaking out, and (2) as the bearings are water lubricated, no periodical oiling or greasing is necessary. The electric motor itself is of the squirrel cage induction type having a power consumption of approximately 70 watts, and both the motor and the impeller are, to all intents and purposes, silent in operation. This is an important consideration where the pump may be working at night, when even the slightest noise can be a constant source of annoyance. The maximum size of pump available at the moment is one of 15 ft. water gauge and with this particular pump $\frac{3}{8}$ in. diameter copper tubes have been used successfully for the heating pipe circuit.

The circulator should, whenever possible, be installed in the return main. The reason for this is that it is then operating at a lower temperature than would be the case if it were fitted into the flow pipe and can, if need be, have cork blocks mounted underneath as a stand and to prevent vibration. With installations having heating mains at a level below that of the expansion tank which is less than the pressure head developed by the circulator, it should be fitted in the flow-pipe to avoid the likelihood of subatmospheric pressures in the high-level

main. Such conditions may sometimes be encountered in fitting heating installations in bungalows, where the pipe circuits may be run at or near ceiling level.

It is important to note that, because of the close fit between the impeller and the case, all parts of the installation should be thoroughly cleaned and flushed out to remove any swarf and other foreign matter likely to jam the pump or cause damage to the bearings.

In dealing with the electrical starting gear, it is imperative that the push-button starter recommended and supplied by the pump manufacturers should be used. This is fitted with the correct current overload release to protect the field coils of the motor from possible damage by over-heating or burning out in the event of the impeller becoming jammed.

Small amount

WITH A small-bore heating system using only a small amount of water working under forced circulation, a very large degree of flexibility is available. Because of this, individual radiators may be turned on or off to suit any given requirements. With the small amount of water used, and that under pressure, there is no long waiting period between turning on any radiator and that radiator reaching the correct operating temperature. However, it is desirable that some method of controlling the entire system in relation to the outside air temperatures should be fitted to every small-bore heating installation. Such form of control will ensure economic running

continued page twenty-one

designing and constructing

SMALL SEPTIC TANKS

WITH the advancement of rural electrification many country dwellers have thought fit to install an automatic pump unit to ensure a constant water supply.

Once this has been installed a short time, the houseowner begins to think of a modern bathroom complete with hot and cold services, and most important of all—an indoor W.C.

It is then that the problem of a satisfactory sewage disposal system crops up. We cannot, of course, allow untreated sewage to flow into nearby ditches or streams. Not alone is it unlawful, but more important still, we would leave ourselves open to all forms of water-borne disease—typhus for instance.

It is evident then that the sewage must be purified to a degree where it can be discharged without nuisance. For the average household, the most satisfactory method is that known as the Septic Tank System.

Before discussing the design of this, it is important to understand the principles on which the tank works. As the sewage flows into the tank and through the filter bed, it is subjected to a bio-chemical process.

There are two distinct divisions in this process of purification—one called the anaerobic action and the other aerobic action.

Retained

IN the anaerobic action, the sewage passes into the septic tank and is retained for a time until suspended

matter such as sludge, etc., falls to the bottom, where it remains until pumped out. With regard to this part of the process, many are of the opinion that the sewage, having passed through the septic tank, has now been digested and liquified so that it is pure enough to run into a watercourse or ditch without further treatment! This is **not** so—even under very favourable conditions, the effluent from the tank will still be liquid sewage which requires further treatment by aerobic action or oxidation before it is safe to discharge.

Before proceeding to discuss this process, a few points must be noted with regard to the anaerobic action previously mentioned. The natural processes of the purification of sewage are helped by the presence of bacteria, of which there are two main types, anaerobic and aerobic.

The anaerobic bacteria—which, as the name implies, thrive when fresh air and oxygen are excluded—form a scum on top of the liquid in the septic tank, and it is this which causes the sewage to break up and become liquified, any suspended matter then falling to the tank bottom. This scum formation takes about six weeks or so to form in a new tank, and once formed should not be disturbed or bacterial action will be retarded.

The usual precautions against this happening are the provision of baffle walls or scum boards across the tank, the fitting of submerged inlets and outlets, etc. It is recommended also

that bath wastes, rain-water, and such like, be not discharged into a septic tank, but instead run into a separate soak-away, as it is thought that the sudden influx of twenty-five gallons or so of water might disturb the scum formation. However, in the case of a small installation, such as that described in this article, no serious upset will occur if this waste is allowed to enter the tank.

No advantage

SOMETIMES it is thought to speed up scum formation and digestion in a new tank by “seeding” it with the remains of a dead animal, or scum from another tank, but this is a fallacy, and no advantage whatsoever will be gained.

Again, on the other hand, I have come across cases where the scum was being removed regularly by the houseowner under the impression that he was making the tank work better! It must be emphasised that the scum formation in a septic tank is not to be disturbed or removed, otherwise the whole bacterial action is upset and bad odours will result.

While on this subject, it should be pointed out that the gases released during the bacterial action are highly inflammable and explosive, so when examining a septic tank, and before removing the cover, all naked lights, matches, cigarettes, etc., must be ex-

continued overleaf

the author . . .

. . . JOHN G. BOLTON, Lecturer in Plumbing and Heating at the College of Technology, Bolton Street, Dublin. Full Tech. Dipl. City and Guilds, London—Silver Medalist and 1st Place in Sanitary Engineering City and Guilds, London—First Place, Dept. of Education, Senior Test in Plumbing—First Class Pass, Final Examination, Heating Engineers Work, C. & G. London—Associate of the Institute of Welding.



Thirteen

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tinguished. I know of one individual who neglected to do this, and so lost his eyebrows, moustache, and almost his eyesight—so be warned!

from page thirteen

When the liquid sewage leaves the tank it passes into a filter—not to be confused with a sand filter for water purification. Our filter in this case consists of rough surfaced clinkers, broken bricks, stones, etc. (each about the size of a handball), with plenty of air spaces through it.

In this filter thrive the aerobic bacteria which demand plenty of air and oxygen, hence the air spaces and aeration pipes. The liquid sewage passing through this is finally purified, and so can percolate into a nearby ditch, etc.

Satisfactory

THERE are many designs of filter, ranging from the elaborate plants with rotary sprinklers suitable for large installations, to the simple type of soak-pit or land drain shown on the drawing. For the single dwelling the soak-pit filter, provided it is spread over a large enough area, will give satisfactory results. Strictly speaking,

for best results the top of the filter should be exposed to the air, but from an appearance point of view, it is usual to cover the filter media with a light earth cover with grass surface about 6ins. to 12ins. in depth (not more if possible).

