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

# THE IRISH PLUMBER & HEATING CONTRACTOR



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SEPTEMBER, 1961





SPECIAL SURVEY—HOT WATER SUPPLY—Page Seventeen

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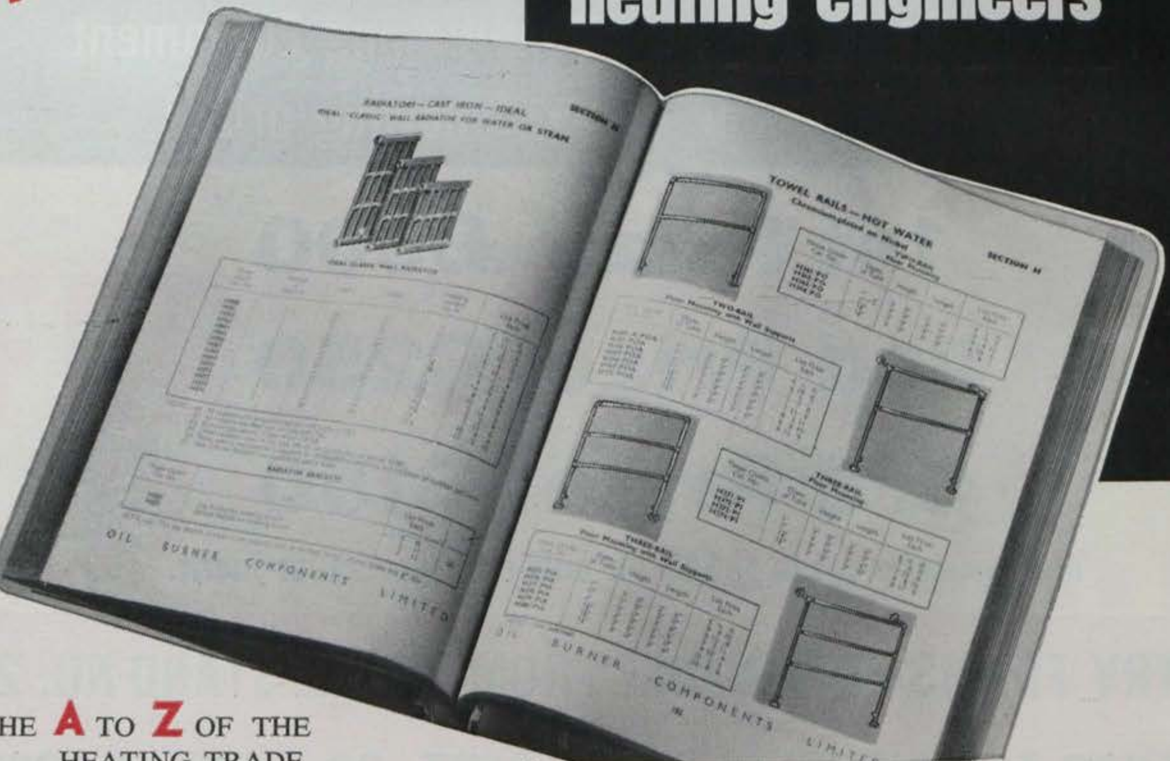

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*September, 1961.*

# THE IRISH PLUMBER & HEATING CONTRACTOR

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**SEPTEMBER, 1961.**

## IN THIS ISSUE



## INDEX TO ADVERTISERS





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# hot water supply systems for domestic use

the author

JOHN G. BOLTON, Lecturer in Plumbing and Heating at the College of Technology, Bolton Street, Dublin.

LAST month the selection and installation of domestic hot water boilers was discussed, and it is intended in this article to examine some of the various systems of pipework needed for the completion of a satisfactory hot water installation.

Most hot water systems depend on gravity circulation to move the water from the boiler to the cylinder, and it is interesting and instructive to follow the development in this country of methods based on this type of circulation.

Prior to about 1880, hot water systems as we now know them, did not exist, the usual method in the houses of the wealthy being a cast-iron tank fitted in the kitchen range so that one side of the tank acted as part of the firebox. A brass plug cock was provided at the base of the tank so as to project from the front of the range and thereby allow the hot water to be drawn off. Great care had, of course, to be taken to re-fill the tank with cold water when the hot was drawn off. Failure to do this resulted in the firebox side becoming red hot, and it needs no great imagination to know the result if the cold water was then poured in!

As fuel and labour were cheap in those days, this system lasted for some time, the only improvement being the provision of a small tank with a ballcock (sometimes a converted W.C. cistern) on the same level as the boiler tank and connected to it by a pipe so as to maintain a constant water level and so remove the hazards of hand filling. **(Fig 1).**

It is evident that with this method, hot water could only be obtained from the plug cock on the range front, and if required on the upper floors, had to be carried by hand—a procedure tolerated because the "servant problem" did not then exist.

The next development in hot water systems proved a marked advance. The top of the range tank was sealed, and the supply cistern installed at the top of the house **(Fig. 2).**

This range tank—or boiler as it was then usually called—and the supply cistern were connected by two pipes, one to act as a cold feed from the cistern to the boiler, and the other to be an expansion or vent pipe and also to supply hot water draw-offs to the various floors.

We now had a hot water supply on each floor below the storage cistern or tank, but limited to the quantity of heated water contained in the range boiler, and with the serious disadvantage and danger of being able to almost empty the system by running the lower taps if the cold supply to the tank at the top of the house should fail.

This system, with the later addition of a hot store tank, became known in the trade as the Tank System and was in use in many of the larger houses during the early years of the present century. Several patented systems, based on this design, but with additions designed to remove all elements of danger, are at present on the market and are very satisfactory for installation in municipal and council housing schemes.

## Tank system

THIS method can be then summarised as follows:—

**Advantage:** Hot water was available at all taps even when the lower taps were in use because the hot water storage tank was overhead.

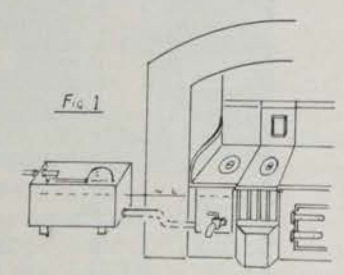
**Disadvantages:** (1) If the cold supply to the store tank failed, it was possible to almost empty the complete system by running the lower taps, so resulting in the boiler becoming overheated, with every possibility of an explosion should the cold water then enter it.

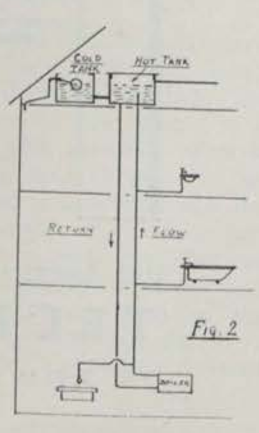
(2) Large heat loss due to the long flow and return pipes between the store tank and the boiler. Insulation was not taken seriously then!

(3) Possibility of roof timbers being saturated with moisture or vapour from the hot water store tank, if a cover was not provided, as was often the case.

With the improvement in living conditions during the years 1920-30,

continued page seven




TANK SYSTEM

and the greater attention to hygiene, the provision of a hot water system became a necessity instead of a luxury in the average dwelling house, and so the cyclinder system **(Fig. 3)** came into its own. It had many advantages over the tank system which now became obsolete, and these may be summarised as follows:—

## *Cylinder system*

**Advantages:** (1) Small heat loss because the hot water cylinder and boiler were only a short distance apart. In the average two-storey dwelling, the distance is usually never more than about 10 ft., and in many cases less. The cylinder, being in the lower part of the house, may be boxed in, and used as an airing cupboard. (Contrast the long flow and return pipes of the tank system).

(2) Except by the use of a drain cock provided solely for repair purposes, the system cannot be emptied by running the hot water taps as all branches are taken off above the cylinder. This means that we always have a safeguard of about 30 gallons of water which would have to be evaporated before danger would arise should the incoming cold supply to the store tank fail.

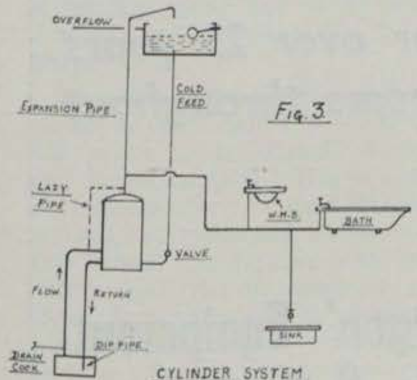
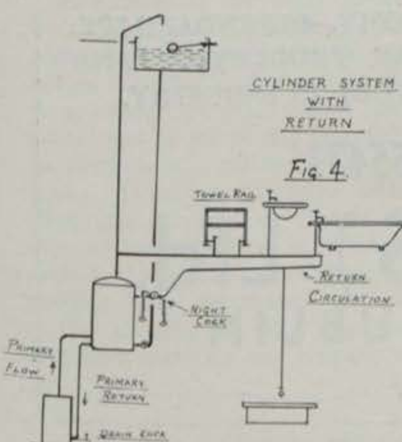



Fig. 3

CYLINDER SYSTEM




CYLINDER SYSTEM WITH RETURN

Fig. 4

*from page five*

# hot water supply systems

**Disadvantages:** (1) As the hot water storage cylinder is installed as near the boiler as possible, it will mean that when a hot tap is opened, especially on the upper floors, a time-lag will occur before hot water flows from the tap. In the meantime the cold water already in the pipe is usually allowed to run to waste—a sore point with water authorities!

(2) When the lower taps in the house are opened, the supply to those above will fall to a dribble or even stop, due to the cylinder being at a lower level. (Note that this did not occur with the old tank system).

## *Flow connections*

WITH the standard hot water cylinder as supplied to the trade in Ireland, the flow and return tappings are situated near the base. It has been contended, however, that if the flow tapping was fitted higher up, better circulation would take place, the heated water immediately entering the top of the cylinder without being cooled by having to pass through the cold water in the lower part of the cylinder. With this change, the main advantage would be in the quicker heating up of the cylinder from cold, especially in the mornings when the boiler is lit.

In an effort to achieve this with existing cylinders some installations are fitted with a by-pass pipe from the flow to the expansion. This is termed a "lazy pipe" **(see sketch).** Its main purpose is to provide quick hot water for shaving, etc. It enables the hot water from the boiler to by-pass the cylinder and go straight to the open tap. As the bore of this pipe never exceeds ½in. it does not interfere with the ordinary circulation to the cylinder.

The cylinder system has proved very successful for the average house, and over 90% of hot water installations are based on this method.

In the case of the larger house, however, the time-lag problem proves

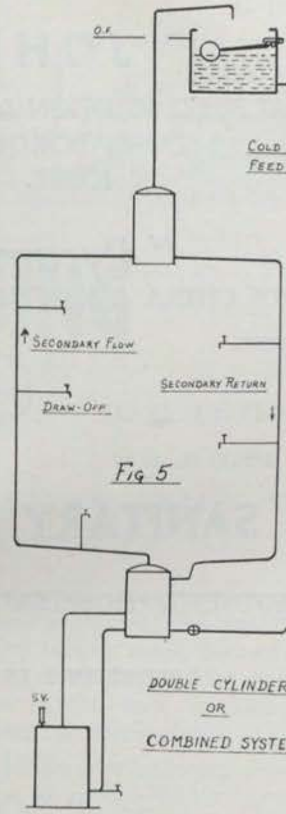



Fig 5

DOUBLE CYLINDER OR COMBINED SYSTEM

a drawback, and also a serious waste of water, because the average person tends to wait until hot water flows from the tap before he puts the plug in the basin or sink, as the case may be.

## *Secondary return system*

THIS time-lag can be prevented by fitting a secondary circulation on the existing cylinder system **(Fig. 4).** In fact, with some water supply authorities, where a hot tap is situated more than 25ft. away from the storage cylinder, a secondary circulation **must** be fitted in order to prevent waste of water.

It will be noted that the secondary return enters the cylinder at a point about one-third of the way from the top, and is occasionally fitted with a "night cock" **(see sketch).** This is simply a plug cock fitted with an open/shut handle somewhat like the old type gas lamps. The idea is that at night the cock will be shut, so stopping the secondary circulation and thereby conserving the heat in the cylinder. In the morning, the valve is re-opened and circulation restored in the circuit.

*continued page forty*

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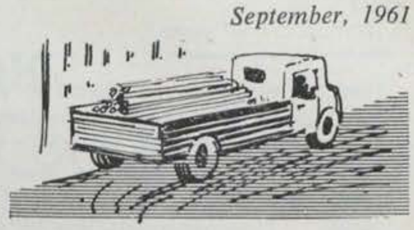
*Increasingly the plumber uses plastics in his day-to-day work and this series of articles propose to deal thoroughly with their applications to the trade.*



# PLASTICS IN PLUMBING

PART THREE

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.*

IN our last article we considered the sizes of pipe available in the two main piping materials, namely, hard PVC and Polythene. It is now proposed to consider the methods in which these pipes are joined to each other and to fittings. Firstly, however, we must look at some of the special properties of hard PVC and Polythene.

In the workings of hard PVC in the making of joints and bends and other fittings use is made of the property known as Elastic Memory. This means, that if a piece of hard PVC pipe is heated to a temperature of about 130°C (266°F) it will become soft or rubber like. If this softened section of pipe is then formed into a socket by pushing it over a warm steel mandril, or if it is bent using a bending spring and then immediately cooled, it will retain its new shape.

However, if the pipe socket, for instance, is again heated to a 130°C it will revert to its original diameter and cylindrical form. This is a most important property of hard PVC and is used, as mentioned elsewhere in this article, in forming the most widely used type of watermain pipe joint. It is also used in connection with joints for smaller pipes and in forming flanged connections and bends.

