CONFIDENTIAL BULLETIN FOR THE USE OF MEMBERS

# THE HOSPITAL ENGINEER NEWS LETTER

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No. 6 Issued JUNE, 1947

## Contents



*Hon. Editor :*
R. G. ROGERS,
"Elmfield,"
Stone,
Aylesbury,
Bucks.

## EDITORIAL

THE Council was fully represented at the meeting held at Withington Hospital, Manchester on the 2nd May, 1947, when the general business of the Institution was dealt with.

The Council had the pleasure of meeting Dr. J. M. Greenwood, M.D., D.P.H., the Medical Superintendent, before the business commenced. The Chairman introduced the members and thanked Dr. Greenwood for so kindly placing the Board Room and other facilities at our disposal for the meeting, and also thanked our colleague, Mr. Oliver for making the necessary arrangements.

The Chairman in his opening remarks said that he was sure the Council would be sorry to learn that Mr. Brain was unable to be present owing to ill health, and knew that all present would wish him a speedy recovery. His place on the Council was taken temporarily by Mr. Heald.

The membership of the Institution continues to grow apace, and Council were exercised for very many hours in dealing with the 138 applications which were before them. Of these, 50 were admitted to membership, 57 to Associate Membership, 16 to graduateship, 5 to studentship, and 10 were rejected.

The Northern Ireland Branch is also steadily increasing in numbers, and your Council have now decided to ask them to appoint a representative to Council.

The British Standards Institute (Hospital Standards Committee) invited Council to appoint one of its members to sit on this Committee, and your Council had no hesitation in unanimously electing Mr. J. Forsyth of Southampton Hospital to represent them on this Committee, with Mr. J. Tomlinson of Kings College Hospital deputising if necessary.

The old question of the setting up of a Joint Conciliation Committee between the B.H.A. and the I.H.E. was again discussed at some length, and ways and means of achieving this were carefully studied. Council have been endeavouring to bring this about since October, 1944 so far without success. The Secretary of the B.H.A. has now stated that the matter will be put before his Committee at their next meeting. It is therefore hoped that the establishment of a J.C.C. on lines similar to that which we have with the M.H.A. will now evolve without delay, which I am sure will be to our mutual benefit.

An approach has also been made to the Scottish Mental Hospitals Association with a view to the setting up of a J.C.C., and the Minister of Health for Northern Ireland has also been made aware of our existence.

The Benevolent Fund was discussed and the Finance Committee were instructed to draw up rules and regulations for the administration of this Fund for presentation to the Council at the next Meeting.

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## OBITUARY.

It is with profound regret that we learn of the death of two of our colleagues of the Lancashire branch.

Mr. GEORGE KEAL, Chief Engineer of Wittingham Hospital passed away at the age of 57 whilst on holiday in the Isle of Man.

Mr. Keal's enthusiasm for the I.H.E. was boundless and he will be sadly missed at the branch meetings. He was one of our earliest members and was at the inaugural meeting of the Lancashire Branch on the 25th of November 1944,

Members of the branch attended the funeral at the Liverpool Crematorium on Thursday, June 12th, 1947.

The deepest sympathy of his colleagues throughout the Institution is extended to Mrs. Keal and her five sons in their bereavement.

The passing of Mr. A. A. BRAINE on June 24th came as a great shock to many of us. He succumbed after a brief but very severe illness at the age of 50.

Mr. Braine was the Chief Engineer at Winwick Mental Hospital and a very highly respected member of the I.H.E. He was the representative on Council of the Lancashire Branch, a member of the J.C.C. with the M.H.A. and a member of the Institution Education Committee. He will be greatly missed by his colleagues on the Council for his sound reasoning and judgment. He was a man whom it was a pleasure to know, a great friend, and a tireless worker.

To Mrs. Braine and her two sons the Members of the Institution extend their heartfelt sympathy in their bereavement.

The funeral was held on Saturday, June 28th when Members of the Institution attended to pay their last respects.

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## "THE LANCASTER" STEAM TRAPS AND THEIR APPLICATION.

*By* J. R. A. BROWNY Esq.

The object of this paper is to briefly review the principles affecting the design and to survey the general considerations involved in the use of "The Lancaster" Steam Traps.

The trapping of steam dates back some 80 years, but it is only during the last 30 years that steam traps have been developed in quantity, and only during the last 15 years have they really been brought within the reach of the average steam user. The author would venture to go further and say that it is only since the outbreak of World War No. 2 that users of steam traps began to sit up and take any interest in them and the correct application for a particular job, and only then through the propaganda put forth from the Ministry of Fuel and Power, and later by the visits of the voluntary inspectors from the same Ministry, plus the increased cost and scarcity of fuel. Even to-day we find steam trap users who haven't the faintest idea how they operate, or where and when to fit them.

To ensure that we are all thinking on the same lines, let us now define what a steam trap is and why it is necessary to use one at all. A trap is defined as a device which permits one kind of thing to pass through while preventing the other from doing so. A steam trap therefore is a device which permits water to pass away, but holds back the steam and prevents its escape.