TANK DESIGN

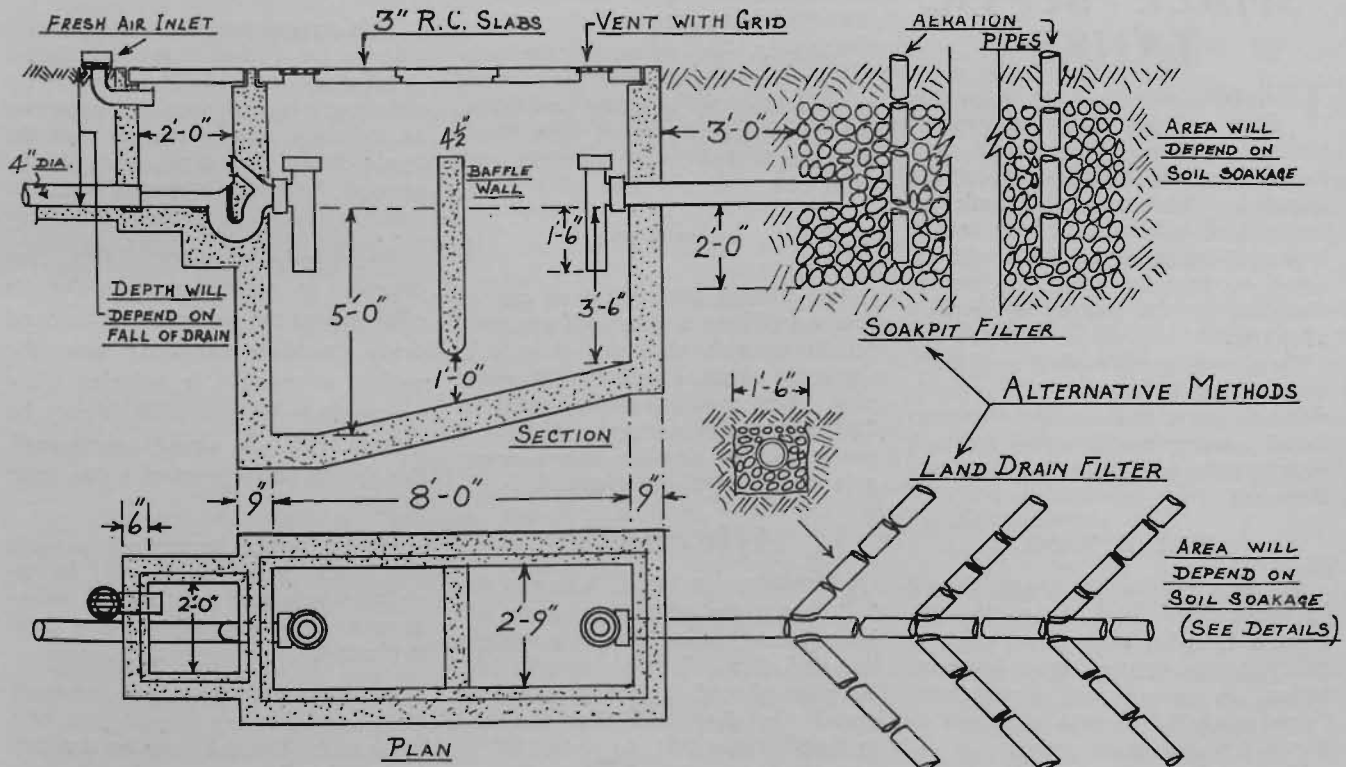
The satisfactory minimum capacity for a septic tank serving one house only has been the subject of much debate. Our Local Government Department specifies a minimum of 450 gallons, the British Code of Practice 550 gallons, and the American Septic Tank Manual, 500 U.S. gallons (416 Imp. gals.).

The Irish minimum of 450 gallons, however, gives very good results, and provided that the sludge formation at the bottom of the tank is removed about once a year—a matter often neglected—no difficulties will arise.

The tank should, if possible, be sited on ground sloping away from the house, and at a distance of at least 60ft. from the dwelling or any public road. It must also be this distance (further, if possible) from wells, etc., so as to prevent all danger of contamination.

The house drain connecting to this tank should be of 4in. diameter laid to a fall of about 1 in 48 and should have a minimum earth cover of 2ft. Where it enters the tank a manhole should be provided for cleaning purposes. On many tanks, an intercepting trap is also fitted at this point to prevent foul gases entering the building if the W.C. seal should evaporate or be siphoned out.

continued overleaf



● SEPTIC TANK SYSTEM FOR A SINGLE HOUSE

DOCKRELL PRIZE FOR DUBLIN NEWLY - WED

A Dublin newly-wed was the winner of a competition organised in conjunction with the Spring Show by Messrs. Thomas Dockrell, Sons & Co. Ltd.

The competition was open to anyone visiting the Dockrell stand at the show and entrants were asked to indicate in order of importance the eight features of the new Gala F.50 refrigerator.

The judging panel consisted of three members of the Irish Housewives Association and the prize was a Gala refrigerator.

Mrs. S. Morris, 90 Silverwood Estate, Templeogue, winner of the



● At the presentation to Mrs. Sheila Morris, of Dublin, were: the Lord Mayor of Dublin, Cllr. Maurice E. Dockrell T.D., and Mr. V. M. Lowe, Electrical Dept., Messrs. Dockrell.

T.D., who is Chairman and Managing Director of the Company.

The organisers of the competition reported the number of entries had been "most gratifying."

The reception, held in Dockrell's Georges Street premises, was well attended by representatives of the national press.

competition, received her prize from the Right Hon. the Lord Mayor of Dublin, Councillor M. E. Dockrell,

from previous page

SMALL SEPTIC TANKS

THE tank should have walls and floor of 9in. thick waterproof concrete, and the floor should slope to the inlet end to allow for sludge removal. The inlet and outlet of the tank should be fitted with branch pipes projecting about 18in. into the liquid so that the scum will not be disturbed by the inflow or outflow of water.

To prevent a wave effect or disturbance caused by a heavy inflow, it is usual to put a baffle wall (sometimes called a scum board) across the tank with a 12in. opening at the base (see diagram).

SIZE OF TANK

For best results, the length should be about three times the width—this gives a retarded even flow which is necessary to ensure better bacterial action. A square tank would have "dead pockets" at each side and so would not give good results.

The minimum inside width of the tank should be about 2ft. 9ins. and the length 8 ft. The total depth

will depend on the invert level of the drain, but the liquid will be about 4ft. 6ins. on average.

Although not necessary for satisfactory working, a septic tank should be provided, as a safety precaution, with R.C. covers about 3ins. thick, and should have vent openings with grids over the inlet and outlet.

FILTER BED

The effluent from the tank can be discharged into a filter bed or soak-pit filled with clinkers, etc., to a depth of about 2ft. below the outlet pipe. This soak-pit should be about 12ft. square for average soil, but if the ground is slow to absorb water a larger area will be required.

Alternative

AN alternative method is to discharge the effluent through unjointed land drains laid in a straight line and at a fall of about 1 in 160. The pipes should be laid on a bed of gravel 6in. deep, and should extend in length from 50ft. to about 300ft., depending on soil soakage conditions. If necessary, branches can be taken in fan formation (see diagram), so that

no single pipeline will exceed 50ft. in length.

This arrangement, of course, is only suitable for a small tank. In a larger installation, it would be necessary to construct a dosing tank and siphon so as to spread over a greater area the liquid from the tank, and thereby prevent "sewage sickness" of the soil.

As already mentioned, this filter depends on aerobic bacteria for its efficiency so the soak-pit and the land drain should be kept as near the surface as possible in order to allow air to circulate, and while it may be grassed over, as already mentioned, this should only consist of a thin layer of soil.

Finally, it must be emphasised again that septic tanks should only be installed where there is no risk of underground water supplies being contaminated.

For contractors who carry out work of this type, a very helpful plan of a septic tank (Ref. S.I.) can be obtained from the Government Publications Sales Office, G.P.O. Arcade, Dublin. Price, 1/3 post free.


Questions

Answered

Can I fit a food waste disposal unit to a customer's existing kitchen sink?

FOOD waste disposal units comprise a fractional H.P. electric motor which rotates a horizontal centrifugal impeller at high speed. Food scraps, deposited into the disposal unit, fall to this impeller and are whisked to the shredding cutters fixed to the vertical lining walls of the disposal chamber.

Food wastes are thus quickly and effectively disposed of by water carriage to the domestic drainage system.

A 1½ in. waste pipe is necessary and the unit dimensions are, roughly, 8 in. diameter x 17 in. deep. It is fitted in suspension from the sink outlet in place of the conventional waste outlet and trap.