Polythene on the other hand may be softened at a much lower temperature. Boiling water may be used to soften the pipe in order to insert into it a copper or brass sleeve used in some type of joints and in order also to form small radius bends on the pipe. However, polythene does not have the property of Elastic Memory, so that the type of shrink joint used for some hard PVC pipes is not possible with polythene.

The jointing of two sections of polythene pipe, for low pressure work, by heating the ends of the pipe and pressing them together while in the soft condition is used. Skill and practice is required to make consistently good joints.

## Joints for small bore hard PVC pipes

THE joint which has found widest application to date for the joining of small diameter hard PVC pipes is the solvent cemented or solvent cold weld joint. In the case of a hard PVC pipe, a socket is formed on the end of one pipe and is of such size that it gives an interference fit with the spigot of the pipe to which it is to be connected. It has been the practice in a number of countries for manufacturers to recommend that the socket is made on the site by the plumber, using the spigot of the pipe as a mandril to form the socket on the next length of pipe.

The socket is then marked, so it can be accurately reassembled again and when it has been cooled it is dismantled and the inside of the socket and the end of the spigot wiped free of any dirt or oil which may be adhering to them. A solvent type cement, such as that manufactured by Wavin Pipes Ltd, is then painted on the spigot of the pipe and on the inside of the socket. The spigot is immediately pushed into the socket and left undisturbed for some minutes.

It must be emphasised here that the cement used for this purpose is of the non-gap filling variety and, in fact, does not act as an adhesive or glue, of the type we are familiar with in use on other applications. The solvent cement, in fact, softens the outside of the pipe spigot and the inside of the socket and these two surfaces weld or fuse together—hence the name used in some countries of cold welded joint.

My company maintains strict accuracy in the manufacture of their pipes, and consequently joints for these pipes may be made with preform sockets either formed in the factory or formed by the plumber himself in his own workshop, using a standard steel mandril.

Fittings for reducing from one size pipe to another and for connection to copper piping are also available with pre-formed sockets to which pipe may be directly connected. Wavin make a full range of fittings for connecting to standard stopcocks, taps, ballcocks and other items used in the plumbing trade. British standard threads are used on all screwed fittings.

## Joints for small bore polythene pipes

THE British Standard sizes for polythene pipes were based on the assumption that the pipes would be coupled by use of compression fittings or methods used in the connection of copper and galvanised iron piping. The normal gauge tube is suitable for connection by means of the compression fittings used for copper pipe and recently special fittings applicable to polythene only have been developed. On the other hand, heavy gauge pipe has a wall thickness suitable for screwing to B.S. 21 type thread.

Fittings involving a fusion process are also on the market for use with polythene pipes. In some of these fittings heat must be applied from an external source to mould together the mating faces of the pipes and the fittings. In the case of one patented

*continued overleaf*

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

*from previous page*

type the fitting has moulded in electrical elements. These are connected to a battery—such as a motor car battery, which is used to heat the elements and thus cause fusion of the joints. However, this type of joint does not seem to have been accepted generally by plumbers who tend to use the compression joint and joints now on the market in which a cement or adhesive is used to connect the pipe to the fitting.

Owing to the long lengths in which polythene piping can be made available, the question of a special joint for jointing pipes is not of such importance as in the case of hard PVC pipes.

In so far as plumbing is concerned the large dimensions of polythene pipe and of the fittings render it rather unsightly. Moreover, its flexibility means that close spacing of pipe clips is required. This again leads to an ugly layout due to the multiplicity of clips.

Polythene, however, has been used extensively for internal plumbing but is definitely losing ground in this field, as figures from both Britain and the Continent show. As mentioned in a previous article, 95% of the polythene pipe made and installed in Britain is used for agricultural purposes.

## Joints on large diameter hard PVC pipes

**FOR** hard PVC watermain pipe a number of different joints are available. In Holland, Germany, Italy and Ireland a joint known as the Shrink Type joint, incorporating a rubber ring, is extensively used and has had great success. For this joint a socket is formed in the factory on one end of the pipe. A rubber ring of suitable size is placed on the spigot end of the other pipe and it is arranged that it is free from twist. This is accomplished by rolling the rubber ring along the pipe spigot between the palms of the hand and then bringing it to rest at a point about ¼" to ½" from the end of the pipe spigot. The pipes are lined along the side of the trench on trestles or heaps of sods and are lined up with one another. The pipe spigot with rubber ring in place is pushed into the socket, so that the rubber ring rolls along the spigot and comes to rest at a point midway along the pipe socket.

Heat is then applied to the pipe socket by means of a propane or butane gas torch. The flame must be played over all parts of the socket, working from the back of the socket towards the open end. Care must be taken to avoid overheating of the hard PVC material. This is accomplished by maintaining the flame in constant motion and not allowing it to dwell at any time on a particular part of the pipe. Owing to Elastic Memory the hard PVC socket shrinks down on the spigot and the rubber ring, forming a watertight joint. Contractors in Ireland have such confidence in this joint that they backfill their trenches completely before testing, so confident are they that they will have no failure.

A second type of joint which has been used on the Continent and is used in Britain extensively is the cemented or cold welded joint. This joint involves the making of an accurately formed socket on one end of the pipe. A cement of the solvent or of a filler type depending on the tolerances used in the socket manufacture is applied to the spigot and the inside of the socket.

Some manufacturers recommend an application to the spigot only. The spigot is immediately pushed home into the socket and left undisturbed for some time.

## Two types of this joint

**TWO** types of this joint have been proposed and used. In one the spigot and socket are parallel. The other, referred to as the Taper Joint, has a taper type socket. Some joints of this type have the spigot end of the pipe also tapered to form a mating fit with the socket. When the socket and spigot, or spigot only, have been coated with cement the joint is then pulled together with a special puller device and held in that position for some time.

Other manufacturers recommend the use of a parallel or unaltered spigot, which has an interference fit with the taper socket at a point near its entrance. The softening action of the cement used to join the two sections of pipe means that the spigot and the socket are slightly deformed when the joint is being made, and they must be held together until the cement has had time to act.

In all cases the manufacturers' instructions for the jointing of pipes must be carefully adhered to. In particular, attention must be paid to the cleanliness of the mating parts of the two pipes.

Wavin Pipes Limited manufacture pipes of the watermain sizes with joints of what is termed the filler cement type. A special cement manufactured by Wavin is used to connect a parallel spigot with a socket of the parallel type.

It is of interest to note that informed opinion in Britain now tends to favour the Shrink Type joint, using a rubber ring rather than joints of the cemented type.

## *in brief . . .*

### *FOR OLYMPIA*

*THE latest design of a new "Sirocco" air conditioning unit, operating on the evaporative cooling principle, will be shown by Davidson and Co. Ltd., Belfast, at the Heating, Ventilating and Air Conditioning Exhibition (Stand 134) Olympia, 26th September—6th October, 1961.*

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### APPOINTMENTS

**Powell Duffryn Heating Limited—the newest member of the Powell Duffryn Heating Group—have announced the following appointments:**

**Mr. A. H. Davies as Marketing Manager; Mr. L. Robinson as General Manager of the Janitor Works, Camberly; Mr. J. Morton, as Sales Promotion and Training Officer; and Mr. F. J. McCann as Publicity Officer.**

★ ★ ★

### *NEW VOLUME*

*A 403 page volume entitled "Domestic and Commercial Oil Burners—Installation and Servicing" has recently been published by the McGraw-Hill Publishing Co. Ltd., 95 Farringdon St., London, E.C.4. (52/6d.).*

*Compiled by Charles H. Burkhardt, National Secretary of the Distribution Division of the Oil-Heat Institute of America, the book in 35 chapters cover all types of burners, their parts, controls and accessories.*

★ ★ ★

### VOKES GROUP

**Also exhibiting at the HEVAC Olympia exhibition later this month will be three members of the Vokes Group of Companies — Vokes Limited, Oxy-Catalyst Sales Limited, and Vokes Genspring Limited. These companies will show all their products covering their very wide applications throughout the air conditioning fields.**



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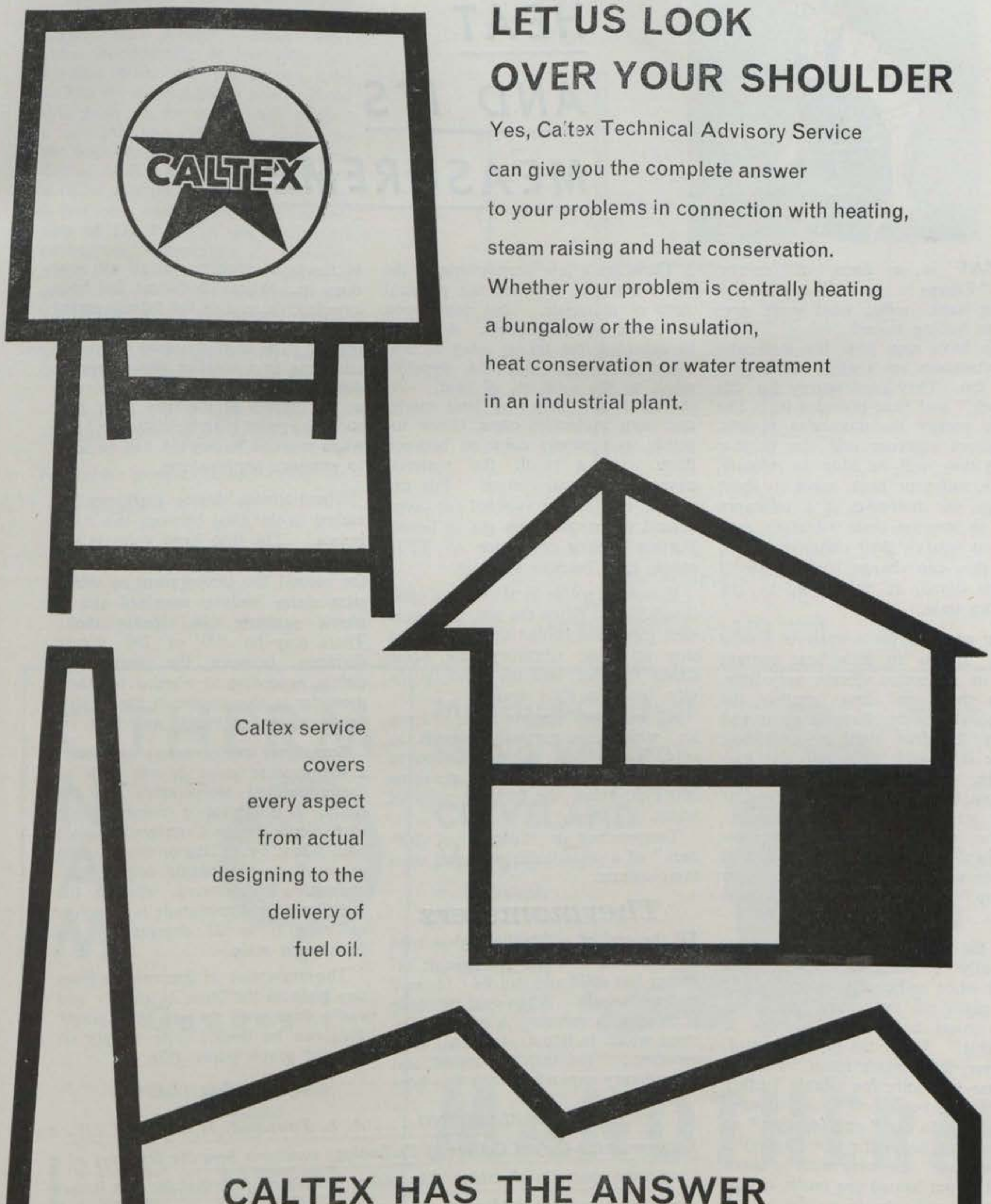
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Building Services Engineering, Vol. 1 [1961], Iss. 6, Art. 1

# HEAT AND ITS MEASUREMENT

HEAT is a form of energy. "Energy" means capacity for doing work. But what work goes on in boiling water?

We have seen how the molecules of substances are always vibrating to and fro. They need energy for this "work," and heat provides it. The more energy the molecules possess, the more vigorous and the further apart they will be able to vibrate. Given sufficient heat input or heat energy, the molecules of a substance can so step up their vibratory rate, and so weaken their cohesive bonds, that they can change from the solid to the liquid, or the liquid to the gaseous state.

For example, ice is water in a solid state. It has so little heat content that its molecules vibrate very little. Since they are close together, the cohesion between them is great and ice is therefore rigid, or solidified. If ice is heated, the molecules gain energy, vibrate further apart, and weaken their cohesive bonds. The solid ice changes into liquid water. Further heating of the water increases the heat energy until the molecules vibrate so strongly that they actually "jump" out of the water to form steam.

In the same way, solder, which is normally a solid metal, becomes liquid when sufficiently heated. Mild steel pipes are not easily bent when cold, unless a bending machine is available. When the pipe is heated, however, it is much more bendable because its molecules vibrate further apart, lose some of their cohesive force, and do not "pull together" so hard. The hotter the pipe, the easier it is to bend. But care must be taken that it is not heated too much, or the molecules will vibrate so far apart that the metal will melt and become liquid.

These are a few illustrations of the effect heat can have on the physical state of materials. No doubt you can think of many more. As might be expected, the taking away of heat from a material has the opposite effect to the addition of heat. As materials cool they lose heat energy and their molecules come closer together with greater cohesion between them. As a result the material changes its physical state. For example, if steam is cooled or condensed it changes from gas to liquid. Further cooling of water to 32°F. causes it to become solid ice.