Steam is largely used either for power or heating or both. Condensation takes place in the pipes or vessels in both cases, in the former due to conductivity, in the latter by giving up its latent heat, to say, heat a building or to industrial processes.

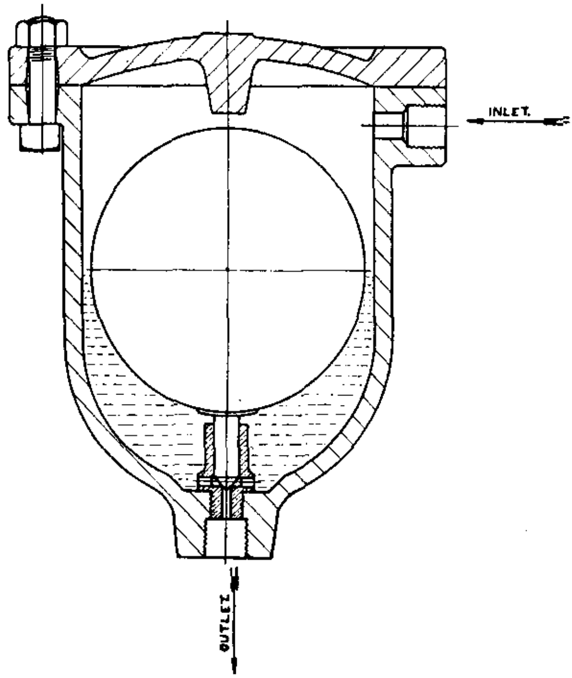
Condensate in power lines is highly dangerous and no effort should be spared in extracting it from the steam (if it is held in suspension, by separators), collecting it and discharging it by means of a trap. *It is* **not** *so important to dispense with the water as soon* as it is formed in heating systems, and if heating surfaces are of large area it is quite economical to drain the water from the pipes or coils below steam temperature, and thereby make some use of the Sensible heat in the water. If heating surfaces are of normal area, then it is considered more economical to dispense with the water at temperatures between steam temperature and 212°F, remembering that water is a very bad conducter of heat. Whether the condensate should be discharged at steam temperature, or 212°F, or below, depends largely on the heating system, pipe layout etc. and will be dealt with later in the paper. It is therefore the function of the Steam Trap to let this water be passed away automatically. A steam trap is not a pump or ejector—it will not draw the water to it (although *the design of some traps have more tendency to do this than others)*— the water must be brought or delivered to the trap. It can be seen then that the most satisfactory position of any steam trap is at the lowest point of the system which is being drained.

The main physical properties which distinguish water from steam are the differences in **temperature, energy** and **density,** and it is by the employment of these differences that most steam trap designs operate. The float operated steam trap is designed round the latter.

**Principles Involved.**

Examination of a very simple diagramatic trap will illustrate the majority of principles used in steam trap design (*Fig.*1). The most simple designs will involve a body or box with two connections—an *inlet for the condensate and steam, and an outlet* for the condensate. A valve and seatings, and a float which by rising and falling with the level of the water condensation, opens or closes the valve. As water flows into the box the float will become buoyant, rise and lift the valve from its seating. The water will then be forced through the valve orifice by the pressure in the trap until the level falls and the float comes down and closes the valve.

The pressure in the box is exerting itself in every direction, and is therefore tending to force the valve on to its seating by Pressure per square inch multiplied by area of the seating. The float therefore has to exert a force equal to the pressure difference between the inlet and outlet side of the valve multiplied by area of the seating.




The main feature of trap design is centred then on the following. The diameter of the seating for a given pressure difference depends upon the force the float can exert to open the valve, or for a **given power of float** the diameter of valve depends upon the pressure difference. The float cannot operate without the presence of water, and it can be seen that after the valve has closed, water still remains in the trap and is therefore the working medium. Before going on to the application of steam traps a brief survey of the fundamental component parts will help the user to study the different types manufactured and later to choose the correct type for any particular job.

**Bodies or Boxes.**

The body of the trap is designed around the internal mechanism in the neatest way possible, taking into consideration ease of maintenance, erection and removal, and it will be noticed that the majority of Lancaster traps can be examined and repaired without breaking any pipe joints. The bodies are made in Cast Iron for pressures up to 200 lbs. per square inch, and in Cast Steel for pressures and temperatures higher than this and in Forged Steel for exceptionally high pressures and temperatures in the region of 500 lbs. per square inch and above.

Bronze bodies have been used when specified and in cases where the condensate is liable to be contaminated with acids, an acid resisting Bronze has been used with success.

Steam Trap bodies are hydraulically tested from twice to four times their normal working pressure and to withstand this special High Tensile steel bolts must be used.

**Floats.**

Three types of floats are used in Lancaster traps. (1) Hollow spherical sealed type. (2) open bucket type. (3) inverted open bucket type.

The hollow sealed type is made in Mild Steel, heavily sheradised for use when condensate has no corrosive properties and in stainless steel when the condensate is so contaminated that it would corrode the former material. This type of float has to withstand external pressures equal to the steam pressure and therefore is preferably made spherical. An internal pressure is put in the floats for tests purposes before being fitted to the trap. The float is usually made of two hemi-spheres welded together.