Food waste disposal units cannot be fitted to existing sinks, which will have the standard 3½ in. outlet rebate. Disposal units have a 3 in. opening to their grinding chambers. They need a 3½ in. opening through the sink bottom, and of course, ordinary sinks have much smaller holes than this.

Fireclay and steel sinks are now being made with outlet holes and rebates to accommodate the food grinders.

Existing stainless steel sinks can have their waste outlets enlarged to accept the unit.

* * *

What is the difference between Soft soldering, Brazing, Bronze welding, and Welding?

SOFT SOLDERING is a term used to describe the jointing of two metals by a third, the solder, which has a lower melting temperature than the metals joined. The solder is of tin-lead composition.

Solder capillary fittings as used on copper tube are a common enough example of soft soldering.

Other examples are the copper bit soldering of a zinc roofing detail, or the soldering of a bottom on to a tin kettle.

Brazing describes a similar process but at a much higher temperature. Again, two metals are joined by a third, a brass, usually called "spelter."

At one time, before the coming of the Yale type lock, the plumber was sometimes asked to lengthen a door key. He would cut the finger turn end off the key to be lengthened. He would take another key of same size and cut the lock bit off. The two pieces would then be carefully filed to a mitre fit, and bound securely with brass wire. Powdered borax would be sprinkled over the brass wire as a flux and then the joint area strongly heated, to red heat, in a powerful blow-lamp flame or oxy-acet. flame. The brass wire would fuse or melt and flow into the joint like a kind of hard solder. Thus a brazed joint was made.

Modern plumbing techniques now use a similar method of hard soldering in copper tube joints. By the aid of a special kit of tools tube ends can be socketed to receive the spigot tube ends as a push fit. The cleaned pipe ends are then assembled, fluxed with a borax flux, and heated by Oxy-Acetylene flame. A strip of silver solder is touched to the prepared socket end and when the correct temperature is reached, the silver solder will flow into the annular space between spigot and socket. This useful up-to-date idea is similar in action to soft solder capillary work but uses a higher melting temperature solder. It is therefore also something like brazing but because a silver alloy solder is used instead of brass, it is another form of hard soldering—silver soldering.

Introducing a new reader service to the *CONTRACTOR* . . . each month this column will solve some of the everyday problems of the plumbing and heating engineer. Our consultants have this month chosen two typical problems and invite you to direct your query to "Questions Answered," all of which will be replied to and the most interesting published.

Bronze welding is a term used to describe the jointing of two metals by a third, the bronze welding rod, which has a lower temperature of melting than the metals being joined.

Oxy-acetylene torches and equipment are essential for this work. A flux, basically borax, is again used. The bronze welding rod is made of good quality brass. You will note the similarity between brazing and bronze welding so far. The real difference between the two is that, in brazing one relies on capillarity to move the "solder" around the joint, and without much control over its movement; whereas in bronze welding the application of the weld rod and therefore the weld metal movement, is at all times under the competent welder's control.

The bronze welding of light gauge copper tubes in all sizes is an economic, quick and effective modern method of jointing.

It is important to note at this stage—in all three types of joint previously described, **there is no fusion** or melting of the metals being joined.

Welding is a term generally understood to imply the fusion of two metals under the influence of heat, filler rod being used to build up the joint area as necessary. Fusion welding then, or more simply, welding, denotes the jointing of two metals by actually causing them to melt and flow together.

This can be done by using an electric arc welding set. In this case the job is "earthed" and the welding rod serves not only as a filler rod but also as a positive electrode. As this is brought to the job an electric arc jumps from the electrode end to earth via the job. The heat intensity of the

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Seventeen

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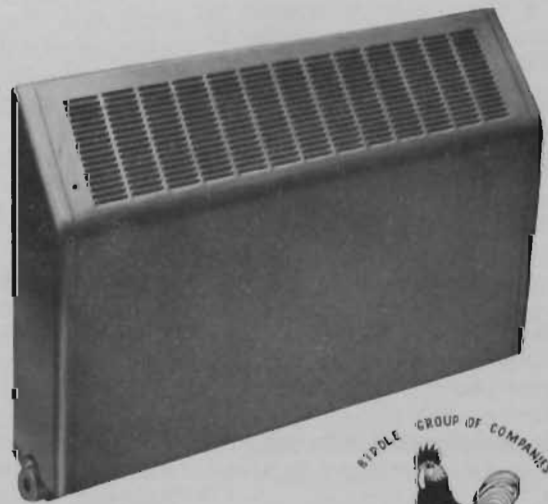
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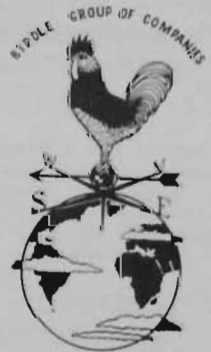
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LARGEST MANUFACTURERS OF HEATING EQUIPMENT IN THE U.K.



MESSRS. L.R. WOOD, Limited, of 174, Pearse Street, Dublin, are now distributing a new refractory product known as FURNASCOTE, which should be most interesting to the leading heating engineers, plumbers, local government authorities, electricity generating stations, offices, schools, and wherever heat is required for production, or factory heating.

Furnascote has proved to be a tremendous success in Britain, and Europe, where fuel oil heating is replacing solid fuels. Owing to the excessive wear and corrosion produced by sulphur compounds from burning fuel oil, it is essential to line combustion chambers with a material which can withstand the ravages of the sand-blasting effect, and sulphur corrosion encountered.

Furnascote has been used continuous-

from page seventeen

QUESTIONS ANSWERED

arc is sufficient to fuse the pipe ends in the vicinity of the arc and melt off some weld rod to reinforce the joint metal.

In the plumbing and hot water field, welding is generally done with Oxy-acetylene equipment, or gas welding. No flux is needed as the oxides of iron are lighter than molten iron. In consequence these oxides float to the top of the weld and away from the joint area. Even so, careless welding or inexpert welding could result in oxide inclusions in the weld to its strength and water tightness detriment.

Flux is necessary in soldering, brazing and bronze welding because the oxides formed do not float away easily. The flux dissolves these oxides so that they will dispel from the joint region.

Lead burning is really lead welding. In fact it is a good example of fusion welding. In this case the stronger milled lead is converted to a lower strength cast lead in the fusion jointing technique of lead burning, and sufficient lead filler rod is added as the weld proceeds so that the joint area has a finished thickness to be of equal strength to the rest of the milled lead.

PROTECTION FROM FUEL OIL ACIDS: MAKER'S CLAIM

ly over a period of five years in some combustion chambers, and has saved the engineers expensive maintenance, and above all, loss of production with consequent loss of revenue, as in the case of an electricity generating station.

Corrosion attack

An interesting feature of Furnascote is that it also withstands corrosion attack by solid fuels, particularly peat.

Uses.—The Furnascote range of refractory coatings has been developed to provide reliable furnace linings that will withstand the destructive action produced by fuel oil combustion.

It is intended for use both in industry and in marine engineering, where the general change from coal to oil fuel has made the demand for such linings increasingly widespread.

Features.—The high proportion of Zircon compounds contained in the coatings gives a good resistance to damage of brickwork by free acids or alkalis. In addition, the coatings have been shown to have a high resistance to flexing. After three years of use on tankers they showed no signs of cracking, although other linings were cracked and spalled in the same conditions. This is also a considerable advantage in factories, where severe vibration can often cause damage.