If molten solder is allowed to cool, it solidifies. When the hot, bent mild steel pipes are cooled their molecules slow up their vibratory rate, come closer together, and the bend in the pipe becomes rigid again.

All materials contain heat. Even ice, which one normally regards as cold, is very hot in comparison to liquid air, which exists at some 300°Fah. below the freezing point of water.

Temperature or "degree of hotness" of a material is measured on a thermometer.

## Thermometers

IF the end of a fine bore glass tube is heated to a dull red heat, it becomes less solid and can be "blown" to form a bulb. When cold this bulb is filled with mercury, a metallic element which is liquid at normal temperatures. The bulb is warmed, and the mercury expands up the fine bore of the tube, pushing out all air as it does so. When all the air has been expelled, the end of the tube is sealed off by having its edges melted together. The mercury cools down and contracts to a smaller size, dropping down towards the bulbous reservoir at the bottom of the tube as it does so. The result is an instrument which, when marked in degrees, can be used to measure temperatures.

Thermometer degree markings are etched in the glass between two fixed points. The first fixed point is the temperature at which ice melts, and the second the temperature at which pure water boils at standard atmospheric pressure (14.7 lbs./sq. inch). There may be 100 or 180 degree divisions between the two fixed points, according to whether the thermometer is to measure in the Centrigrade or the Fahrenheit scale **(Fig. 1)**.

Sometimes it is necessary to convert a temperature given in one scale to the equivalent temperature on the other. It is helpful to remember that each single degree Centrigrade equals 180/100ths; i.e., 9/5ths or nearly twice as much as each single degree Fahrenheit. Furthermore, whereas the freezing point Centrigrade is 0 degrees or zero, it is 32 degrees on the Fahrenheit scale.

The conversion of temperature from one scale to the other is quickly and easily done with the aid of a graph. This can be made quite simply on squared graph paper **(Fig. 2)**.

*Continued next column*

*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.*



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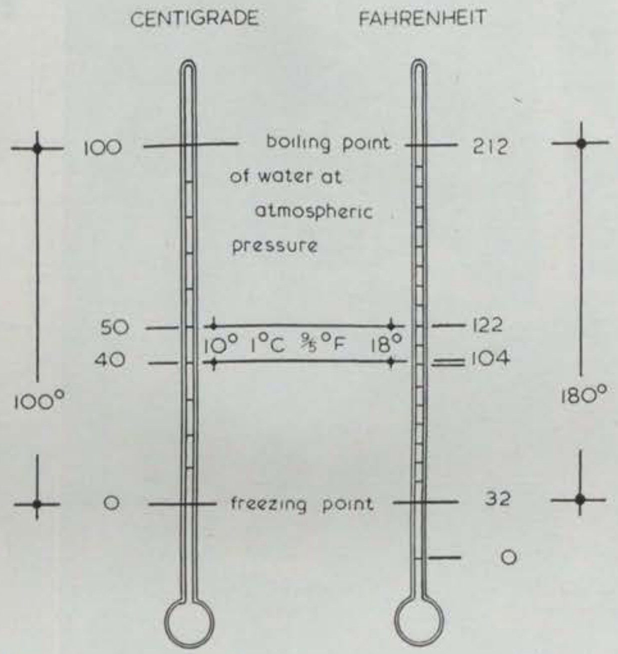
To use the graph, find the known temperature in its own scale on the graph. Then project a straight line, either horizontally or vertically according to the scale you are on, until its hits the sloping graph line. From this point on the graph line, project a straight line at right angles to the other scale and read off the new degree reading. This simple process is called interpolation, and in the **Fig.** it has been used to show the conversion of 122 Fah. to an equivalent centrigrade temperature. Alternatively, the example shows how the graph may be used to convert 50° Centrigrade to its equivalent Fahrenheit temperature of 122°. Other temperature conversions may be got from the graph in the same way.

Arithmetically, it may be done by memorising the following rules:—

$$\text{Fahrenheit temperature} = (\text{Centrigrade temperature} \times \frac{9}{5}) + 32$$

$$\text{Centrigrade temperature} = (\text{Fahrenheit temperature} - 32) \times \frac{5}{9}$$

*continued page fifteen*

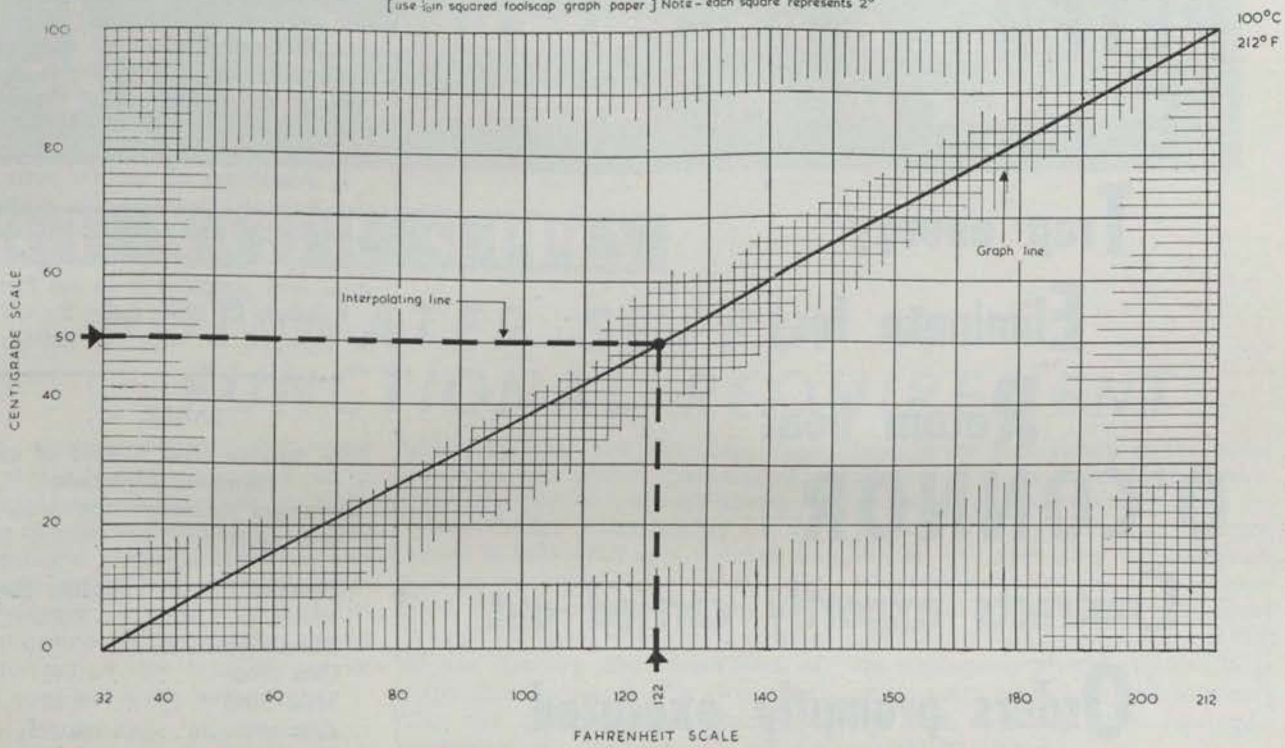



Thermometers

Graduations & Comparisons

Temperature Conversions by Graph

[use 1/10 in squared foolscap graph paper] Note - each square represents 2°




# HEAT AND ITS MEASUREMENT

*from page thirteen*

**Examples:**

i. Convert 4° Centrigrade to Fahrenheit:

$$(4^\circ\ C \times \frac{9}{5} + 32 = \frac{36}{5} + 32$$

$$= 7\frac{1}{5} + 32$$

$$= 39\frac{1}{5}$$ or 39.2 degrees fahrenheit.

ii. Convert 39.2 degrees Fahrenheit to Centrigrade.

$$39\frac{1^\circ}{5}\ F - 32 \times \frac{5}{9} = 7\frac{1}{5} \times \frac{5}{9}$$

$$= \frac{36}{5} \times \frac{5}{9}$$

= 4 degrees Centigrade.

## Quantity of heat—the British thermal unit

THE temperature of a material and the amount of heat it contains are two quite different things.

Consider a cupful of water and a bucketful of water both at 180°. Clearly it took more heat to raise the bucketful of water to 180° than it did to raise the cupful to 180°. Although they have the same temperature, the cupful and the bucketful of water contain quite different amounts of heat.

The amount or quantity of heat that a substance contains is measured in British Thermal Units. (Commonly abbreviated to B.Th.Us.).

One B.t.u. is the amount of heat required to raise the temperature of 1 lb. of water by one degree Fahrenheit.

If one B.t.u. of heat is put into 1 lb. of water to raise its temperature by one degree Fah.; and that cools down one degree Fah.; then one B.t.u. of heat will be given off. Since this is so, it is clear that a B.Th.U. can also be defined as the amount of heat given off by 1 lb. of water cooling one degree Fah.

It must be remembered that the B.t.u. relates only to the Fahrenheit temperature scale and so, although this is not always done, you should be careful to mention "degrees Fah." (or °F.) and not just "degrees."

Another much used "heat unit" is the therm. One therm represents 100,000 British Thermal Units of heat.

## Specific Heat

THE specific heat of a material is the amount of heat necessary to raise one lb. of that material one degree Fah. in temperature.

From what has already been said, it will be clear that the specific heat of water is 1 (one) because it takes one B.Th.U. to raise a pound of water one degree Fah.

Not all materials require this amount of heat to raise one pound by one degree Fah., and different materials have different specific heat values as Table A shows.

It will be seen that only 25/100ths or ¼ of a B.t.u. is required to raise a pound of air one degree Fah.

Mercury, too, has a low specific heat value and is consequently very sensitive to heat variation. This is one reason why it is used in thermometers.

Lead has a low S.H., and so has tin, although as will be seen tin requires more heat to raise its temperature one degree Fah. than does lead. In consequence tin takes longer to cool

*continued overleaf*

*from previous page*

down than lead, and this explains why one is sometimes troubled with "tin runs" out of the bottom of a wiped soldered joint. The more rapidly cooling lead solidifies in the solder joint whilst the tin is still liquid, and runs over the surface of the joint.

A knowledge of specific heats and the B.t.u. is necessary in work on domestic hot water and central heating systems. One or two examples will show how simple it is to use them.

**Example i.** How many B.t.u.'s will be required to raise 30 gallons of water from 50°Fah. to 150°Fah.? (Assume one gallon of water weighs 10 lbs.).

**TABLE A.**

**The Specific Heat Values of some Plumbing Materials.**

(Arranged in descending order of "heat capacity" or specific heat values).

| Material. | Specific Heat. |
|---|---|
| Water | 1.000 (One) |
| Aluminium | 0.212 |
| Cast Iron | 0.13 |
| Mild Steel | 0.12 |
| Zinc | 0.095 |
| Copper | 0.092 |
| Tin | 0.056 |
| Lead | 0.03 |
| Mercury | 0.03 |
| Air | 0.25 |

**The figures represent the amount of heat in B.Th.Us. necessary to raise one pound of material one degree Fah.**

B.Th.Us. required = Lbs. of substance x Specific Heat of substance x Temp. rise.

**Note:** Since the S.H. of water is 1 (one) we do not normally bother to write it into our calculations. The lbs. of water to be heated are simply multiplied by the number of degrees Fah. by which the temperature is to be raised.

= gallons x 10 lbs./gallons x 1 (S.H.) x (150°F.—50°F.).
= 300 lbs. x 1 x 100°F.
= 30.000 B.Th.Us.

*continued page forty*

**NEXT MONTH**

**HEAT—ITS EFFECTS ON PLUMBING MATERIALS**
**Coefficient of thermal expansion;**
**Thermal movement of pipework; and**
**Thermal movement of sheet metal coverings.**



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AN IRISH PLUMBER & HEATING CONTRACTOR SPECIAL SURVEY

# HOT WATER SUPPLY

## HOT WATER SUPPLY A FUNCTIONAL REQUIREMENT

AN adequate domestic hot water supply is properly considered to be an essential functional requirement of the modern home. Used for personal ablution, laundry, cooking and dishwashing, and for domestic hygiene, a good supply of hot water contributes much to health and comfort of all who enjoy the service of a good hot water system.

Larger buildings of domestic or commercial character have equally pressing need of hot water supplies, while some factories demand copious amounts for process and other needs. Such large scale services may differ in equipment design and, of course, equipment capacities from that employed in the smaller domestic dwelling, but the fundamental principles which underly the choice of system of hot water supply are common to each case and in this brief survey it has been decided to deal with those aspects which apply to domestic dwellings in particular.

**Local systems** may be described as those in which fuel, usually electricity or gas, is consumed within a storage or non-storage water heating appliance fitted near to the point of draw off.

Single point gas or electric water heaters are typical examples.

**Central systems** are those comprising one or more hot water storage vessels placed in a position centrally disposed to a number of dispersed draw offs. The common boiler—cylinder, boiler—hot store tank, or boiler—cylinder and hot store tank are three well known examples of a Central system of hot water supply.

**Non-Storage water heaters** are designed to heat water as it is drawn by way of the appliances. Clearly the rated fuel consumption of any non-storage appliance will have a bearing on the quantity and temperature of water that it delivers in a given time. This can affect the performance of equipment of this kind as will be shown later.

**Storage water heaters** are those which retain a quantity of water which is heated over a period of time for subsequent draw off as required within the capacity of the water content of the equipment and the recovery rate of the prime heat source.

With one isolated exception, which will be described later, all electric water heating appliances are of the storage kind.