The open bucket types obviously have to withstand no pressure as they are not sealed and therefore cause no anxiety with regard to collapsing. These floats are made in copper or stainless steel, and the joints are usually soldered, brazed or welded.

**Valves and Seatings.**

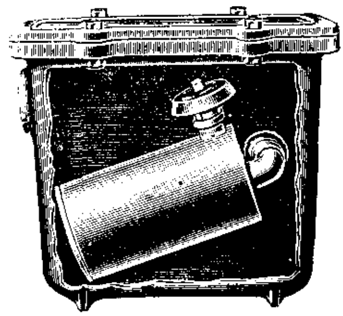
With the exception of " The Lancaster " Float Type Trap and the larger Continuous Flow Type Traps, all valves are conical needle pattern which have been found very suitable and have proved themselves over a good number of years. For the greater part the valves are made of stainless steel, the only exception being on the larger Continuous Flow Traps when the operating pressure is very low, and here P. Bronze has stood the test very well indeed, both for valves and seatings. The same applies to the seatings except that they are not all made entirely of nickel, mostly the actual seating is a nickel insert let into a P. Bronze cast body.

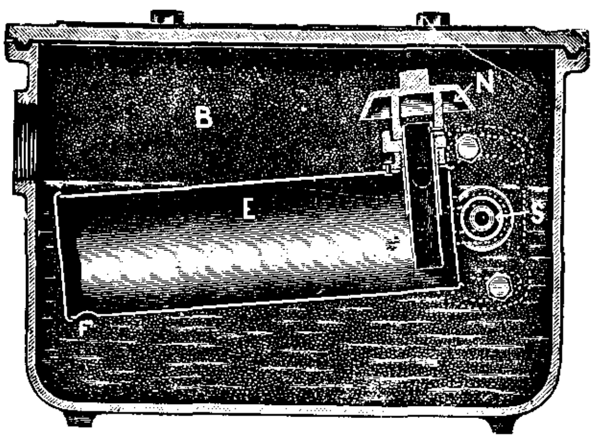
**Mechanisms.**

The mechanisms of all the different types of Lancaster traps vary to a great extent, and will be described for each trap later, they are all designed however, to give a float leverage over the valve of 5 to 1 and over.

**Types of Traps.**

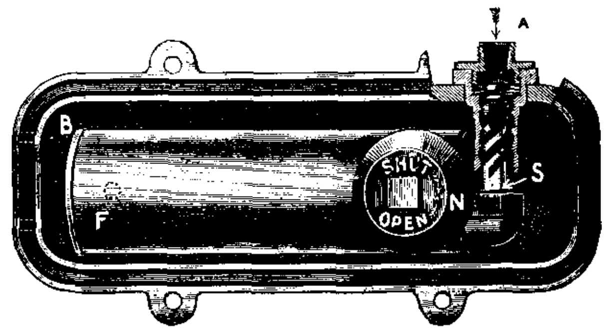
(1) THE FLOAT TYPE STEAM TRAP. Originally patented in 1892 this trap has become famous throughout the World as one of the most reliable traps ever designed, and there are to-day hundreds of these still doing good work after 45 years continual service. The hollow cylindrical float has holes in the bottom and so comes under the heading of the inverted bucket. The valve is closed against the steam by the action of a quick threaded screw and nut and a considerable float leverage. Before starting up the trap has to be primed by removing the cover and filling with water. When the trap is not in operation the normal position of the float is on the bottom of the box and the valve is full open. When the stop valve to the vessel or heating system etc., is opened, the condensate thus formed enters the inlet to the trap through the open valve and hollow screwed spindle into the float and passes through the holes in the bottom or through the dip pipe into the body of the trap. The water rises and passes through the outlet by displacement. Should steam enter the float it would displace the water therein and the float would become buoyant and rise thus closing the valve. This steam then gradually condenses and the water in the body of the trap enters the float again through the holes in the bottom and the float loses its buoyancy, falls and re-opens the valve.






It may be remarked that should the float become full of air it would not condense as would the steam and the operation would fail.

To overcome this the dip pipe has a small hole drilled in it at the highest point of the float to allow all the air to escape. The same hole also facilitates the passage of steam and by increasing the size of the hole, the float can be made to lose its buoyancy more rapidly, so that the trap pulsates more frequently. It is found essential to increase the hole when draining condensate at high temperature. The hole is increased or decreased by rotating the cast iron bell which is fastened to the top of the dip pipe and can be adjusted whilst the trap is in operation. There is no pressure in the body of this type of trap and very little in the float and it will be noticed that the body is only of comparatively light section and that the cover is only held by four $\frac{3}{8}$ in. bolts, the joint being a round of soft hemp rope. When condensate at temperatures higher than 212° enter the float re-evaporation occurs in the float and the valve closes as described previously and it is only by allowing this re-evaporated steam to escape freely that water at high temperatures can be passed in anything like large quantities. The higher the temperatures of the condensate the higher the percentage of re-evaporation or flash and it is obvious therefore that the rate of discharge of the trap will decrease as the temperature of the condensate increases and visa versa. The rate of discharge of condensate at temperatures below 212°F is exceptional and owing to the great leverage of the float, valve seatings can be fitted with very large area, making it absolutely unnecessary to fit by-passes for warming up periods.