Description.—The range consists of three basic types of coating, each of which is effective within a definite temperature range. The glazed (vitreous) type, of which there are three versions, is designed for use in an overall range of 815-1,650°C. The universal (non-vitreous) type, which gives a smooth matt white surface, is effective between 10° and 1,910°C, while the mortar type for bonding and plugging is effective up to 1,650°C.

When using the glazed types, it is essential that the first firing of the furnace or boiler after application reaches a temperature which secures the vitrification of the coating. When this temperature is attained, the coating fuses into a soft glaze which has good sealing properties and is sufficiently plastic to expand and contract with the furnace wall.

Reflects heat

The glazed surface of the coating reflects heat back into the furnace, and therefore increases efficiency. The coating will also resist slagging and is not readily wetted by slag.

All three types can be applied to the bricks or the furnace or boiler by brushing or spraying and create a barrier $\frac{1}{8}$ -in. to $\frac{1}{2}$ -in. thick as required. They are normally supplied in powder form, in 56lb. waterproof drums, designed to export to arctic or tropic conditions.

SEEKING PUMPING PLANT

TRIM Urban District Council are inviting tenders from Contractors for the supply and installation of Duplicate Pumps for the Trim Water Supply Improvement Scheme. Pumps shall be capable of delivering 125 gallons per minute against a total head of 134 feet and shall be complete with electrical equipment, gauges, water meter, pipe work and control equipment specified by E. T. Hanrahan, M.E., Ph.D., A.M.I.C.E.I., of Nicholas O'Dwyer, Son and Part-

ners, Consulting Engineers, 6 Burlington Road, Dublin.

Contract Documents may be obtained from the Consulting Engineers on payment of a deposit of £5 5s. 0d., which will be refunded on receipt of a bona fide tender not subsequently withdrawn.

Sealed tenders, marked "Pumping Plant," should reach W. Power, Town Clerk, Town Hall, Trim, not later than 5 p.m. on Wednesday, June 28, 1961.

Nineteen

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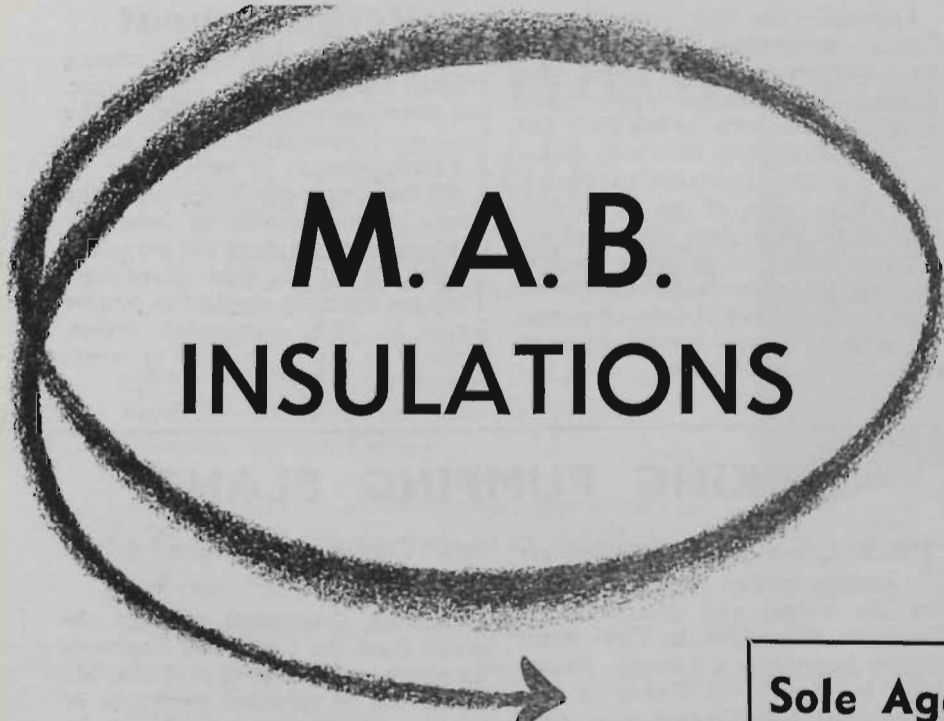
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from page twelve

SMALL BORE HEATING

of the system and at the same time provide a constant and adequate supply of domestic hot water. It may be thought that control by the boiler thermostat alone would be a satisfactory method to adopt. It cannot be emphasised too strongly that such a practice must be avoided, because if such control were used, the closing down of the boiler firing rate would equally cut the heat output to the domestic water side.

The ideal method of control is one that is fully automatic and works through a temperature-sensitive bulb fitted outside the house. A capillary tube runs from the bulb to a three-way control valve fitted to the flow-pipe from the boiler and a by-pass connecting it to the main return pipe. The temperature-sensitive element, being continuously in operation opens or closes the mixing valve on the heating mains conversely with the outside temperature and thus maintains, within limits, the room temperature at a constant figure. The motive power to operate the control comes from the pressure differential

across the pump. By using this type of control unit, all rooms are maintained at the correct temperature and localized air disturbances caused by open doors and windows in some rooms do not affect other rooms. The small additional cost of this piece of equipment should, it is claimed, be recouped over two or three heating seasons by reason of the expected saving in fuel costs.

An alternative method of control is to use room thermostats coupled to the pump, thereby controlling the amount of heat passed to the radiators. There are, however, a number of disadvantages attached to this, such as finding suitable positions for mounting and the cost of installing the necessary switch and electric mains wiring. Similarly, individual radiator thermostatic control would be expensive and would leave the heating mains 'alive' with a consequent waste of fuel.

The only other way of dealing with the problem is to install a three-way by-pass valve connected between flow and return mains, and to adjust

this valve manually. This entails the householder altering the setting to meet outside temperature variations.

A variation of the three-way by-pass valve is also available. It consists of an automatic three-way mixing valve, with a bimetal spiral in the upper part of the valve casing, controlling the movement of the double clack in the lower part, which either opens the inlet port or closes the return port, so that a mixed flow temperature can be selected and maintained.

It is advisable to provide an isolating valve on both the flow and return mains. This will allow the radiators and pipe circuits to be drained without shutting down the boiler and domestic hot water supply side of the system. The valve on the flow main only may be closed in the event of wishing to shut down the central heating circuits. If the valve on the return were closed, there would be a likelihood of high pressure occurring in the heating system due to the expansion of water.

Lock shield valves should be mounted on the return main of all secondary circuits; this will enable the circulation to be reduced to the required rate and will also prevent 'short-circuiting' of the major circuits. The adjustment of the lock shield valves on the secondary circuits is carried out when the system is first put into use, so that with all the radiators working, the water in the return mains from all circuits is at the same temperature.



from page eleven

amp. If the plug is to serve a lower power appliance an appropriate fuse change is necessary.

PERSISTENT FUSE BLOWING indicates a serious fault. Leave well alone until the system and equipment has been checked by a competent electrician.

FLEX AND LEAD LAMPS are indispensable in many situations. These should be purpose made, not just made up from odd lamp sockets and odd lengths of lighting flex. They should be watertight—remember water will conduct electricity, and if your lead lamp falls into a cistern full

of water your own light may go out—for good. Purpose made lead lamps have a wire screen protector enclosing a glass watertight lamp housing. They will be provided with heavy duty 3-core cable. Above all, they are intended for use with a 3-pin plug fitted to an earthed 3-pin socket outlet.

IT IS DANGEROUS AND FOOLISH to use any old kind of lead lamp. The author still mourns the sad loss of a most promising young plumber friend who did this. His body was found three days after his makeshift lead lamp, connected to an ordinary lighting socket, had short-circuited to the complicated pipework among which he had been entangled.