### GAS APPLIANCES

**Gas heated Instantaneous** or " non-storage " type water heaters may be sub-divided into two groups—single point and multi-point. Heaters of both groups may have direct connection to the water undertaking's supply, where this is permitted, or alternatively they may be supplied from elevated cold feed cisterns. One **important installation point** with regard to cistern fed gas water heaters: the operation of the gas/water valve requires a minimum head of 8ft. measured vertically from the water level in the feed cistern to the outlet of the highest tap served by the heater.

**Gas supply pipework** to these appliances also needs careful attention so far as pipe-sizing is concerned, otherwise dismal failure of the equipment will result from an inadequate fuel flow. It should be remembered that the multi-point heaters and the large single point heaters as used to supply one bath, need a gas flow rate equal to 200 ft. 3/hour.

To achieve this the gas supply pipe to the appliance must be at least ¾in. if up to 10ft. long; 1in. for each foot thereafter to 20ft., and beyond 20ft. a 1¼in. dia. supply pipe may be required.

**Gas meters** too must be checked before final decision to install this type of appliance to an existing gas installation. In addition to the 200 ft. 3/hr. demand of the heater, the meter must be capable of passing enough gas to supply all other items of space heating or cooking equipment which might be in use at the same time as the water heater.

**Modern gas water heaters** are efficient, take up very little space, and in appearance they leave nothing to be desired.

**Flues** are required for gas water heaters with hourly gas rate in excess of 78 ft. 3/hr. Thus single point bath water heaters and all multi-point heaters need flue provision but the smaller single point heaters which find

*continued page nineteen*

*This special survey—the third in a series on important aspects of the plumbing and heating trades—has been compiled by technical expert A. L. Townsend, M.R.S.H., M.I.P., R.P.*

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# HOT WATER SUPPLY

*from page seventeen*

increasing usage at sinks and sometimes basins, are rated at about 72 ft. 3/hr. and no flue is needed.

The complete combustion of coal gas produces no harmful by-products but the heat, water vapour, and $C.O_2$. generation in the process of combustion could have discomforting effects in a confined space such as a bathroom.

**Balanced flue heaters** solve even this not insuperable matter of flues for gas appliances. By ingenious arrangement of air input products of combustion output at the same terminal point, a stability of pressure within the appliance is assured under all climatic conditions. As soon as the appliance is operated the flue or product of combustion column within the heater is hotter and therefore less dense than the fresh air input column and so the air flow for combustion is assured and the flue functions with efficiency and safety.

**Storage type gas water heaters** have a relatively low hourly gas rate and flue provision will depend upon this rate as previously described.

**Gas Circulators** offer a neat and effective " booster " for existing boiler-cylinder systems or it may be used as the sole heat source in periods of low demand, especially in summer.

## *Electric appliances*

**ELECTRICALLY heated instantaneous heaters** are available but on account of the limitations imposed by normal domestic wiring installations the current flow and, therefore, the quantity of water heated through a given temperature in a given time is also very limited. One currently advertised model is rated at 3kW and will produce about 1½ pints of water raised from 50°F. to 150°F. in one minute. Its application might be useful in an isolated local supply as for shaving water.

**Storage type water heaters** fall into three distinct groups as follows:—

1.—**" Open-outlet "** or non-pressure types. These are generally connected direct to the undertaking's supply. They are essentially local appliances intended to serve one sanitary appliance only. They are available in capacities of 1½ gallons for use at sink and basins, and in larger sizes of 5 to 12 gallons for supplies to baths. Recovery rates, i.e., period taken to completely re-heat content after withdrawal, depends upon the loading of the immersion heater fitted. For the 1½-gallon size this is usually 0.75kW, and for the larger sizes 1kW and 1.5kW respectively.

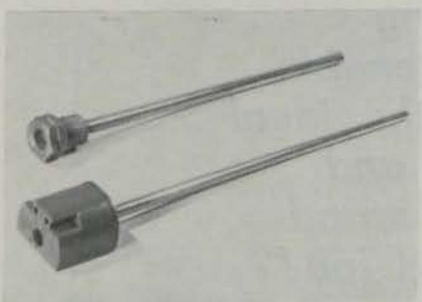
Discharge rates are good since the flow from storage heaters, of any type, is not dependent upon fuel flow rates. Only the water storage capacity of the appliance affects the quantity of hot water that can be drawn and this capacity must be carefully related to the assessed or known habitual needs of the family for whom the appliance is being selected.

The " under the basin " or " under the sink " non-pressure water heater of this type is a fairly recent innovation which offers great possibilities in the form of clean, automatic, efficient, unobtrusive, and economic installation as a local appliance, e.g., in bedrooms remote from any Central D.H.W. supply and where gas services are not available, easily run, or not considered desirable.

2.—**Pressure types**. These comprise a cylindrical hot store vessel of 20, 30, or 40 gallons capacity. They are provided with two thermostatically controlled immersion elements. One of these, situated near the top of the vessel and rated at 1kW, provides about 6 gallons of hot water constantly for sink or lavatory basin use. The other heater element is placed at the bottom of the vessel. This element is rated at 2kW and can be manually switched. Normally the lower heater is switched off so that only a small amount of heated water stratifies at the upper level of the hot store. When baths or laundry impose a greater demand for water the lower element is manually switched on some time before the anticipated demand arises.

The " U.D.B. " or under the draining board appliance is of this type. Its function is similar to that de-

*continued overleaf*



**• Pictured here is the new H.8 immersion thermostat from Messrs. R. B. Pullin and Co. Ltd., of Brentford, Middlesex.**

**Operation: The Pullin H8 immersion thermostat has been developed for accurate temperature control of electric water heaters. The shape of the head enables it to be incorporated in almost every immersion heater manufactured in accordance with B.S. 1556-1949. Alternatively the H8 thermostat can be supplied complete with its own pocket to enable it to be positioned away from the heating element.**

**Irish Agents: National Agencies, 7 Upper Camden St., Dublin.**

## *Cox water heaters*

**• Probably the greatest attraction which the Cox Water Heater has is its simplicity. There are no moving working parts or delicate controls to go wrong, and silent operation at all pressures and temperatures is assured.**

**The heater operates without steam traps, as steam is only consumed when the heater is in operation, so there is no question of heat loss by storage.**

**The instantaneous action of the heater requires no strainers and produces water at any temperature from cold to boiling, if required.**

**The size of the units throughout the range are quite small for the large output, being only a fraction of the size of an indirect heater.**

**There is a complete range of Cox Heaters for every possible application, from the small chromium-plated Baby Cox, which is suitable for wash-hand basins in factories, hospitals, or at any point where hot water is required.**

**Moving from the attractive Baby Cox Heater, we look at the industrial range, which can provide any quantity of hot water up to 25,000 gallons per hour.**

**The smaller of the industrial range, the Junior Cox, varying in size from ¾" to 2" connections, can produce any desired quantity and temperature of hot water for whatever industry demands.**

**Senior Cox Heaters have been fitted for the instantaneous and silent production of large quantities of hot water, such as is required for process work or pre-heating boiler feed water.**

**The Cox range of heaters are marketed by Messrs. Halpin & Hayward, Limited, Unity Buildings, 16/17 Lower O'Connell Street, Dublin, and Bedford Buildings, 7, Bedford Street, Belfast.**

# HOT WATER SUPPLY

scribed under Gas Appliances in which a circulator was attached to a cylindrical hot store to provide a gas-heated under draining board appliance.

**Electric Pressure Type Water Heaters** need provision of cold feed cistern and distributive pipework, vent pipe and "dead-leg" draw offs as for a simple form of boiler-cylinder system. (As also does its gas counterpart).

Head pressure must not exceed 60ft. but this is unlikely to present any problem in normal domestic application.

3.—**Cistern type.** In this arrangement the heater has an integral cold feed cistern. The capacities of these appliances vary from 5 to 30 gallons and electric ratings from 1 to 3 kW. It forms a complete hot water system in itself and can usefully serve, say, bath, basin and sink. Its only limitation would appear to be that it must of course be mounted above the highest tap it is intended to serve. This, however, presents no great problem for the appliance could be housed in an airing cupboard or, since they are obtainable in quite pleasing appearance, they may well be acceptable as wall mounted in the bathroom.

It is well known that electricity presents no flue or fuel storage problems

• The Sadia "Two Plus" electric water heater provides instant hot water for all the jobs done at the sink.

The unit gives a week's supply of hot water—100 gallons—for only 32 units of electricity.

Irish Agents: A. P. Haslam, 39 Lower Gardiner Street, Dublin.

The Sadia Unit is produced by Aidas Electric Ltd., at Northolt, Middlesex.







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# HOT WATER SUPPLY

and builders work and dirt are thereby eliminated—important factors worthy of serious consideration when running costs are being critically compared. One cannot make a monetary adjustment for amenity but the efficiency, ease of control, and absolute cleanliness of electricity does much to commend its well informed use as a fuel of to-day.

* * *

## *Previously described*

**ALL** appliances previously described, with the exception of the gas circulator applications and the pressure type electric water heater, were local appliances.

The term central system infers a centrally placed prime heat source, usually a solid fuel, gas or oil-fired boiler, coupled to a centrally placed hot store of sufficient capacity as carefully assessed to meet the needs of the establishment. From this central store hot water is distributed to taps throughout the building.

System design is a vast topic and beyond the scope of this survey. The more commonly adopted pipework arrangements will be well known to readers of this Journal. Mention might, however, be made to Direct and Indirect systems.

**The Direct system** applies where water heated in the boiler passes directly to the hot store vessel and thence to the draw offs.

**The Indirect system** applies where the heated boiler water circulates to some form of heat exchanger, usually a pipe coil or annular inner cylinder, and thereby the surrounding bulk hot store or secondary water is indirectly heated for withdrawal at taps as required.

**Application of the Indirect System** is desirable in the following circumstances:—

1. Where the hardness of the water

*continued page thirty-seven*


• The Burco E300 ten gallon electric washboiler with 3-heat control is shown here.

The container is of rustless anodized aluminium and the element load is 3kW.

Irish Agents: A. P. Haslam, 39 Lower Gardiner Street, Dublin.

***The original and best-known oil-fired central heating scheme***

# IRISH SHELL AND BP HOUSEWARMING

Irish Shell and BP Housewarming is the best known system of its kind because very heavy advertising has continually kept it in front of the Irish housewife. Hard-selling campaigns have hammered home the many advantages of Irish Shell and BP Housewarming, making Mrs. 1970 as familiar to the housewife as the woman next door. These campaigns have stressed the fact that the system can be paid for over a period by means of extended payments. And the speed and ease with which the local Irish Shell and BP Appointed Installer can install it. The special Irish Shell and BP Housewarming sign is boldly illustrated in every advertisement as the sign which means quick and efficient service. In short, everything possible has been done to ensure that when a housewife thinks of oil-fired central heating — she thinks of Irish Shell and BP Housewarming!

# IRISH SHELL AND BP 'HOUSEWARMING'

**THE ORIGINAL SCHEME FOR OIL FIRED CENTRAL HEATING IN THE HOME**

**IRISH SHELL AND BP LIMITED**
**SHELL-BP HOUSE,**
**FLEET STREET, DUBLIN 2.**

**Reporting**

# THE SHELL AND BP HOUSE WARMING PLAN

**In this series a Contractor reporter reviews the domestic heating plans operated by the major oil companies in Ireland.**

**DURING** the past two or three years, the average householder has become very much more conscious of home comforts. With the advent of television he will spend very much more of his time at home and will be more appreciative of the advantages given to him by warmth in the home.

Many of the researches carried out recently have shown that one of the luxuries that people are beginning to place high up in the list of requirements in the home is central heating, and for this reason Irish Shell and BP Limited pioneered a scheme to encourage the installation of oil fired central heating in the domestic market.

The first step in the campaign was to create a demand for central heating by advertising to the general public the great advantages of not only central heating, but central heating by oil. The main advantages have been so well advertised now that it is fully realised that for cleanliness, ease of operation and economy, oil is unsurpassed.

The central theme of Irish Shell and BP Limited's advertising is Mrs. 1970. She is the typical housewife who has, in 1961, what most housewives will have in 1970, oil fired central heating. She is lovely auburn-haired June Ganley, who was chosen from hundreds of applicants to "represent the housewife of the future" in the national advertising campaign both in Ireland and in the U.K.

Having created the demand for oil fired central heating, it was realised that one of the objections that the trade would have to overcome was the initial cost of installation. In order to assist in this, Irish Shell and BP Limited inaugurated a Credit Sale Plan in conjunction with the Mercantile Credit Company of Ireland Limited, which gave the installer the opportunity to offer to spread the cost of installation over one, two, three, four or five years, without any deposit being put down. This scheme also offers the customer the advantage of income tax being deducted at source, without him having to claim for it, and is the most convenient scheme of this nature available to the public. It also ensures the installer is paid in full on completion of the job and he is not responsible for any bad debts resulting at a later date.

In a further effort to acquaint the public with the advantages of oil heating, Irish Shell and BP Limited has encouraged merchants, and those installers with showrooms, to display equipment and, if possible, to install a working model, so that the housewife can sense exactly how the boiler would work in her kitchen.

**A group of appointed installers at the Shell and BP Domestic Heating Centre in Fulham during a practical session.**

## Demand

**HAVING** created demand and overcome any objections that the customer might have, Irish Shell and BP Limited set up a country wide network of appointed installers and is at present engaged in assisting them to train in every aspect of the selling, installation and design of oil fired heaing systems.