*Disadvantages of this type.*

1. Takes up a fair amount of space.
2. Cannot be suspended from the pipe e.g. on a unit heater.
3. Not very suitable for draining water at high temperatures, as from steam mains to engines and power plant.
4. Not suitable for pressures over 180 lbs. per square inch.
5. As the outlet hole is of large diameter and must not be diminished it may prove inconvenient when running tail pipes to drains.

6. Will not lift its discharge. Note :—These traps have been made to lift their discharge for low lifts by strengthening up the box slightly and " plating up " the lids and fitting a rubber joint for the cover. A special box, however, is manufactured of strong design with machined joints and faces, a strong cover with ample bolts and non-return valve fitted to the outlet. The same design of float mechanism is fitted and the trap is named " The Marine " type, and has proved very satisfactory for many years, especially in marine work—hence its name. The outlet pipe diameter is the same as the inlet and the trap is capable of lifting its discharge 2 ft. per pound of steam pressure available at the trap outlet. These traps were fitted in the old Mauritania and did 23 years' service until the ship was broken up, without so much maintenance as renewing the valves and seats.

*Advantages.*

1. Will pass very large quantities of water at low temperatures, thereby doing away with by-passes for starting up periods.
2. Will pass large volumes of air thus obviating any chance of the very common trouble of air lock or " air, water, air, pocketing " in steam lines.
3. Large area seatings which do not easily become stopped by dirt.
4. Can be observed in operation by merely removing the cover.
5. By opening or closing the dip pipe escape hole, can be made to pass water at within a few degrees of steam temperature or hold it up until the temperature has dropped to boiling point. This feature is very useful where it is desired to use the sensible heat in the water before discharging it (as in space heating) or where the water has to be discharged into the atmosphere owing to the absence of drains or the inconvenience of not being able to collect and return it to some hot well, and it is desired to minimise the nuisance and unsightliness of visible re-evaporation.
6. Will pass any amount of oil which may be present in the condensate without any ill effects to the operation of the trap.

" The Lancaster " Float Type is very recommendable then for

(a) All space heating pipes whether on high or low pressure steam.

(b) All low pressure process work such as drying cylinders, sizing machines etc.

(c) Low pressure flash tank drainage.

(d) Oily condensate from oil separators on engine exhaust.

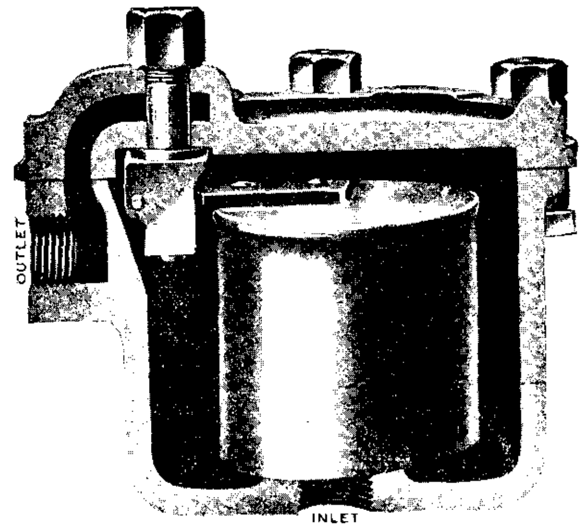
(e) Any process where large quantities of low temperature condensate have to be removed.

(f) To remove water from air mains or air receivers.

(g) To drain condensate from systems which have a very heavy initial condensate rate during the warming up period with a low rate from then onwards. This type of trap is made in four pressure ranges, 0—20 lbs., 20/90 lbs., 90/150 lbs. and 150/180 lbs. per square inch pressure. The outlet is made larger than the inlet diameter so that the large quantity of condensate can pass away freely during the warming up period, and not build up in the box and cause the cover joint to leak, or at the worst the box to burst.

(2) "THE LANCASTER" BELL FLOAT STEAM TRAP.

It was in 1930 that Messrs. Lancaster & Tonge Ltd., forecast the now very popular and efficient method of independent steam




trapping. In 1931 the first Lancaster inverted bucket trap was put on the market and since that time scores of thousands have been sold and it has become one of the most famous of all traps. Incidentally the author visited a customer recently who had fitted a large number of these traps on his heating system during the first year of manufacture, and all are still working efficiently. None have received any attention since the day they were installed.

The operation in principle is similar to the float type. The valve is opened and closed by an inverted float through a lever which is hinged at a point near to the valve, giving a leverage of approximately 6 to 1. The float which acts in a manner similar to the divers' bell is placed directly over the inlet of the trap and floats or sinks in a reservoir of water. The normal position of the trap when the steam is off or when working under cold conditions is with the float sunk and therefore the valve is fully open. Water entering the trap passes the sunken float, through the open valve and away through the open valve and away through the outlet by reason of the pressure behind it. When steam enters, it displaces the water in the float causing it to rise and close the valve. An escape hole is provided in the float to allow air to escape, so that the float is prevented from becoming air locked. Steam also condenses and escapes through this small hole and allows the water to rise in the float until it loses its buoyancy and falls again opening the valve as before. The valve is on the outlet side and therefore the body of the trap is subject to the full working pressure. It will be noticed that the body is designed to withstand this pressure ; it is round in shape and has machined joint faces and the cover is fastened down with an adequate number and size of bolts. Three designs of bodies are made.