IT IS DANGEROUS AND FOOLISH to use any electric powered tool off a lighting socket for these do not have provision for earthing.

CENTRE TAPPED TRANSFORMERS are available for use with

electric powered hand tools. These take current from the 230/250 volt A.C. mains and transform the outgoing current to tools to only 110 volts. If the electric hand tool is earthed, as of course it should be, then the operator will receive no current if a fault develops in the tool. But by virtue of the earthed centre tapping arrangement on the transformer, even if the tool is not effectively earthed the most the operator will get is a 55-volt current shock. This will give him a "kick" but is by no means dangerous.

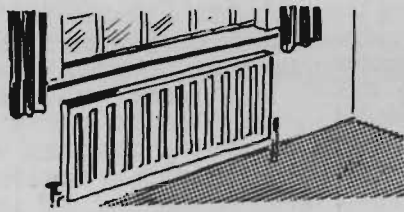
SUCH TRANSFORMERS COST ABOUT £6. For a little more they can be had with 12 volt tappings to supply car type bulbs for lead lamps. These give adequate light with perfect safety.

Twenty-one

automatic temperature control - - - 3

oil burner controls

THE realm of the heating engineer is primarily mechanical but modern practice is using more electrical devices and never more so than in the field of oil burner controls. It cannot be expected that every heating engineer will be in possession of sufficient electrical knowledge to trace and repair faults in the circuitry of oil burners and most oil burner manufacturers appreciate this and provide



efficient service organisations for this purpose. Nevertheless a basic understanding of the functions involved can be most useful to the heating engineer not only in avoiding trouble before it occurs but in enabling him to accompany any request for service with some specific details of the fault.

Nearly all modern oil burners rely on their control system for three cardinal applications:—

Sequence: To bring in each component of the burner in the correct order and at the correct time. This entails the use of a timing device which can be electro-hydraulic, electric resistance or an electric clock type and varies with different manufacturers. The timing of the system also varies with differing types of burners.

Safety: To prevent the starting of the burner if a faulty component or faulty conditions exist. In most cases these conditions result in no flame establishment and the control fails to safety or lock-out, requiring manual attention before a fresh start can be made.

Security: To stop the burner if faulty conditions arise during a run. Again flame failure is the usual result of such conditions and the control stops the burner or re-introduces ignition. If the burner is stopped one new start is made which on the fault continuing produces lock-out as previous paragraph. When re-ignition is introduced, cor-

started and oil is forced into the boiler combustion chamber across the spark from the ignition electrodes. If the flame is then established the photo cell receives light from the flame and this allows the control relay to fall out and stop the ignition. The motor circuit, however, is maintained and the burner continues to operate as long as the controlling thermostat or pressure switch calls for heat.

If the oil does not ignite the photo cell will not be illuminated and a thermal timer will lock-out the control within approximately twenty seconds. As explained before, once lock-out occurs manual reset of the control is necessary before restarting. Provision is made for an alarm when this condition occurs.

If the flame fails during a normal run, the photo cell will go dark and re-introduce ignition but if the flame does not establish itself within thirteen seconds lock-out will occur.

This gives a simplified version of the sequence and timings involved, and while these may differ between controls and burners from different manufacturers, it can be taken that most reputable controls adhere to the standards laid down by British Standard Specification 799-1953.

From the heating engineer's viewpoint the two major considerations in respect of controls are that of installation and maintenance.

Installation

THE present tendency is to supply the oil burner with controls already fitted and pre-wired. This particularly so with those controls using photo cells as flame sensing devices since these are generally mounted in the barrel of the burner. Other types of controls have components mounted elsewhere and careful installation can save much trouble at a later date. The following hints may

By
R. E. AYERS,
M.A.S.E.E.

rect flame conditions allow the burner to continue to run, but if no-flame conditions persist lock-out ensues.

Timing device

EACH oil burner control then must have a timing device for the sequence, a relay to start and stop the ignition and the oil pump and a flame sensing device. This last device can be of either the bimetal type, which reacts to flue temperature, or the photo-electric or photo-resistance type, which reacts to light from the flame.

Fig. 1 shows a modern oil burner control for light or medium oil burners and uses a photo-resistance cell as its flame sensing device. This type of photo cell does not require the use of an amplification circuit, thus enabling a simpler control circuit and smaller unit to be used. When the controlling thermostat or pressure switch calls for heat the control relay closes, which energises the ignition transformer. Approximately fifteen seconds later the pump motor is

be useful in this respect.

- (1) Use flexible conduit to finish off connections to components. Anyone who has wrestled with a solid conduit to a component situated at the back of a hot flue will know the saving in time and temper such a precaution can give.
- (2) Where possible place the component where it can be easily withdrawn. Bimetallic fluestats (Fig. 2), particularly, need frequent cleaning and they will not receive this if it is difficult or sometimes impossible to withdraw them easily.
- (3) When fitting a bimetallic fluestat look for a position where it will be well in the gas stream of its own boiler, protected from any other common flue and, most important, will be subject to sufficient fluctuation in flue temperature to operate. The manufacturers' leaflet will give full information on this.
- (4) On large burners it is sometimes found necessary to fit the photo cell unit to the boiler front plate. It is convenient if some form of local adjustment to the fitting is available because it is most essential that the photo cell has a clear and uninterrupted view of the stable position of the flame (Fig. 3). See that the front brickwork does not cut off the view. Avoid long sight tubes which by their length restrict the area of view and usually get badly carboned. Avoid positions where vibration is excessive—apart from connection trouble it will shorten the life of the photo cell.

sible, maintain insulation, clean contacts as necessary—these are just a few points to remember.

Keep photo cells clean, and this includes glasses between cell and flame if provided. Maintain high insulation reading on photo cell connections; if this falls the signal from the cell will become weaker and may not be sufficient to operate the control even though the flame is established.

Clean bimetallic fluestat stems or bimetal scrolls of flue mounting control units.

Check safety features of control frequently by introducing conditions leading to lock-out. Such faults on controls are very rare but it is a precaution well worth taking occasionally.

Most oil burner manufacturers offer regular maintenance contracts to check the burner and controls. Such contracts have many advantages, so where they are available inform your customer.

Service

NOT all failures of oil burners are such that the service organisation of the manufacturer is necessary to trace and repair the fault. Indeed, most faults occur at certain peak periods in the year and if the fault can be traced and put right by the heating engineer or customer so much time can be saved. Furthermore, if it is necessary to call in a service organisation it is of invaluable assistance to know something of the fault before arriving on site. The following comments may be of use in this respect.



FIG. 1—Control box using Photo-resistor cell (top).

★ ★ ★

FIG. 2—Bimetallic Fluestat (centre).

★ ★ ★

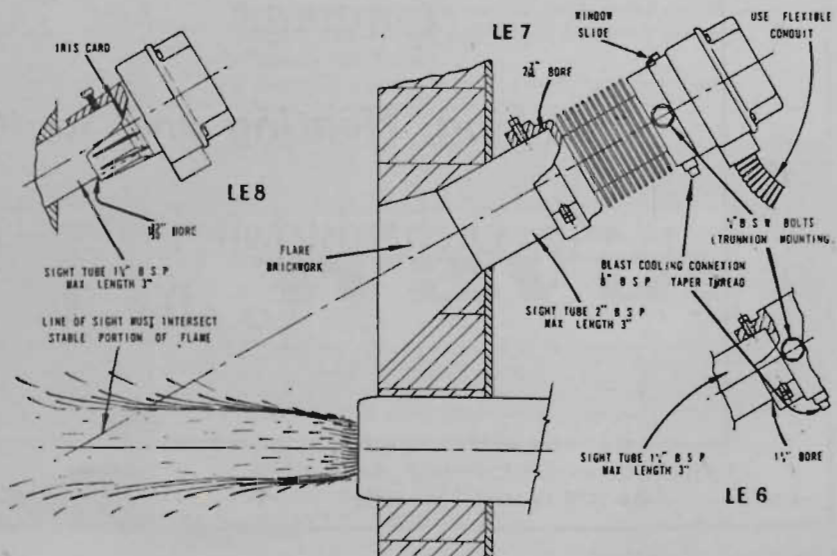
FIG. 3—Fitting a photo-cell head (below).