*continued page twenty-five*

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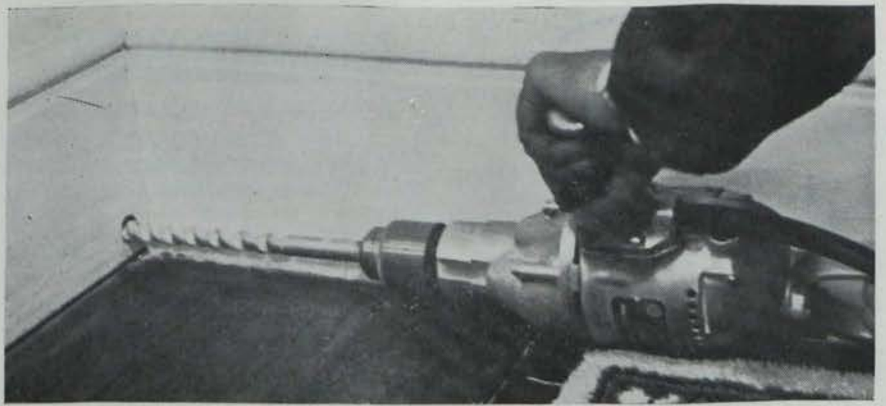

● **One of the modern methods of installation as learned at the Shell and BP Domestic Heating Centre—drilling for small bore piping.**

*from page twenty-three*

# THE SHELL AND BP HOUSE WARMING PLAN

At the excellently equipped Domestic Heating Centre in Fulham, installers and merchants can attend the most thorough courses on the practical and theoretical aspects of heating as well as the best method of selling the scheme to the customer. There are five different courses available, all lasting a week, and many installers have already taken advantage of them.

## Advantages

Other advantages of the Shell and BP House Warming Plan to installers over and above the training and Credit Sale plan, is co-operation with design and share-payment advertising, the payment of painting of installer's vans, assistance with such things as the Shell and BP Heat Loss Calculator and the production, shortly, of the Appointed Installers Hand Book which will be their text book of oil fired central heating.

Many manufacturers of oil fired boilers have availed themselves of the vast technical backing provided by the laboratories and design engineers of Irish Shell and BP Limited's associated companies and have evolved with them the best burners and boilers on the market to-day. This is proved by the fact manufacturers of boilers, such as Perkins, Wilson, Redfyre, Portway, etc., exclusively recommend BP Domesticol for their vaporising burners and Shell Domestic Fuel Oil for their pressure jet burners. Many of the latest developments in the oil firing field has stemmed from this close co-operation.

Throughout Ireland, the installers and merchants are guided and assisted by technical representatives covering the whole of the country and are beginning to look upon them as the source of information and guidance concerning the latest developments in this market.

They also keep in close contact with builders and architects to ensure that they have the answers to any of the requests they get from the general public, more and more of whom are availing of the advantages offered by the original scheme for making oil fired central heating available to all the households through the length and breadth of Ireland. This scheme is supported by the availability of a delivery service for oils second to none throughout the country and one which will ensure prompt, courteous and efficient attention to any order placed with one of the many strategically situated depots throughout the country.

## Service

This all adds up to the Shell and BP House Warming Plan which, with the co-operation of all the parties involved in it—merchants, installers, builders, architects, manufacturers—gives the modern housewife the service she expects when she decides to investigate the most up-to-date heating system available, namely, oil fired central heating.

# GALA HEATING APPLIANCES NOW MADE IN IRELAND

A reception was held late last month in the Shelbourne Hotel, Dublin, by A.E.I.-Gala Limited to mark the commencement of the manufacture of Gala heating appliances in Ireland.

The announcement that the complete range of A.E.I.-Gala heating appliances are to be manufactured by Plessey (Ireland) Limited at their Swords factory comes from A.E.I.-Gala after only two and a half years in this country.

Speaking at the reception, Mr. F. R. de Garrs Hewitt, General Manager, A.E.I.-Gala, said that Gala appliances were being exported to over 50 countries but Ireland was still the most important single market.

In his address, Mr. P. N. Walsh, Area Manager for Ireland, outlined the new range of Irish-made Gala heaters.

There were two basic models, he said—the Gala Convector (which gives general heat) and the Gala Superglo (a radiant fire, for direct heat).

Also present were: Mr. J. L. Clague, Projects Manager; Mr. K. L. Mennell, Marketing Services Department; and Mr. A. A. Farrell, Director and General Manager of Messrs. Plessey (Ireland) Limited.

## Appointments

● **Two appointments to the Board have been made by Richard Baxendale & Sons, Ltd., Bamber Bridge, Lancashire, manufacturers of Baxi fires and heating systems.**

**Mr. Stanley M. Thornley, F.C.A. (left), has been appointed Commercial Director, and Mr. Ian C. Smith, B.Sc. (Metallurgy), Technical Director.**

# Questions Answered

*Each month this column will solve some of the everyday problems of the plumbing and heating engineer when our consultants deal with queries directed to "Questions Answered." All queries will be replied to and the most interesting published.*

**A customer reports that the boiler in his sitting room grate works very well and heats the cylinder quickly, but complains that when he relights the fire in the morning the hot pipes vibrate and give off a banging noise. I should like to hear your views on this problem.**

THE alarming noises complained of could be caused by recurrent air locks within the back boiler itself. The questioner does not mention whether this is provided with side or top flow and return tappings, but in either case if a space in which liberated gases could accumulate does exist these noises can sometimes be traced to this cause.

The more likely cause in this instance is what is known as "Reverse Circulation."

Gravity circulation is promoted by the differing densities of water at different temperatures. If the vertical flow water column is hotter than the return column an unbalance of water weight results and the heavier, cooler return water falls by gravity to displace the lighter warmer water up the flow pipe. Thus, circulatory motion continues so long as there is a temperature difference between the ascending flow and the descending return pipes.

## Circulation slows

As the temperature difference between flow and return lessens so the rate of circulation slows. If the two temperatures were identical or balanced no circulation would occur at all, e.g., when the system is first filled with uniformly cold water.

If little or no hot water is drawn for long periods from an efficiently heated system, then a uniformity of temperature will tend to arise in flow and return columns with resultant slowing of circulation until it barely moves at all.

If, in this condition of near temperature stability, the fire is allowed to go out, the circulation pipework will continue to lose heat to the cooler surrounding air. The rate of heat loss, and therefore rate of cooling of the flow and return water columns, will be related to the surface area of respective pipework exposed.

If the flow pipe is longer than the return, and this happens with back boilers coupled to cylinders with high level flow connection, then the flow pipe will lose heat, and cool quicker than the return pipe. In such circumstances the flow pipe water will become cooler and therefore heavier than the return pipe water and a new unbalance of densities will arise to promote a new circulation down the flow pipe and up the return pipe—just the opposite direction to normal circulation.

## Dissipate heat

This "Reversed Circulation" will continue throughout the night to slowly dissipate the heat stored in the water of the hot store vessel.

This initial reversal of circulation does not of itself cause any noise but when the fire is re-lit in the morning the boiler water content begins to locally re-heat, and this heated water, subject to greater weight of the return column, tries to rise up the flow pipe.

Two opposing forces are thus arraigned one against the other, the water falling down the flow pipe in continuance of the reversed circulation and the newly heated boiler water trying to move up the flow pipe.

Eventually these opposing forces resolve themselves, with the resultant stoppage of the reversed circulation and a restoration of circulation in the normal direction. It is the resolution of these forces which gives rise to the frightening banging and vibration of the pipework.

From the above it will be seen:
**1.** That circulatory motion will take place so long as there is a temperature difference between the ascending and descending columns of water.
**2.** The descending column will always be the one at lower temperature.
**3.** The cause of reversed circulation is an abnormal unbalance of water column temperature due to more rapid cooling rate of the flow column under conditions of no fire but near uniformity of hot water temperature throughout the system.

## The cure

**The Cure:** Clearly, the heat losses from the flow pipe must be reduced or the system so arranged that return pipe heat losses will always be greater than flow pipe losses. The following alternatives suggest themselves as effective cures.

**1.** In new work, where system layout indicates that flow and return pipes will be of similar lengths, use a low-level flow tapped hot store cylinder. In this way the flow length will be reduced by the amount it would otherwise pass up the outside of the cylinder to a high level tapping. The flow pipe should continue vertically inside the cylinder to within 9 ins. from the crown in order that a relatively small amount of hot water may be drawn soon after lighting the fire under the boiler.

**2.** In existing work, apply some form of insulation to the flow pipe but **not** to the return pipe. This will ensure a lesser heat loss from the flow with assurance that its water content will be always higher and therefore lighter per unit volume than the return pipe water, hence circulation in normal direction will result at all times.

# TENDERS

...**Dublin County Council** (North Co. Dublin Regional Water Supply Scheme).—Tenders are invited for the supply and installation of electrically driven pumping plant in accordance with specification and form of tender obtainable from Messrs. N. O'Dwyer Son and Partners, Consulting Engineers, 6 Burlington Road, Dublin. The works include provision of pump capable of livering 315,000 gallons per hour against a head of 55 feet and three clear water pumps, any two of which must be capable of delivering 345,000 gallons per hour against a head of 248 feet. Latest date for receipt of tenders in official envelope provided is 12 noon, October 16, 1961.

* * *

**Limerick County Council** have invited tenders for the following three schemes:

1. Ardagh Sewerage Scheme.—For the construction of a complete sewerage scheme for Ardagh in accordance with the drawings, specification and Bill of Quantities prepared by Chevalier Patrick J. Sheahan, K.S.S., F.R.I.A.I., M.I.C.E.I., Consulting Engineer, 47 O'Connell Street, Limerick, from whom contract documents may be obtained. The works include, the provision and laying of 1,022 lin. yds. of 6" dia. sewers and 427 lin. yds. of 9" dia. sewers; provision and laying of 1,097 lin. yds. of 4" dia. rising main in either spun iron P.V.C. or A.C. pipes; laying of house connections, erection of Ventilating shafts and the construction of 26 No. manholes; and construction of a Disposal Works, consisting of balancing tank, settlement tank, percolating filters, humus tanks, sludge beds and pump house. Sealed tenders should be delivered to the Secretary, Limerick County Council, 82/83 O'Connell Street, Limerick, not later than September 22, 1961.

2. Ardagh Sewerage Scheme—for the provision and installation of two complete sets of pumping plant in the Council's two Pumping Stations at Ardagh, Co. Limerick, in accordance with the plans and specifications prepared by Chevalier Patrick J. Sheahan, K.S.S., F.R.I.A.I., M.I.C.E.I., Consulting Engineer, 47 O'Connell Street, Limerick, from whom contract documents may be obtained.

The Pumping Plants required are as follows:—(a) Main Station: Two 65 g.p.m. vertical spindle sewage pumps. (b) Disposal Works: One 50 g.p.m. vertical spindle sludge and liquor pump.

Sealed tenders should be posted to the Secretary to arrive not later than September 22, 1961.

3. Castleconnell Water Supply Extension.—For the provision and laying of 2,900 lin. yds. of 4" dia. Class B watermain, as an extension to the water supply system at Castleconnell, in accordance with the drawings, Specification and Bill of Quantities prepared by Chevalier Patrick J. Sheahan, K.S.S., F.R.I.A.I., M.I.C.E.I., Consulting Engineer, 47 O'Connell St., Limerick, from whom contract documents may be obtained.

Sealed tenders should be delivered to the Secretary not later than September 22, 1961.

* * *

**Clare County Council** (Ennistymon-Lahinch Water Supply).—Tenders are invited for the construction of the above scheme in accordance with contract documents prepared by Messrs. P. H. McCarthy & Son, Consulting Engineers, 26 Lower Leeson St., Dublin. The contract comprises the following works:—

(a) The construction of settling tank, filters, chemical house and filter control room.

(b) The construction of two service reservoir having a capacity of 185,000 gallons and 60,500 gallons.

(c) The laying of approximately 14,078 lineal yards Class B water mains.

Contract documents may be obtained at the office of the County Secretary, Courthouse, Ennis. Tenders, in sealed envelopes marked "Ennistymon-Lahinch Water Supply," will be received by D. Blackwell, County Secretary, up to September 22, 1961.

* * *

**Donegal County Council** (Falcarragh Sewerage Scheme).—Tenders are invited for the supply and installation of a 50 gallon ejector pump with air compressor and receiver for the Falcarragh Sewerage Scheme, in accordance with the general conditions of contract, specifiation and drawing prepared by the County Engineer, from whom contract documents may be obtained.

Sealed Tenders should be forwarded to the County Secretary, Lifford, Co. Donegal, to arrive not later than September 29, 1961.

* * *

**Templemore, Co. Tipperary, Urban District Council** (Water and Sewerage Schemes).—Tenders are invited for the construction of House Connections to existing sewers, and the reconstruction of existing water distribution system in the town of Templemore, in accordance with the Plans and Specification prepared by Michael Cantrell, B.E., M.I.C.E.I., of Nicholas O'Dwyer, Son & Partners, Consulting Engineers, 6 Burlington Road, Dublin, from whom copies of the Contract Documents may be obtained.

The work comprises the construction of approximately 80 house connections to sewers entailing the laying of the following provisional lengths of sewers:

1375 L. yds. 4" stoneware pipes.
764 L. yds. 6" stoneware pipes.
30 L. yds. 9" stoneware pipes.
and ancillary fittings,

together with the improvement of the water Distribution System in the town of Templemore entailing the laying of the following provisional lengths of watermain:

20 L. yds. 7" C.I. class B pipe.
60 L. yds. 6" C.I. class B pipe.
60 L. yds. 5" C.I. class B pipe.
600 L. yds. 4" C.I. class B pipe.
660 L. yds. 3" C.I. class B pipe.
900 L. yds. $\frac{1}{2}$"-$\frac{3}{4}$" C.I. service pipes
and ancillary fittings.