Very careful thought has been given to the design from a maintenance angle. By removing the cover bolts, the cover and internal parts are taken away in one ,leaving the body of the trap still fastened to the piping. The complete fitting is fastened to the cover by a brass cap nut screwed on the top of the seating stem which passes through the cover making a metal to metal steam tight joint. Should the trap be dismantled for any reason it is most important before putting it together again to see that this joint is thoroughly cleaned and a perfect joint remade, otherwise steam will be allowed to pass directly to the outlet and will eventually corrode the faces. The trap is manufactured in cast iron in three pressure ranges 0—20, 20/90 lbs., 90/200 lbs. per square inch, and is most suitable for the following uses. Also in Cast Iron and Forged Steel.

(a) Space heating pipes of high or low pressure steam, especially if the condensate is being lifted to a higher level.

(b) Draining unit heaters.

(c) Battery trunk heating.

(d) Radiator and Panel heating.

(e) Small calorifiers, sterilizers, vulcanisers, spreading machine cavity tables, hot plates, kettles soup boilers, etc.

(f) Fuel oil heaters.

(g) Tank coil heating for chemical, plating, dyeing, soap and oil industries, etc.

(h) All types of Drying Machines.

(i) Laundry presses, tumblers, callanders, sleevers, dryers, etc.

*Disadvantages.*

1. Liable to damage by frost.
2. Liable to become made up by scale, etc. owing to small diameter of valve seating.
3. Do not discharge air as rapidly as float trap.
4. Cannot be observed whilst in operation.
5. Not advisable on steam pipe to engine owing to pulsations of steam in the pipe (due to strokes of the piston) acting on a float in suspension.

*Advantages.*

1. Only occupies small space.
2. Easily examined and quickly repaired.
3. Can be hung on the actual pipe being drained without need of supporting bracket.
4. Not costly and therefore encourage independent trapping.
5. Will discharge water at steam temperatures.
6. Will lift discharge (2 ft. per lb. of steam at the trap).
7. No air lock since valve at top.
9. Simplicity of design.

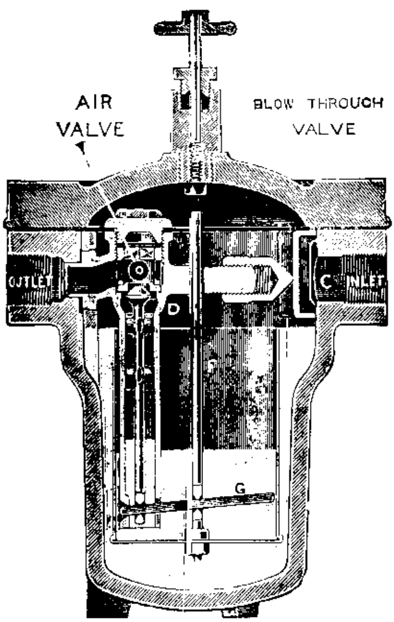
**Radiator Traps.**

For pressures up to 25 lbs. such as prevails in heating by radiators, panels etc., the "Radiator Trap" was designed and has proved a great success. It is similar to the Bell Float save that it has no lever or fulcrum operating between the float and valve and therefore it is only suitable for low pressures.

Before going on to describe the next type of trap the author would like to put right the wrong conception which prevails regarding the action of inverted bucket traps when working on light loads. It has been said by many engineers and it is the opinion of many users that this type of trap wastes a large amonut of steam when only dealing with very small quantities of condensate and that to be anything like efficient the trap has to be working on extreme load. The theory is put forward that steam is continually escaping through the escape hole in the float and is therefore very wasteful. A few minutes' consideration on the operation will prove beyond doubt that this is not the case. The pressure in the box is equally distributed, and therefore the float is in balance and the only difference of pressure between the steam inside and outside the float is one equal to the actual weight of the Float. In a ½ inch Bell Trap this is approximately .25 lbs. and the escape hole in the float for a trap working at 90 lbs. per square inch pressure is 3/64 inch diameter. Therefore the only escape of steam is the amount which will pass through a 3/64 inch hole at .25 lbs. pressure difference, since the time to condense against the lid is very slow.