- (5) Ensure that the electrical system is efficiently earthed. Apart from being good practice it is necessary with a number of controls to provide stable operation.
- (6) Read the manufacturers' leaflets. Pay special attention to the requirements of maximum ambient temperatures because most timing devices are thermally operated and high ambient temperatures can cause trouble with short timings or even non-operation.

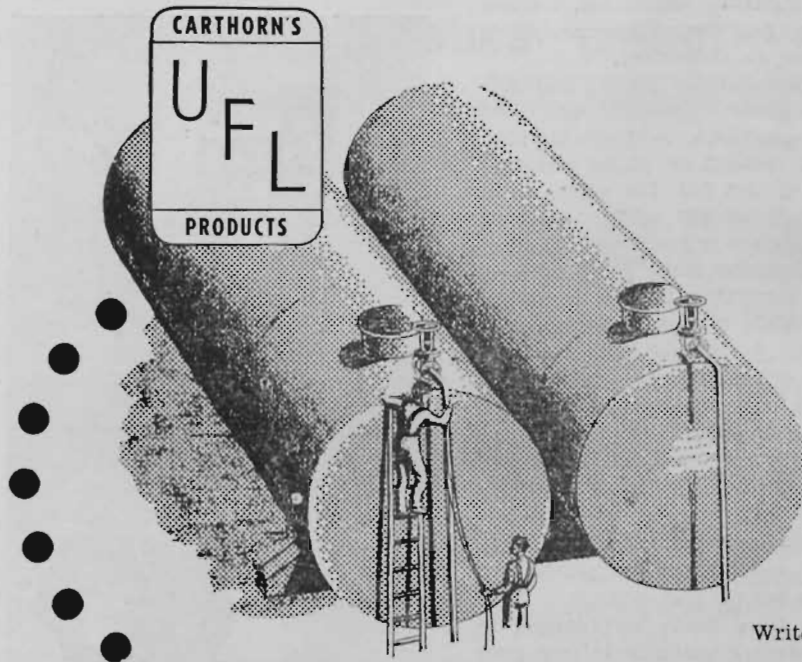
Maintenance

SINCE most controls are purely electrical the standard electrical maintenance procedure should apply. Check terminals regularly, keep controls clean and as dust free as pos-

continued page Thirty-two



Twenty-three



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Copper pipes contaminated water supply in new houses

CONTAMINATION of water supplies, due to copper pipes installed in new houses at Villa Park, Navan Road, Dublin, was referred to at a recent meeting of the Dublin Health Authority.

Senator J. J. Tunney said the water pressure was very bad, and the impurity of the water had made life a nightmare for the occupants.

Dr. J. B. O'Regan, Chief Medical Officer, said that a sample of the water taken at the end of March had an extraordinary amount of copper, but samples taken since then had less than one part per million, the acceptable limit. The contamination was due to the type of copper piping put into the houses, and the matter was being dealt with by the Corporation.

Mr. D. Larkin said if the contamination came from the pipes, responsibility went back to the builders and the people who supplied the copper.

Senator Tunney said that it also went back to the officers of the Corporation who certified that the materials used in the houses were correct. A deputation had met the Minister for Local Government, and he (Minister) was going to have the matter investigated.

NEXT MONTH

A. L. TOWNSEND ON -

The make-up and behaviour of Plumbing Materials:—

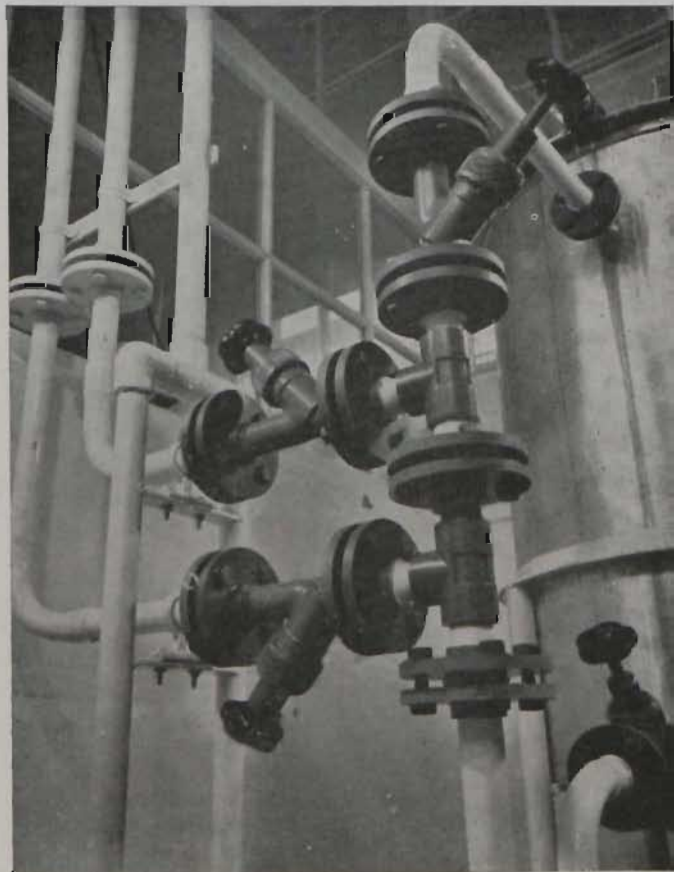
- Chemical properties of matter;
- Chemical composition of matter;
- Physical properties of matter;
- A note on pressures;
- Mixtures; and the
- Reduction of metallic ores.

NEXT MONTH

Plant for water scheme

OFFALY County Council have invited tenders from Pumping Contractors for the supply and installation of Pumping and Softening Plant for Rhode Water Supply Scheme in accordance with the contract documents prepared by the Council's Consulting Engineer, Mr. Ed. Ralph Ryan, M.E., 1 Montpelier Terrace, Galway, from whom the contract documents may be obtained on deposit of £10 10s. 0d., returnable on receipt of a bona fide tender not subsequently withdrawn and the return of the documents.

Sealed tenders on the form provided, endorsed "Rhode Water Supply Pumping Plant," should reach the County Secretary, Courthouse, Tullamore, not later than July 8, 1961.



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Castleforbes Works had a problem! A highly corrosive chemical, used in their modern manufacturing process in Dublin made very short work of conventional pipes. This could mean frequent renewal of the pipe-lines, with consequent loss of production and the risk of dangerous bursts—but they chose Wavin PVC because Wavin PVC Pipes are immune to chemical attack. They are also inexpensive and easy to instal, with a complete range of PVC fittings. And they solved their problem efficiently and cheaply.

If you have a problem in pipework, why not consult Wavin—the pioneers of PVC in Ireland.

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Twenty-five

The Irish Plumber and Heating Contractor.



Reviewing some recently introduced products of Messrs. Richard Baxendale and Sons Ltd.

THE BAXI PATENT FIRE

MESSRS. Richard Baxendale & Sons, Ltd., ironfounders, of Bamber Bridge, Preston, Lancs., report that their revolutionary Baxi patent fire has now taken its place among other successful products manufactured by this firm.