Sealed tenders, addressed to the Town Clerk, Town Hall, should arrive not later than October 2, 1961.

# F. H. BIDDLE LAUNCH INTERNATIONAL "IDEAS" COMPETITION

MESSRS. F. H. BIDDLE LTD. have recently launched international competition for ideas on new or improved heating, cooling or air conditioning equipments.

The organisers ask would-be competitors: " How would you improve heating and air conditioning?"

The following prizes will be awarded: 1st prize, £500; 2nd prize, £250; 3rd prize, £150. In addition, further special awards of £20 will be given to entries of particular merit.

A distinguished panel of judges will consider each entry.

Entry forms are available from the Irish agents: Messrs: Quadrant Engineers, 6 Mount Street Crescent, Dublin.





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NEW PRODUCT

# HEAT METERS

BY means of a thermocouple an EMF is produced causing a current which is constanly proportional to the amount of heat delivered by the radiators. Thus, the quantity of mercury precipitated in an electrolytic electricity meter is an indication of the heat, delivered by the radiators.

**The formula:** The delivery of heat (Q), of a radiator, is determined by the formula:

$$Q = cS\,(Ta - Tr)$$

where S = heating surface of the radiator.

Ta = average temperature of the radiator.

Tr = ambient temperature (room temperature).

c = transmission coefficient of the radiator.

c is depending upon the type of radiator used, its size, construction, height, etc. (ref. Rietschel: Leitfaden für Lüftungs-und Heizungsanlagen). c varies a trifle with the temperature, but within the temperature ranges of a heating plant c can be counted on as being approximately constant.

For the determination of the EMF in thermocouples we have the following formula, which renders sufficient accuracy in practice:

$$E = a\,(T_1 - T_2)$$

where $T_1$ = the hot junction temperature in °C.

$T_2$ = the cold junction temperature in °C.

a = a constant depending upon the metals used.

a can be counted on in most cases as being approximately constant within the ranges of temperature used for the said purpose.

If more thermocouples are connected in series, and exposed to the same temperatures, the formula will read:

$$E = an\,(T_1 - T_2)$$

where n = number of thermocouples.

As stated above, the coefficients c and a varies with the radiator-temperature. They both increase at rising temperature, and the variations are of the same order of magnitude. If thus a battery of thermocouples in series is mounted on each individual radiator, so that the cold junctions are exposed to the average temperature while the hot junctions are exposed to the average temperature of the radiator, it is seen that, by comparing the first and last equations, there is a proportion between the delivery of heat of a radiator and the EMF of the corresponding thermobattery when the overall proportion is the same between the number of thermocouples on a radiator and the quantity cS for the radiator in question.

**This article, which outlines the basic principles of the heat meter, has been compiled by the Technical Department of Messrs. Kemp and Lauritzen of Denmark. Irish agents for these K. and L. products—illustrated here — are Technical Sales Co., 79 Lr. Leeson Street, Dublin.**

When all the elements are connected in series with an electricity meter in a closed circuit where the internal resistance is constant, a current proportional to the delivery of heat will, at any time, flow through the meter.

The number of thermoelements on each radiator must correspond with the quantity cS, the latter of which may be called the giving-off power of the radiator in question as it signifies the quantity of heat given off by the radiator per 1 hour per 1° of the temperature difference.

In the case of hot water plants, a value for c must be chosen, which corresponds with a temperature difference of 40 to 50°C.

Fig. 1 illustrates a calorimeter plant for three radiators. The thermobatteries are connected in series, and connected up to the joint meter.

If a radiator is to be hidden in some kind of a cover the delivery of heat is reduced, and if this is ignored, the calorimeter will in fact indicate more than it should. Consequently, the number of thermoelements in the batteries mounted on the radiators in covers, have to be reduced in the same proportion as the radiator cover would reduce the delivery of heat.

## *How the metering plants are carried out*

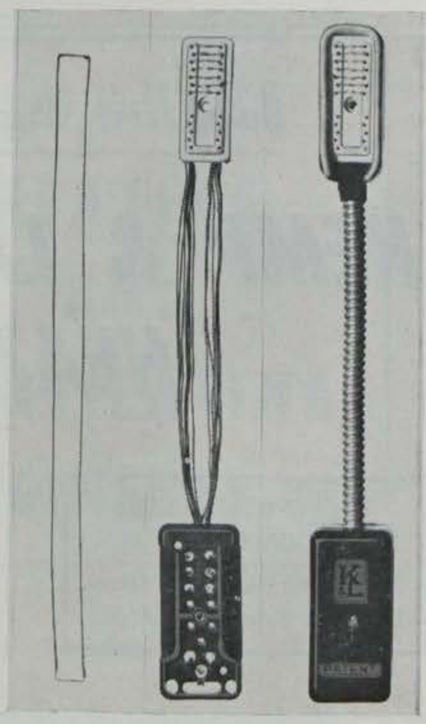
Fig. 2 illustrates the electrolytic meters employed. In the measuring glass about 32 divisions of mercury which have been precipitated by a normal consumption of heat during a season will cover a substantial part of the scale, in order to reduce wrong readings. The glass tube, however, must never be filled-up to the bulb as, in that case, it would be impossible to take readings.

For practical purposes the meters must be uniform, and in order to secure this, the meter is fixed with an adjusting resistance.

In accordance herewith a constant

*continued overleaf*

**Fig. 1**



*from previous page*

# HEAT METERS

is adopted for each meter, and this constant is stamped on the meter plate (see Fig. 2).

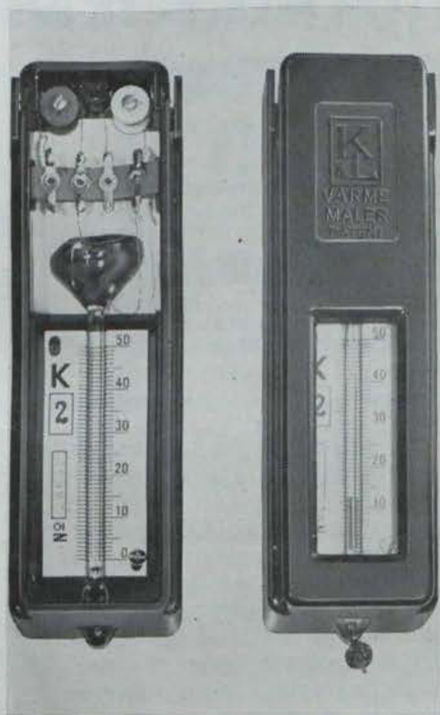
The consumption of heat is determined by the constant multiplied with the number of divisions read.

The meters are usually placed in halls or other accessible rooms. The meters may also be centralized and mounted on a joint board in the basement.

In the thermobatteries the hot junctions are fitted on porcelain with metal covering. The cold junctions are fitted in a bakelite box, and the wires between are protected by armoured tubing.

**Mounting Thermobatteries:** The hot junction being mounted on the back of the radiator, and sealed with lead at the fixing point, and the cold junction mounted on the wall. The connections between the thermobatteries and the meter to be cable for weak current. This is laid under the floor-boards in the case of new buildings, and otherwise along the skirting-board.

**Fig. 2**






NEW PRODUCT

## Packaged Small Bore Central Heating System

A new packaged small bore central heating system named the Baxi-Pak, costing approximately £150, including complete installation and a Baxi underfloor draught fire, has just been marketed by Baxi, Bamber Bridge, Lancashire.

The system is for whole house heating, designed to operate with a Baxi fire and back boiler of the tubeless type which never requires cleaning and wastes no room space.

The Baxi-Pak itself consists of a radiator output boiler, radiators with


brockets and blanking piece, towel rail and compact electric circulating pump.

The Baxi-Pak for a 16" fire has two radiators 20½" high and 32" long, and two 20½" high and 45" long. The 18" fire size includes an extra 15 sq. ft. area radiator.

The Irish Baxi agent—Mr. A. G. Smyth, 99 Upper Rathmines Road, Dublin—hopes to introduce the new Baxi-Pak in the near future.

## Correction

REPORTING in the July issue, the new "Centramatic '35'" automatic oil-fired central heating boiler presented by Newton Chambers & Co., Ltd., of Sheffield, we listed Messrs. Ravensdale & Co., Capel St., as Irish Agents. This should have read Messrs. Baxendale & Co. Ltd.

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# thermal insulation values

By A. L. TOWNSEND, A.M.I.P., M.R.S.H.

THE progressive plumber should be able to explain to his clients the advantages to be gained from the relatively small cost of employing proper thermal insulation for hot store vessels and pipework and for the walls, floors and roof of a house.

The function, types and properties of insulating materials generally were outlined last month together with an example showing possible economic advantages.

**The Thermal Insulating Values** of building materials and purpose made insulating materials need to be understood and confidently applied if useful comparison between different materials is to be made.

**The Overall Thermal Transmittance** or quantity of heat in **B.t.u's per hour** that will pass through **one square foot** of material area when the **temperature difference** on its two faces is **one degree Fahrenheit**—is denoted by the symbol **U.**

**U Value or Thermal Transmittance Tables** are published and conveniently list those values for most types of building materials and methods of construction. TABLE I. is a short, simplified version of a **U** value Table. It will help those new to this work to quickly understand the purpose and value of the more complete tables which appear in various Books on heating as essential aids to the first steps in designing central heating systems.

**TABLE I.**

**Heat Transmittance Coefficients (U values) in B.t.u./Sq.Ft./hour/deg.F.**

| | | |
|---|---|---|
| **Walls.** Brickwork. | | |
| Solid, unplastered, | 4½in. thick | 0.69 |
| | 9in. thick | 0.5 |
| Cavity wall, plastered (unventilated). | 11in. thick | 0.31 |
| ditto. (ventilated) | | 0.36 |

A cavity wall is built of two separate 4½in. walls or "skins" with a 2in. air space between.

| | | |
|---|---|---|
| **Glass:** | | |
| As in single glazed windows | | 1.0 |
| **Doors:** | | |
| 1½in. thick | | 0.42 |

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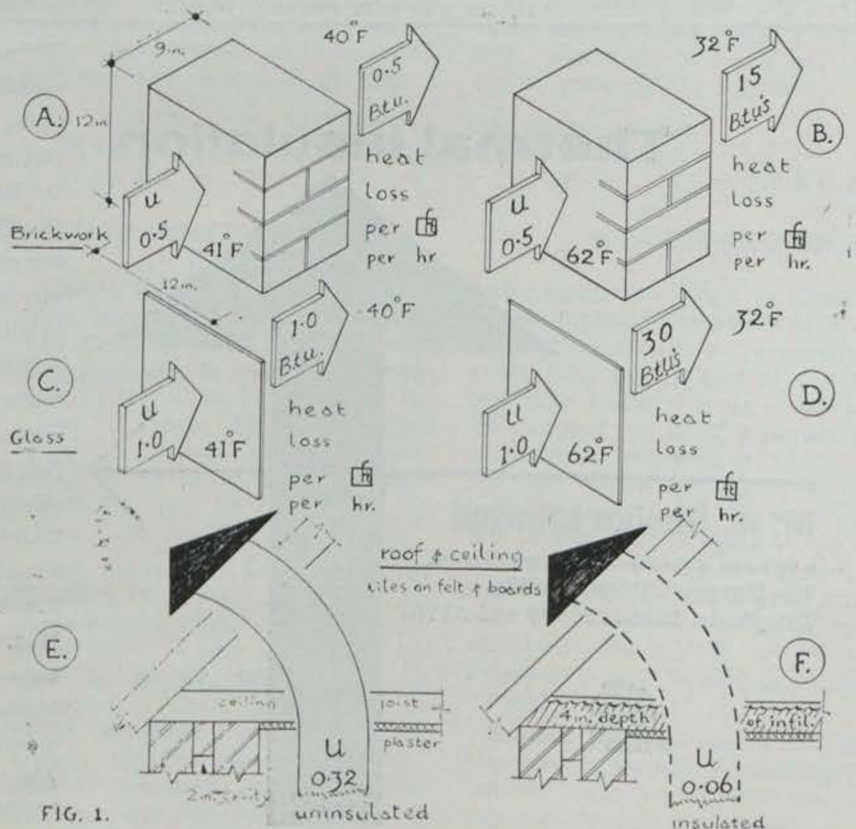


FIG. 1.

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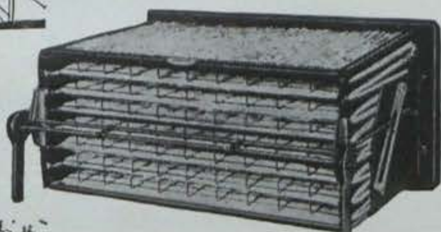
Perfected by years of research and development in the Vokes laboratories and in the field, the K.600 'Kompak' air conditioning filter is the most efficient as well as the most widely used of its type. Features which have led to its popularity include long life, reliability and extreme ease of maintenance.

Efficient air conditioning filters are essential in the provision of clean air inside buildings of all kinds. Impurities in the air supplied to factories can cause contamination of products or damage to valuable plant; in public buildings unfiltered air shortens the life of furnishings and decorations. Vokes K.600 'Kompaks' are installed in the air conditioning systems of large commercial and industrial office blocks, factories and engine test houses, public libraries and picture galleries, hotels and cinemas, concert halls, hospitals, multiple stores and establishments for scientific, pharmaceutical and photographic research and processing.



*You can trust K 600 'Kompak' because like all Vokes air filters it is fully tested in accordance with BSS. 2831.