## " The Lancaster " Compact Trap.

The Compact trap like the Bell Trap has the valve and seat at the outlet and the valve opening against the steam pressure. The box is subject to the full steam pressure and is therefore made of robust construction and the condensate can be lifted approximately 2 ft. per lb. of steam pressure at the trap. In this case the operating medium is a floating bucket which on losing its buoyancy plucks the valve from its seat which is situated near the top of the gun metal body. An automatic air release valve is fitted above the seating, to allow air to be automatically discharged during the warming up period. It comprises of a stainless steel ball which lies in a small cylindrical fitting with a seating at one end and which is open to steam at the other. During the warming up period with little or no pressure, the ball falls away from the seating and is held on to it when pressure is present. It is thought that the ball falls away slightly at each pulsation of the trap and therefore allows any air present to be discharged during each pulsation. The float mechanism has a leverage over the valve of approximately 6 to 1 and therefore a comparatively large diameter seating can be fitted. The body of the trap is very small in relation to the large amount of condensate the trap can handle, and the name " Compact " is therefor well chosen. There must always be a quantity of water outside the float to operate it. As condensate flows into the trap it rises in the box until it overflows into the float, and the float loses its buoyancy, sinks and thereby opens the valve. The pressure in the trap discharges the water until steam enters the trap and thereby discharges the water from the float until its buoyancy is restored and it rises and closes the valve. The reservoir of water has the desired effect in swamping the float once it begins to fall. Under heavy lead conditions e.g. when starting up from cold when pipes are full of water,



the float remains flooded and the water will be discharged as a continuous flow. Under normal working conditions the trap discharges a definite amount of water per pulsation, the number of pulsations per minute being dependent of course on the amount of condensate coming to the trap.

From the point of view of " fair wear and tear ", it is not desired that the trap should pulsate more than from three to four times per minute.

The working parts of the trap can be easily removed from the body without disturbing the pipe connections, by first removing the body cover and slacking back the jacking nut securing the fitting to the body ot the trap. The trap is made in Cast Iron for pressures up to 180 lbs. per square inch and in Cast Steel for pressures in excess of this. Pressure ranges are 0—20 lbs. per square inch, 20-50 lbs. per square inch, 50-100 lbs. per square inch, and 100 lbs., 180 lbs. per square inch. Supplied with screwed connections or flanged with feet or bracket for fastening to deck or bulkhead or wall, etc.

The trap is very suitable for draining :—

1. Callender beds.
2. Tumblers and Drying Machines.
3. Steam mains and separators.
4. Cargo heating coils (ship and land installations).
5. Trunk air battery heaters.
6. Space heating coils if condensate lift is desired.
7. Large calorifiers, sterilizers, vulcanisers, hot plates, soup and potato boilers.
8. Evaporators and distillers.
9. Brewery stills.

Etc. etc.,

*Disadvantages.*

(a) Mechanism not as simple as other Lancaster traps and may be damaged by unskilled handling during maintainance.
(b) Liable to damage by frost.
(c) Dirt and scale may accumulate under the float and prevent it from opening the valve.
(d) Cannot be observed during operation.

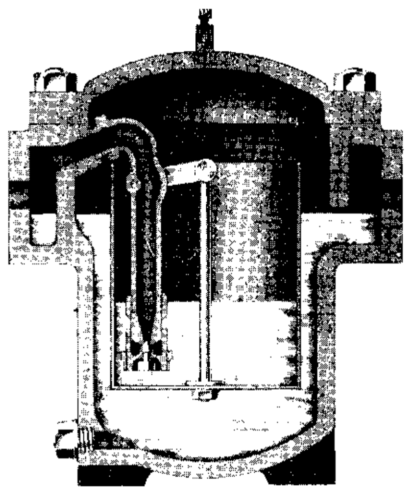
*Advantages.*

(a) Small and compact with high rate discharge.
(b) Will lift condensate 2 ft. per pound of steam.
(c) Easily examined.
(d) Will discharge water at steam temperature.
(e) Not disturbed by pulsations of steam in engine steam pipe due to piston strokes.
(f) Air automatically discharged through air valve and therefore cannot become air locked.

## High Pressure Bucket Traps.

The High Pressure Bucket Trap is similar in operation to the Compact Trap. The operating mechanism however, is more substantial and the body and trap more robust as it has to work on very much higher pressures and superheat.

The main differences in design are :—



1. The G. metal internal body fitting is fastened to the body of the trap with two screws instead of being jacked as in the Compact.
2. The valve and seating is situated at the bottom of the body instead of at the top.
3. The float has no central guide spindle, but is guided by ribs cast on the internal circumference of the trap body.
4. Normally no automatic air valve is fitted to the interior of trap, but a hand operated air valve is screwed into the top of the cover.
5. The trap is supplied with flange connections only.

The float mechanism is worthy of special attention. The float operates a pair of parallel levers which are secured at the other end to the G.M. body by a pin on which they can swing up and down with the movement of the float. Near this fulcrum on the external faces of the levers and integral with them are a pair of pins from which a stirrup is suspended which carries the valve at its lower end. The valve is carried in a cage which slides round the valve seating, and forms a guide for the mechanism. The arrangement gives the bucket a considerable leverage over the valve. The trap is suitable for the same work suggested for the Compact trap but can be used for pressures up to 450 lbs. per square inch.

## Continuous Flow Traps.

In this trap, the valve, although fitted at the outlet opens with the steam pressure and closes against the pressure difference. It is used mostly where extraordinary large quantities of condensate have to be dealt with. Very large diameter valves and seatings are fitted, the valve being actuated by a sealed metal float through a large leverage. Water enters the body of the trap and as the level of the water increases the float rises and opens the valve. The amount the valve opens is dependent on the height of water existing in the trap. As the flow of water will be almost continuous the function of the trap is to discharge this water and the valve to close against the steam pressure on the rare occasions when the water ceases to flow.