Working on the principle of a controlled draught system, the Baxi fire draws air through an under-floor pipe into the bottom of the grate. A simple hearth control enables you to select any type of fire, from a smoulding glow to a roaring blaze.

The under-floor draught principle is the basic reason why a Baxi fire warms the room so fast and thor-

oughly; why it extracts the maximum heat from any solid fuel; and why it gives a roaring blaze within five minutes of lighting.

Design award

A Baxi Standard Model under-floor draught fire, with rotary ashbox and radiator output boiler, was specified in his award-winning design for a Small House Competition in Britain by architect Peter J. Ball, A.R.I.B.A.

The competition was organised jointly by the *Ideal Home Magazine* and the *Royal Institute of British Architects*.

ours: armour bright and chrome (finishes), black and mushroom (vitreous enamel); and copper, pewter or old silver (lustres).

Under normal circumstances the following heating capacities can be obtained: 16" model, 2,000 cubic ft.; 18" model, 2,300 cubic ft. Each fire is guaranteed by the makers.

The Baxi fire comes in various models to meet all home heating requirements. For greater efficiency, the following modifications have been approved: the Burnall model with three methods of ash disposal; the Max air model, and the rotary ash-box model.

The Burnall is capable of burning every known type of fuel.

It is available in 16 in., 20 in., and 24 in. sizes. Centre air inlets are available for all sizes; side inlets can be supplied with 16 in. and 18 in. lift-out ash-box only.

Cuts draughts

The Max Air and Rotary models, however, are available in 16 in. and 18 in. sizes only.

In the Max Air model secondary air supply cuts room draughts, give greater warmth, improves ventilation and saves more fuel.

The Rotary ash-box model is a continuous burning Baxi for chimneys on inside walls. There are two ash boxes underneath the fire and by lifting off a cover plate in the hearth, the full ash box is lifted out after rotating the empty ash box into position while the fire continues to burn.

Baxi fires, which can be kept burning continuously at any desired intensity, are of particular value for supplying a Baxi central heating system, either by hot water radiators or by warm air convectors.

The Baxi radiator output boiler—out of sight behind the Baxi fire—provides abundant hot water for bathroom and kitchen.

Easy to fit

The Baxi is easy to fit, quick to light, and has been installed in more than a quarter of a million homes.

The fire can be supplied in six sizes: 14", 16", 18", 20", 22", and 24". It is obtainable in eight col-



● The Baxi patent fire, fitted with the rotary ash-box. There are two ash-boxes underneath the fire and by lifting off a cover plate in the hearth the full ash-box is lifted out after rotating the empty ash-box into position, whilst the fire continues to burn.



● The new Baxi Burnall model is capable of burning every known type of fuel.

Ideal in any central heating plan, of course, is the Baxi domestic output boiler. It is a really efficient installation, designed to give ample hot water for all normal domestic purposes. It has a much greater heating surface than normal boilers and is constructed so as to avoid blocking the flue, by means of the sloping base.

The Irish agent of Richard Baxendale & Sons is Mr. A. G. Smyth, 99, Upper Rathmines Road, Dublin.

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Twenty-seven

self—and my client—that it is suitable for plumbing purposes.” In short, what standard or specification does it comply with and what are the requirements of that specification?

During the past twenty years this matter of specifications for plastic pipes and other plumbing items has been actively considered in a number of countries. In Germany, the great production of hard PVC pipe led to the issuing (in 1941) of a leaflet dealing with this type of pipe. Since that time a number of draft detailed specifications have been issued in that country—culminating in the issuing in July, 1960, of a preliminary Standard (DIN 8061).

Since the second World War the International Standards Organisation (I.S.O.)—of which our own Institute for Industrial Research and Standards is a member—has been busily engaged with the help of many countries, including Russia, in endeavouring to

from page eight

Plastics in plumbing

produce an International Standard for plastics pipes. A great deal of work has been done and draft standards issued by Holland, Denmark and Germany are based on the findings and decisions of I.S.O.

We may be proud to note that in Ireland, owing to the foresight of the Local Government Department, the City Engineer of Dublin, Mr. E. G. Bourke, M.E., and the late Professor Walsh of Cork, steps were taken as far back as 1957 to prepare a specification which could be used for the control of the production and sale of hard PVC pipe in this country. The large quantities of Wavin Hard

PVC pipes, which have been manufactured and sold in Ireland and abroad since that date, have been made to the provisional specification issued by the Department of Local Government. This specification sets down not only the sizes and dimensions of pipes but also the tests to be carried out by the manufacturer to ensure a satisfactory pipe, which will be suitable for use for the conveying of potable water under pressure. The specification covers a range of pipes of nominal sizes from $\frac{3}{8}$ " to 6" and suitable for working pressures equiv-

continued page thirty-two

TABLE I.
PHYSICAL PROPERTIES OF HARD P.V.C. as MANUFACTURED BY WAVIN PIPES LIMITED.

PROPERTIES.	METHOD.	UNITS.	VALUE.
Specific Gravity.	—	—	1.4
Tensile Strength (min.) 20°C.	Din 53455.	Kg/cm ²	500-550
Compression Strength.	Din 53455.	Kg/cm ²	700
Impact Strength (Izod) 32°F. 68°F.	ASTM D256	ftlb/inch of Notch. " " " "	0.5-1 1-2
Modulus of Elasticity.		Kg/cm ²	30.000
Thermal Conductivity.		cal/cm/cm ² /°C/h. kcal/m/cm ² /°C/h.	4 x 10 ⁻⁴ 0.14
Specific Heat.		Kcal/kg/°C.	0.24
Heat Distortion Temp. 264 psi.	ASTM D648.	°F	158
66 psi.		°F	171
Coefficient of Linear Thermal expansion.		m/m/°C	5.5 x 10 ⁻⁵
Water Absorbtion 20°C.		% 3 x 24 hours.	0.1
Durometer hardness " D."	ASTM D785		80
Flame Resistance.			Self Extinguishing.

Atomic age apprentice's suggestion!

THE new rural sewage disposal scheme had recently been completed. The villagers were both proud and pleased. No more, the unpleasant journeyings to the bottom of the garden when nature called, and no more, the unpleasant emptying of bucket closets or the re-siting of the privy.

Alas, short lived seemed their delight, for one day the sewage failed to run away along its appointed sewer. The local Inspector quickly diagnosed a partial blockage, but what could it be? More important still, where could it be?

The new sewer ran over five miles long. It rose quite steeply from the village to the treatment works, and the sewer pumps strove valiantly to dislodge the offending blockage—but to no avail.

The entire village grew restive, and not without cause. Something had to be done, but quickly. To excavate trial holes along the length of sewer would be both costly and time absorbing, and time was running short. Then, a young apprentice—product of this atomic age, timidly suggested the placing of a radio active ball into the sewer on the pump side of the blockage.

Quickly the idea caught on. The assistance of nearby Research Centre was sought. A rubber ball was rendered radio active and introduced at the pump. The sewage slowly moved by the partial blockage and along with it went the ball, its passage noted by a geiger counter. Eventually the earnest watchers noted that the ball had ceased to flow with the sewage. Quickly a hole was dug and the sewer opened up—hang on the blockage.

Very soon the sewer was cleared and all was well—much to the relief of the villagers.

Warning—Plumbers are respectfully invited to try all conventional forms of drain blockage removal before thinking of seeking atomic science aid.

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a dry atmosphere exerts a pressure of 14.7 lbs. per square inch (or barometric pressure of 30" mercury. The diagram on page six makes this clear, and illustrates also how this variation of pressure will affect pumps and syphons which work by air pressure.