**Simply constructed and using an inexpensive, easily replaced filter medium, the K.600 'Kompak' has a normal rating of 600 cubic feet per minute with an initial resistance of 0.15 inches w.g. The actual velocity of the air passing through the developed area of the filter is only 22.5 feet per minute. Tested in accordance with BSS.2831, using highly penetrating test dusts, the 'Kompak' recorded an efficiency of 95% against Aloxite 50, and 93% against Aloxite 225. Write now for comprehensive literature on the 'Kompak' and 'Vokes' other air filters to:**

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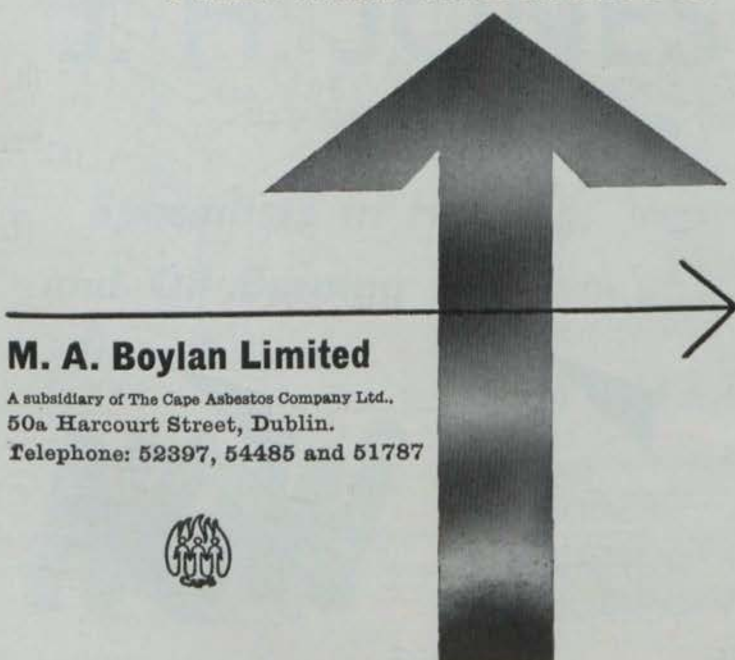
# Thermal Insulation



We are the foremost **insulation** specialists in the country **with** many important **insulation** contracts to our credit. **The huge** Oil Refinery at **Whitegate and** the Derrinlough Briquette **factory** are recent examples. **If you have** any heat-loss problem, **discuss** it with our highly experienced technical staff. Our recommendations are offered free and without obligation.

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*from page thirty-three*

# thermal insulation values

**Ground Floors:**

| | |
|---|---|
| Wood floor on joists (ventilated underneath) .. | 0.40 |
| Solid floor, i.e., concrete on hardcore laid direct on ground .. | 0.26 |
| **Roofs.** Flat: | |
| Asphalt on 6in. thick concrete | 0.70 |
| Ditto but plastered on underside | 0.61 |
| Asphalt on 6in. thick concrete with 1in. thick cork slab beneath .. | 0.22 |
| Ditto but plastered on the cork .. | 0.21 |
| Asphalt on 6in. thick concrete with 2in. thick cork slab beneath .. .. .. .. | 0.13 |

N.B.: the increasing value of cork as thermal insulant.

**Pitched.**

| | |
|---|---|
| Tiles on battens (no felt underlay) | 2.0 |
| Tiles on battens, felted .. .. | 0.78 |

N.B.: the insulating value of the felt which reduces draught in the roof space.

**Ceilings.**

| | |
|---|---|
| Plaster ceilings with tiles above .. | 0.64 |
| Ditto but with boards **and** felt beneath tiles .. .. .. | 0.32 |

N.B.: In this case the boarded and felted roof reduces the heat loss to **half** that which occurs with an unboarded, unfelted roof.

**Note:** A wall facing North will lose more heat than a wall facing the warmer South. This is allowed for in the more complete tables just as allowances for greater exposure to cold winds are. This simplified table gives U values for surfaces rather severely exposed to the wind and facing N.W.

**Remember:** The figures on the right hand side of the table are the U values. These figures indicate how many B.t.u.'s of heat will pass through one square foot of the given material in one hour for each one degree F difference in temperature on its inside and outside faces.

**Application:** You will see that the U value for a 9in. unplastered wall is given as 0.5. This simply means that each square foot of such wall surface will pass 0.5 or ½ a B.t.u. of heat each hour from the warmer inside face to the cooler outside face for each degree F. temperature difference between those faces.

*(see examples)*

## Examples

**Example 1.** If the temperature difference was only one degree F. then the quantity of heat loss per hour would be:—

| Area of Surface | x | U value | x | Temperature difference | |
|---|---|---|---|---|---|
| 1 sq. Ft. | x | 0.5 | x | 1°F. | = 0.5 B.t.u./hr. |

**See also diagrams A & B, Fig. I.**

**Example 2.** If the temperature difference was 30°F. then the hourly heat loss through the one sq. ft. of 9in. brickwork would be:—

| Area of Surface | x | U value | x | Temperature difference | |
|---|---|---|---|---|---|
| 1 sq. Ft. | x | 0.5 | x | 30°F. | = 15 B.t.u.'s/hr. |

**Example 3** will show that small as these losses might appear to be, they do mount up when a larger surface area is considered as is the case when computing heat losses for central heating design.

Suppose a wall of 9in. unplastered brickwork is ten feet long and eight feet high. Its internal temperature is at 62°F. when the external air temperature is at 32°F. What will be the hourly heat loss through this wall?

| Area of Surface in sq. ft. (L x B) | x | U value | x | Temperature difference inside and outside. (62°F−32°F=30°F diff.) | |
|---|---|---|---|---|---|
| 80 sq. ft. | x | 0.5 | x | 30F. | = 1200 B.t.u.'s/hr. |

**Example 4** enables you to compare the insulation value of the solid 9" wall as Example 3, with another method of building the same wall in brickwork. Suppose an 11 in. cavity wall was used instead of the 10ft. x 8ft. 9in. brick wall. What would be the hourly heat loss?

From Table I you select the U value for the cavity wall. This is 0.31. Again, the heat loss is worked out or computed as follows:—

| Area of Surface in sq. ft. | x | U Value | x | Temperature difference inside and outside. | |
|---|---|---|---|---|---|
| 80 sq. ft. | x | 0.31 | x | 30°F. | = 744 B.t.u.'s/hr. |

Clearly, the cavity wall construction offers better thermal insulation value than the 9 in. solid wall although there is no greater thickness of brickwork in the 11 in. cavity wall. The 2 in. air space between the two "skins" or "leaves" of 4½ in. brickwork forming the cavity wall, is largely responsible for the reduced heat transmission.

You will see that Table I gives two U values for cavity walls, 0.31 for **unventilated** cavities, i.e., where the air in the cavity is kept almost still, and 0.36 (a greater heat loss) for **ventilated** cavities, i.e., those with air bricks permitting the passage of air between the two 4½in. wall " skins." This air movement takes away heat more quickly than still air would do and so where the best insulation value was sought, the unventilated cavity wall construction would be chosen.

**The Structural Insulation** of floors, walls and roof needs to be considered at the early design stage of any new building. Example 4 has shown how the architect can select materials and methods of construction which are not only strong enough to be load bearing but are better thermal insulators as well. By so doing he can obtain the two important functions—structural stability and a good standard of thermal insulation—more effectively and at less cost than if insulation is later applied as an afterthought.

**Existing buildings** can be thermally improved by the simple application of suitable insulation between the ceilings and the cold roof spaces.

*continued overleaf*

*from previous page*

# thermal insulation values

The plumber can do this easily, using infil materials poured to sufficient depth between the ceiling joists or, alternatively, using flexible quilted materials laid between the joists or draped over them. This simple form of structural insulation will stop most of the heat loss to the cold roof space. The heat which would be otherwise lost is retained within the living spaces to the immediate benefit of the occupants for the house will be warmer, dryer, more comfortable and generally much more healthy to live in.

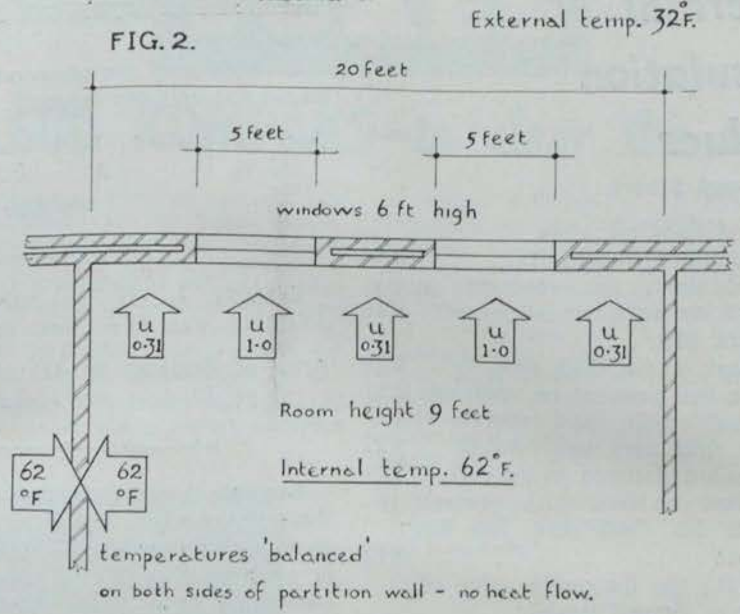
According to the type and thickness of material used, an ordinary dwellinghouse can be improved in this way for as little as £7 to £10.

**Diagrams E and F of Fig 1** show comparisons of uninsulated ceilings and insulated ones. Table 1 gives the U value of a ceiling with tiled, felted and boarded roof above as 0.32 B.t.u.'s/sq.ft./hr./Deg.F. difference in temperature on both sides. The same roof—ceiling construction with a 4 in. thickness of glass fibre insulating material laid between the ceiling joists has a U value of 0.06. This shows the insulated roof to be FIVE times more resistant to the passage of heat than the uninsulated one.

Suppose the total roof area involved was 100 sq. ft. and that the air temperature outside was 32°F. when the room temperatures below the roof were 50°F. (assuming the rooms to be bedrooms, 50°F. is sufficiently high a temperature for comfort), you can easily work out the total heat losses per hour for both insulated and uninsulated roofs. You may be surprised by the remarkable saving in heat—and in consequence, of fuel—that sensibly applied thermal insulation can provide.

**The Computation of Heat Losses** through building structures forms an interesting and essential first step to-toward the design of central heating systems. The heating plant must be sized so as to produce sufficient heat to warm the building to the desired temperature and to maintain this warmer interior temperature by making good the continuous hourly heat

FIG. 2.




## Computation of structural heat loss

It is advisable to set down working in systematic manner as below:

| Material. | Dimensions (in feet). | Area (in sq. ft.) | | U Value. | | Temperature difference inside and outside. | | B.t.u.'s heat loss per hour. |
|---|---|---|---|---|---|---|---|---|
| Single glazing to windows. | 5ft. x 6ft. (Twice). | 60 | x | 1.0 | x | 30°F. | = | 1800 |
| Brkwk. 11in. cavity wall (unventilated). | 20ft. x 9ft. Less window area. | 120 | x | 0.31 | x | 30°F. | = | 1161 |
| | | | | | | Etc., for ceilings, floors, doors, etc. | | |

NOTE:—The window area is but one-third of the wall surface and yet the glass loses more heat than the brick wall surface area. Compare the relative U values of the two materials.

losses through walls, floors, roofs, doors, windows, etc.

This involves the use of U value tables and from what you have seen, this is not difficult—it just needs plenty of practice to get used to doing it. Further applications up to the design of full sized heating systems will be dealt with in the next issue of the journal. These will offer useful guidance and practice in this important branch of modern plumbing work.

In the meantime it will be sufficient to understand what is meant by the term "U value" what it measures, and how it can be usefully employed to compare the thermal insulating values of different materials and methods of building construction.

**Another Simple Application** is illustrated in **Fig. 2.** Part of a room plan is shown. Dimensions, temperature conditions, and the method of computing the structural heat losses are also shown.

Study this carefully and follow the working, which is just the same as in the previous examples.

Compare the hourly heat loss through the smaller area of window glass with the hourly loss through the higher U valued walls.

Now you should be able to draw a

*continued page thirty-nine*



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# HOT WATER SUPPLY

*from page twenty-one*

would cause dangerous, uneconomic, precipitation as impediment to water flow and heat transfer from fuel to water.

2. Where in corrosive waters some discolouration of hot water might result at the boiler and primary circulation and issue from taps if a direct system was used.
3. Where it is desirable to have D.H.W. supply and some measure of space heating by radiators from the one prime heat source—the boiler.

**Special equipment** has been developed to provide economy of capital cost and economy of accommodating space for equipment. The "Rolyat" and the "Fortic" products are worthy of consideration and the "Primatic" indirect cylinder, which obviates the need for the separate feed-expansion cistern for primary water as used on the conventional indirect system, offers a measure of economy.

**Boilers** for D.H.W. supplies have improved considerably in efficiency, whilst in appearance many are no longer recognisable as boilers and might well be mistaken for refrigerators! Now an oil-fired boiler with a balance fire as described for gas water heaters is available. These boilers need no brick-built fire.

*continued overleaf*

## *Extensive Santon Range*

THE range of products produced by Messrs. Santon Ltd., at their works in Newport, Mon., England, in the field under review, is quite staggering.