The temperature of the condensate makes little or no difference to the operation of the trap and it is unable to discriminate between high and low temperature water.

The bodies of these traps are made in Cast Iron, Steel and Phospher Bronze.

These traps are used for draining all kinds of plant which condense large quantities of water with small pressure differences such as :—

1. Sugar Evaporators.
2. Distillers.
3. Large tank heaters with large area immersed coils.
4. Bled steam feed water heaters.

In the latter case the traps are made large enough to be able to deal with an emergency lead such as would occur should a feed water tube burst, when the feed water would pass directly into the trap.

*Disadvantages.*

1. Can become air locked, (but is usually balanced back to the vessel being drained, or is fitted with an air valve).
2. If the rate of flow of condensate is very small and pressure high it is possible for rapid erosion to take place on the seating, hence these are made in Stainless Steel except for low pressures.

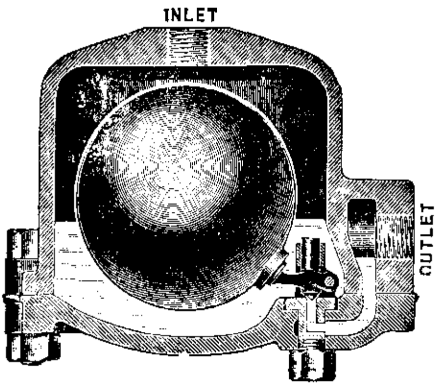
   (If correctly designed and specified this does not arise).

*Advantages.*

1. When on normal and heavy loads valves and seats have no wear and tear as they are fully open.
2. Last for very long periods without repair.
3. Arrangement of mechanism acts as a safety valve should abnormal pressure occur in the body of the traps.

## "The Lancaster" Air Trap.

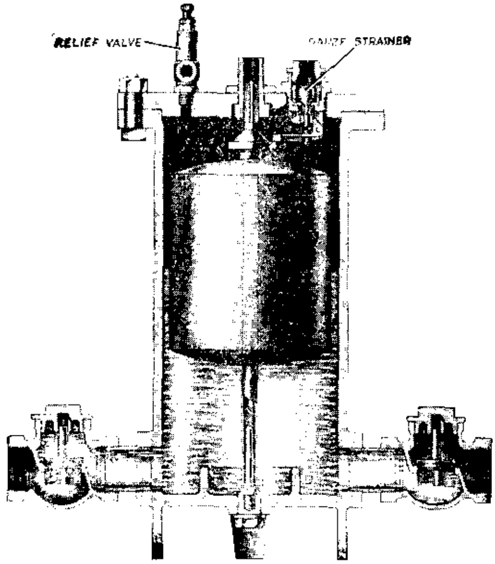
As the name suggests this trap is made for draining water from compressed air mains. Its operation is very similar to that of the Continuous Flow trap trap save that in the air trap the valve opens against the pressure and not with it as in the former. It is especially useful for draining moderately large quantities of condensate from steam vessels at low pressures or under vacuum and discharging to a vacuum pump.




If used under these conditions maximum output is obtained by arranging the inlet at the side as in the Continuous Flow traps and balancing the trap from the top to the vessel being drained. It is possible to lift the condensate 2 ft. per lb. of steam pressure at the inlet to the trap. There is no escape of air as the valve is always covered with water forming a seal.

## Lifting Traps.

From the description of the aforementioned traps it will be noticed that all are capable of lifting their discharge, even the Float type when fitted in the Marine type box. The outlet of the trap should have full bore to atmosphere. We are very often asked if a steam trap will lift its discharge water and if so to what height. The answer is that if there is sufficient steam pressure at the trap inlet to effect the desired life the trap certainly will lift. A trap itself has no power within itself as regards lifting, the lifting is done by the steam pressure behind the condensate. It is safe to say that only those traps which have the valve at the outlet will have full steam pressure in the trap body and this type will lift its condensate if sufficient pressure is available. A special trap has been designed to lift condensate from these systems whose working pressures are so low as not to be able to lift any height through the ordinary steam trap. The same traps are capable of draining water from vessels under vacuum.




## Pumping or Vacuum Traps.

The traps are so called because by employing an auxiliary steam or air supply they are made to act as a pump in so much that they will deliver water from a lower pressure head into a higher, and because it is possible to drain water from a vessel under vacuum by employing this type of trap.

If it should be desired to collect the condensate from a number of traps working at a pressure below that which is necessary to give a certain lift, then the traps should be fitted with sight glasses or similar tell tale on the outlet connections, and all be run into a common condensate main of adequate size. This main would be connected to a pumping trap and so arranged to give a sufficient fall to enable the water to rise in the body at the necessary speed to operate the float through the valve mechanism. As the water flows into the trap through the non-return valve the float rises with it and finally engages the trip motion which opens the live steam and closes the exhaust or vent valve simultaneously. The pressure of steam in the trap displaces the water, discharging it through the outlet non-return valve. The float falls with the water until it engages the collar on the bottom of the spindle, and in so doing closes the steam valve, and at the same time opens the exhaust or vent valve. The steam in the body is exhausted and the pressure is restored to atmospheric allowing the water to re-enter the trap and repeat the cycle. Very little steam is required for average conditions and high steam pressures are unnecessary—a pressure of between 40 and 50 lbs. per square inch is very suitable for most installations.