Atmospheric corrosion

THE moisture content of atmospheric air; the solubility of carbon dioxide and sulphur gases which make this moisture acidic; and the readiness of oxygen to combine with and convert metal surfaces to non-metallic oxides are corrosive influences which attack some metals exposed to them, with costly and damaging effect.

In the case of non-ferrous metals, that is, metals other than iron or steel,

exposure to moist air will result first in the formation of a surface oxide. Following closely upon this, acidic atmospheric moisture in the form of dew, mist or rain will act on the surface of a non-metallic oxide, producing a "skin" of basic oxycarbonate, and losing its own acidity in the process. This skin is adherent, that is, it sticks to the metal, and forms a protective film which resists further corrosion. The underlying metal will therefore last for a long time; that is, it will be durable.

This is not the case with the ferrous metals—iron and steel—for the oxides of these (rusts) expand as they form and crack off the metal in doing so.

It will be seen that non-ferrous metals protect themselves by developing a skin from the products of in-

from page six

the atmosphere

itial corrosion, and suffer no further attacks in consequence. The atmospheric corrosion of iron and steel is progressive, and unless precautions are taken these metals will be completely destroyed by oxidation, or rusting.

Protective coatings

TO prevent this, it is necessary to protect metals, and particularly iron and steel, with some form of resistant coating. Some of these in common use are listed here:—

TYPE OF COATING	PROTECTIVE COMPONENT	APPLICATION
Paints. (applied by brush).	Oil base or Bitumen base.	Cast iron and mild steel pipework and fittings exposed to atmospheric air or to soil corrosion.
Doctor Angus Smith's Solution (applied by hot dip).	Bitumen base. N.B.—The term bitumen is correctly applied only to a naturally occurring mineral substance which exudes from the ground, as in Trinidad. The term is loosely used to describe pitch—a by-product of petrol refining from crude oil; or coal tar pitch—a by-product of coal gas manufacture.	Cast iron drain pipes and fittings. Cast iron soil pipes and fittings.
Anthracene Oil (applied by cold brush or hot dip).	Oil. This oil is the present day counterpart of the older Angus Smith's Solution.	
Galvanising (applied by hot dip).	Adherent zinc film.	Mild steel tubes and fittings. Mild steel hot store vessels. Mild steel cisterns.
Plastics (Extruded on application).	Adherent, inert polythene "sheath."	Copper tubes for use in severely corrosive soils.
Electro-plating (applied by electrolysis).	Adherent electro-deposition of corrosion resistant metal, chromium for example.	Taps, copper tubes and fittings for towel rails, etc. Generally applied more for appearance than as true protection against corrosion.
Prepared wrappings (applied by hand or machine).	Petroleum jelly (Vaseline) or alternatively a bitumen base on hessian, cotton or a glass silk bandage.	Pipes and structures of all kinds exposed to severe atmospheric or soil corrosion.

TABLE 2.
Details of Pipe Sizes in Accordance with L.G.D. Provisional Specification—June, 1958.

Nominal size of Pipe Ins.	CLASS B.		CLASS C.		CLASS D.	
	Wall Thickness Ins.	Internal Diameter Ins.	Wall Thickness Ins.	Internal Diameter Ins.	Wall Thickness Ins.	Internal Diameter Ins.
$\frac{3}{8}$ " ..			0.04	0.39		
$\frac{1}{2}$ " ..			0.045	0.54		
$\frac{3}{4}$ " ..			0.055	0.68		
$\frac{3}{4}$ " ..			0.065	0.85		
$\frac{1}{2}$ " ..			0.085	1.09		
1" ..			0.105	1.36		
1 $\frac{1}{4}$ " ..			0.12	1.73		
2" ..	0.09	2.30	0.125	2.23	0.165	2.15
2 $\frac{1}{2}$ " ..	0.105	2.74	0.155	2.64	0.195	2.56
3" ..	0.125	3.29	0.18	3.18	0.235	3.07
3 $\frac{1}{2}$ " ..	0.145	3.65	0.205	3.53	0.26	3.42
4" ..	0.155	4.02	0.225	3.88	0.285	3.76
4 $\frac{1}{2}$ " ..	0.175	4.57	0.255	4.41	0.325	4.27
5" ..	0.195	5.12	0.285	4.94	0.365	4.78
6" ..	0.205	5.85	0.305	5.65	0.40	5.46

CLASS "B"—Suitable for Working Pressure of 87 pounds per square inch.
 CLASS "C"—Suitable for Working Pressure of 130 pounds per square inch.
 CLASS "D"—Suitable for Working Pressure of 173 pounds per square inch.

from page twenty-eight

alent to 200, 300 and 400 ft. head of water—87, 130 and 173 pounds per square inch.

Details of pipe sizes are set out in Table II.

It is particularly important that the plumber should note the considerable difference in the actual bore of a pipe from that indicated by its nominal size.

In the case of the smaller sizes of pipe with which the plumber is prim-

arily concerned, the actual bore is greater in each case than the nominal size. This fact should be taken into account when sizing pipes for any particular job. It will often be found possible to use a smaller pipe of hard PVC than would be necessary if conventional metal pipes were used. Further reference to this point will be made in a future article of this series dealing with the Hydraulics of Wavin Hard PVC Pipes.

The work of producing a specification for Polythene Plastics piping was considered in Britain during and after

World War II., and a British Standard Specification (No. 1972) was published in 1953. The details of pipes in accordance with this specification are set out in Table III. It is essential that the plumber note here a fundamental point regarding the working pressure of polythene pipes. Owing to the low tensile strength of this material, the wall thickness of pipes would be excessive if a constant pressure rating were retained for all sizes. Table 3 shows details of polythene pipe dimensions and working pressures as laid down in B.S.S. 1972/1953.

TABLE 3.
DETAILS OF POLYTHENE PIPES IN ACCORDANCE WITH B. S. S. 1972/1953.

Nominal Bore Ins.	NORMAL GAUGE			HEAVY GAUGE		
	Wall Thickness Ins.	Inside Diameter Ins.	Working Pressure Lbs./Sq./In.	Wall Thickness Ins.	Inside Diameter Ins.	Working Pressure Lbs./Sq./In.
$\frac{3}{8}$ " ..				0.151	0.375	270
$\frac{1}{2}$ " ..	0.093	0.50	135	0.173	0.494	230
$\frac{3}{4}$ " ..	0.125	0.75	100	0.173	0.750	150
1" ..	0.125	1.00	80	0.173	1.00	115
1 $\frac{1}{4}$ " ..	0.125	1.25	65	—	—	—
1 $\frac{1}{2}$ " ..	0.140	1.47	65	—	—	—
2" ..	0.187	2.001	65	—	—	—

from page twenty-three

Oil burner controls

- Check that the oil and electricity supply is at the burner. Most elementary but always the first job of the service engineer.
- Burner fails to start. If there is no operation at all check thermostats or pressure switches to ensure they are calling for heat. Has fluestat been removed for cleaning—was it reset when put back into

flue?

- Burner starts but no flame. Check for ignition spark—are electrodes clean? If necessary use test probe on control box terminal for ignition to check supply to transformer. If spark is there and motor runs check for oil.
- Burner starts, flame ignites but control box goes to lock-out.

Check fluestat stem is clean. If photo cell check cell and glasses are clean. Change photo cell and amplifier valve (if used). Is flame stable enough for flame sensing device to pick up the effects?

It can be seen therefore that a knowledge of the sequence and timing involved can be a great help in determining where the failure occurs, just as careful installation and maintenance can reduce the possibility of such failures.



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