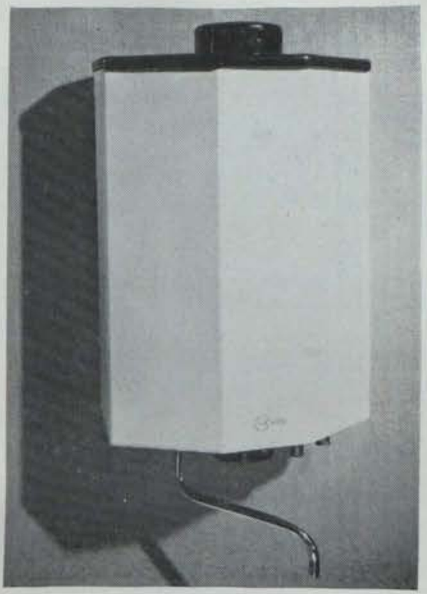
We list here a number of these products drawn from the comprehensive Santon Industrial Catalogue.

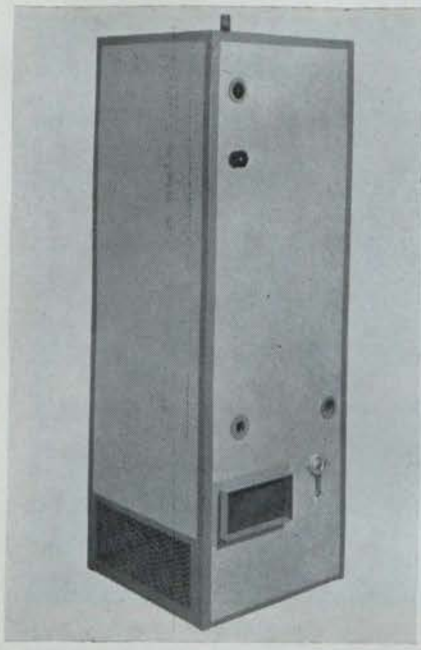
- A wide range of industrial water immersion heaters of the removable, fixed and non-withdrawable element types.
- The QX Type hot water circulator for electric heating of central heating systems, etc. A test run of this circulator showed the production of 10,200 B.t.u.'s per hour at 3kW.
- The "Newlyn" S12/2 sink storage water heater produced by Radiation New World Ltd., North Circular Road, London,

The unit is designed to meet all domestic requirements at the sink or wash basin, ensuring a hot water service with two gallons of hot water always available.

The outer casing and top are finished in white and black vitreous enamel and the hot water outlet spout is chromium plated.

Irish Agent: Mr. C. S. Rolls, 115 Crawfordsburn Road, Bangor, Co. Down.





# NEW BIDDLE "WARM FLO" HEATER


● Pictured here is the new "Warmflo" product developed for the domestic market by F. H. Biddle Limited, London. The "Warmflo" provides in one compact unit all the advantages of a warm air heater plus a means of storing domestic hot water.

Consisting of a hot water to air transfer coil (similar to a car radiator), and indirect hot water storage cylinder and a centrifugal fan and motor set, the "Warmflo" is designed to be incorporated into the normal hot water service installation in a similar way to the ordinary indirect cylinder (the pipe connections are actually the same).

The system can equally well be heated by an oil or gas fired boiler or by the normal solid fuel domestic hot water boiler, preferably thermostatically controlled.

The neat construction of the "Warmflo" enables it to be easily fitted into a cupboard or some out-of-the-way space. It is capable of heating to comfort temperature, the lounge, diningroom and kitchen (or bedrooms as selected), of the normal semi-detached or detached two to three bedroomed house or bungalow. Alternatively, if required, it can provide background heating throughout.

The warm air is distributed to the various rooms by means of small, round or rectangular ducts terminating in elegant, attractive grilles.

In summer it is possible to recirculate cool air throughout the premises by simply resetting the damper on the return air inlet.

IRISH AGENTS: Quadrant Engineers, 6 Mount Street Crescent, Dublin.

# HOT WATER SUPPLY

*from previous page*

Neither does the new electrically heated boiler. This boiler offers the dual advantage—no fire, no fuel store.

**Fuels** include gas and electricity as already outlined. Light distlate oils are rapidly gaining in favour where automatic operation is desirable. Solid fuels press determinedly to retain their traditional place in this field and it is worth mentioning that some of the newer magazine boilers, e.g., Trianco, offer a very high standard of thermal efficiency with a new standard of cleanliness and ease of operation not generally associated with solid fuel appliances. Gas offers a clean, "on tap" fuel of high calorific value, and of easy automatic control.

**Comparative running costs** must enter any consultation regarding choice of D.H.W. installation, but is beyond the scope of this all too brief survey.

The various Fuel Councils have produced their own figures:

**Solid Fuels:** The Coal Utilisation Council, 3 Upper Belgrave Street, London, S.W.1.

**Oil Fuels:** The offices of the major fuel oil companies in Ireland.

**Gas:** The Gas Council, 1 Grosvenor Place, London, S.W.1.

**Electricity:** The Electrical Development Association, 2 Savoy Hill, London, W.C.2.

## *Summary*

THE selection of any one system demands reasoned study of user requirements to decide initially whether a **Local or a Central** system is best to meet his need. Thereafter the following points must also receive the same careful attention.

1. **Equipment performance:** e.g., British Standard Code of Practice 342 "Centralised D.H.W. Supply" recommends bath tap outflow of 5 G.P.M. for user convenience in quick bath filling. An instantaneous gas heated appliance consuming 200 ft. 3/hr. of 500 D.C.V. gas at 85% thermal efficiency, would raise 100 gallons of water through 100°F. in 1 hour, i.e., an outflow rate of a little under 1¾ gallons per minute.

2. **The calorific values** of the possible alternative fuels. This will be advisable in the interest of assessing possible operating costs.

3. **Thermal Efficiencies** of the various appliances. In association with 2, this will affect fuel consumption and hence, operating costs.

4. **User convenience.** The amenity value is quite important as has already been pointed out. The client has a right to have these values put to him for assessment before a final choice is made.

5. **Builder's work involved.** Flues, fuel stores, etc., can be costly items. Fuels which are less demanding in builder's work may seem more expensive but over a long period may well prove economic if building costs can be substantially reduced through using them.

6. **Capital cost.** This is important, of course, but restraint should be exercised against selecting the cheapest initial cost arrangement.

**A compromise solution** must derive from a careful study of all these factors. This is no easy matter. We hope that this Survey will help readers, and their clients, to a greater realisation of the problem and for the need to approach it in a scientific manner.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## SOUTH CORK WATER SCHEME

DETAILS of a £2,000,000 scheme to provide new and improved water supplies in South Cork were discussed at a special meeting of the Southern Committee of Cork County Council.

The 10-year plan envisages a total of 119 schemes to serve a total of 5,616 houses. The proposal is to spend £1,000,000 in the first five years of the scheme and a further £1,000,000 in the following five years.

## Seek Plumbers

**Tipperary (South Riding) Co. Council** have invited applications from qualified Plumbers for employment with the Council. Wages will be paid in accordance with the locally recognised trade union rate.

Application forms and particulars may be obtained from the Secretary, County Council Offices, Clonmel, with whom completed application forms should be lodged not later than 5 p.m. on September 22, 1961.

*from page thirty-six*

## thermal insulation values

dimensioned plan of the room in which you are working, and assuming that its inside temperature is 62°F. use Table 1 and work out the structural heat losses per hour when the outside temperature is, say 42°F.

* * *

**Pipework, Infil, and "ready to fit" Insulation values** are usually stated or declared by the manufacturer in accordance with the requirements of the relevant British Standards for those materials.

**B.S.1304** deals with "Ready to Fit" cylinder, tank, and cistern insulation jackets or sets.

**B.S.1334** deals with Pre-formed insulation for pipes, fittings and store vessels. The rigid sectional pipe insulations are a pre-formed type of insulation.

**B.S.1589** deals with plastic composition, flexible, and loose fill materials.

B.S.'s 1304 and 1334 are closely related and to some extent are interchangeable. Both give minimum recommended economic thicknesses of insulation and this varies according to the declared insulating value of the material used and whether the insulation is applied in indoor or outdoor work.

For example, the U value of glass fibre might be 0.25 for a one inch thickness of material. For ¾ in. thickness the U value would be 0.3 and for ½ in. thickness it would be 0.5.

**Recommended thicknesses** for material of this insulating value are as follows:—

½ in. to 1½ in. diameter pipes: use 1 in. thickness of insulating material.

Over 1½ in. diameter but not more than 4 in. diameter: use ¾ in. thickness.

Over 4 in. diameter and for flat surfaces: use ½ in. thickness.

Greater thicknesses would be required to give the same degree of insulation if materials of higher U value were used. (Remember, the lower or smaller U value, the less heat will pass).

*from page seven*

# hot water supply systems

Like many other ideas, however, this shutting and opening of the valve was often neglected, so much so that it is now unusual to find one fitted on the normal job.

Another big advantage of a secondary circulation is that a towel rail or coil can be fitted as we have a circuit to branch into.

Even with the provision of a secondary circulation, one defect still remains with this system—the bad flow of water at the upper taps when the lower are in use. This is due to the storage cylinder being fitted in the lower part of the house, and can only be remedied by fitting another cylinder in the top of the house **(Fig. 5).**

## Double cylinder or combined system

THE system is then known as a double or combined cylinder system, and provided pipe sizes and boiler rating are correct, will prove very satisfactory, its main advantages being as follows:—

(1) Lower cylinder cannot be emptied by running ordinary hot taps.

(2) With the provision of a secondary circulation almost immediate hot water can be obtained from the taps.

(3) Towel rails or airing coils can be installed without difficulty.

(4) A very good flow of hot water is obtained from all taps even when the lower are in use, as a store of hot water is available above all fittings.

Although this last system is the ideal, it is only installed in the larger dwelling where its extra cost is justified. For the average house the ordinary cylinder system is quite satisfactory because the defects of time-lag and poor supply at the upper taps are not normally noticed to any great extent due to the compact nature of the pipe layout.

This brief survey of hot water circuits has not dealt with problems associated with the installation of systems in bungalows, or where an indirect system is necessary. It is hoped to enlarge on these aspects in the next issue.

LETTERS TO THE EDITOR

# Cold water pipe condensation

Sir,—In your August issue the Consultant to your "Questions Answered" Column dealt with the question of condensation on cold water pipes and suggested that thermal insulation would supply an effective cure.

No mention was made, however, of the correct use of vapour barriers, and this is surprising in view of the fact that insulation, by itself, is not the complete answer, especially if the condensation is particularly severe.

The majority of insulating materials used on cold water pipes permit the passage of moisture vapour while, at the same time, retarding heat flow. Because of this, an impervious barrier should be applied to the warm (external) surface of the insulation in order to prevent moisture passing through it and condensing on the pipe underneath.

Suitable vapour barriers are oil-bound paints, bitumen paints and solutions and, of course, metal cladding. It is essential to maintain the temperature of these vapour barriers above dew point, otherwise they will become condensing surfaces themselves. This can invariably be achieved by an adequate insulation thickness, which will be directly related to the thermal efficiency of the insulation used.

Yours, etc.,

J. C. PARRY-JONES.

Whitestacks,
Killiney Hill Road,
Killiney, Co. Dublin.

*from page sixteen*

# heat and its measurement

**Example ii.** Suppose this water had to be heated to the same temperature in one hour, 30.000 B.Th.Us. of heat would have to be applied to the water in that one hour. For any other given time in which a quantity of water is to be heated, the rate at which the heat must be applied is as follows:—

**Number of B.t.u.'s required to raise the water to the required temperature.**
**The number of hours heating time available.**

Thus: 30 gallons to be heated 100°F. in 3 hours:

$$= \frac{30.000 \text{ B.t.u.'s required.}}{3 \text{ hours.}}$$

Heat must be applied at rate of **10.000 B.t.u.'s per hour.**

And: 30 gallons to be heated 100°F. in $\frac{1}{2}$ hour:

$$= \frac{30.000 \text{ B.Th.Us. required}}{0.5 \text{ hours.}}$$

Heat must be applied at the rate of **60.000 B.t.u.'s per hour.**

No allowance has been made for thermal efficiency of the water heating apparatus or for the continuous loss of heat from the heated water to the cooler surrounding air. These considerations are, of course, important points, which affect the design and installation of domestic hot water supply and central heating systems. They will be dealt with later.

**Example iii.** 2 gallons of water cooled from 180°F. to 140°F. How many B.Th.Us. of heat will be given off?

2 gallons x 10 lbs. per gallon x 1 (S.H.) x (180°F.—140°F.).
= 20 lbs. x 1 x 100°F.
= 2000 B.Th.Us.

**Example iv.** 2 gallons of water at 50°F. are placed in a copper vessel weighing 12 lbs. The vessel and its water are then raised to 150°F. How many B.Th.Us. are required?

In this case we are told the material of which the water container is made. This will also have to be taken into account, and heated to the same temperature as the water. The specific heat of copper is 0.092.

B.t.u.'s required for heating the copper vessel:
= 12 lbs. x 0.092 x (150°F.—50°F.).
= 12 lbs. x 0.092 x 100°F.
= 110.4 B.Th.Us.

And: B.t.u.'s required for water:
= 2 gallons x 10lbs. x (150°F.—50°F.)
= 20lbs. x 100°F.
= 2000 B.Th.Us.

Total B.Th.Us. required = 110.4 + 2000 = **2110.4 B.Th.Us.**

**Example v.** 25,000 gallons of water in a swimming pool are to be heated from 50°F. to 70°F. How many therms of heat will be required?

B.Th.Us. required:
= 25,000 gallons x 10 lbs./gall. x (70°F.—50°F.).
= 250000 x 20.
= 5000000

(Note: One Therm = 100000 B.Th.Us.).

Then No. of Therms required:

$$= \frac{\textbf{B.Th.Us. required to heat water}}{\text{100000 B.Th.Us./Therm.}}$$

$$= \frac{\text{5000000 B.Th.Us.}}{\text{100000 B.Th.Us.}}$$

= 50 Therms of heat required.

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