## Air Release Trap.

" The Lancaster " Air Release Trap is a modification of the Bell Float Steam Trap. A sealed float is fitted instead of the inverted float and the body is made a little deeper to accomodate it. It is fitted at the highest point of a High Pressure Hot Water system to prevent the collection of air by discharging it at it finds its way to this position. The inlet and outlet connections are the same as in the Bell Traps. With no air present the trap body is full of water. and therefore the float is in the highest position and the valve is closed. When air finds its way into the trap, the level of the water is lowered by the amount of air present at the top of the trap. The float will therefore fall with the level of the water and the valve open. letting the air escape. The water then rises, taking the float with it, thus closing the valve and preventing the water from passing.

## Specification.

The more information which is given to the trap manufacturer the more he is able to supply a trap which will prove suitable and efficient for any particular job.

In the " older days " the engineer, manager or secretary, appeared to order a trap from the makers with the thought that all traps were alike regardless of size, type or pressure. A trap would be ordered by rule of thumb and a guess made at the required size. In such cases the manufacturers task was easy—a trap merely taken from stock and dispatched just as ordered. The tendency to-day is to give more detailed information of the duty required of the trap for each particular job and the manufacturer has to spend time in calculations with regard to the size and type before entering the order. Although this puts a greater amount of work and responsibility on his shoulders, he does know that the correct trap is being supplied, and there is no " come back." The author well remembers going to a small cotton mill to check on an order for a 3 inch steam trap. He found that the trap was required for use on a small heating range, total length approximately 150 feet of piping. The trap has been ordered 3 inch because the piping was 3 inch diameter ! A half-inch size was all that was necessary.

The following information is a good guide when ordering traps from the manufacturer as to the kind of data useful in determining the correct type of trap for the particular job.

1. Maximum steam pressure likely to be obtained at the trap.
2. Minimum steam pressure likely to be obtained at the trap.
3. Amount of superheat if any.
4. Amount of condensate to be handled (found by calculation or experiment). Warming up and working load.

5. Whether it is required to lift the condenaste and if so, how high.
6. The type of vessel being drained whether steam main, drying cylinder, heating coil, etc., Give heating surface.
7. Is the steam clean or dirty?
8. Is the condensate free from contamination such as acids, etc?

## Installation.

Having given the steam trap manufacturer all the information possible it can safely be left to him to supply the right trap. It is now up to the customer to fit this in the correct manner, and in the correct position, giving a good deal of thought to the matter and not of merely sticking the trap on the end of the pipe and expecting the trap to do the rest. As a general rule any trap should be placed at the lowest point of the system to be drained, and to assist the flow of water there should whenever possible, be a general fall to the trap. Unfortunately dirt and scale find their way to the lowest point of the system and provision should be made to catch this before it can enter the trap by fitting a dirt pocket or a strainer or both.

Before fitting traps to a system where long lengths of new piping have been used, or where new steam vessels (especially Cast Iron ones) have to be drained, it is always a good policy to allow the steam to blow through the system for some hours to help rid it of scale, sand, jointing compound, etc., which is always found in large quantities on such occasions.

Ordinary size dirt catchers cannot cope with this large amount of grit and sometimes by-passes are fitted so that all the dirt is by-passed before bringing the trap into operation.

Whereas the latter are useful for this purpose and at the same time facilitate examination and removal of the trap, they can prove themselves to be steam wasters if not properly looked after. In the first place the valve can be left open by the operator and forgotten and in the second place the valve itself can become faulty and allow steam to pass unnoticed over long periods.

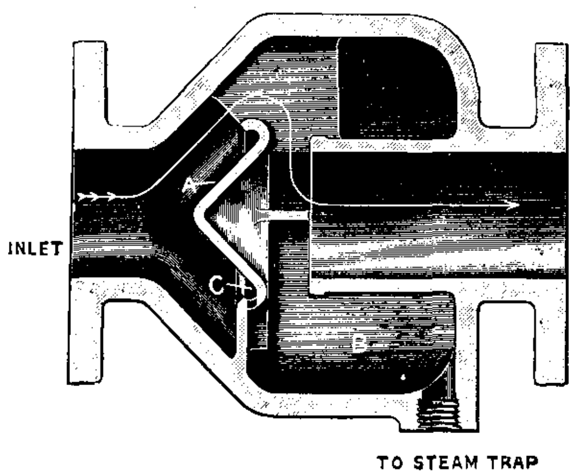
When draining steam coils for space heating care should be taken to design the layout or that a good fall is obtained at the trap. Avoid very long lengths of piping and if the building to be heated is of large area such as a weaving shed, for instance, it is better to split the heating coils into two, three, or four separate heating units with a steam trap to each. This has several advantages (1) The steam is through the system quicker, (2) The condensate has not to be pushed through long distances thus reducing water-hammer (3) More fall can be given to each trap, (4) It gives a more uniform room temperature.

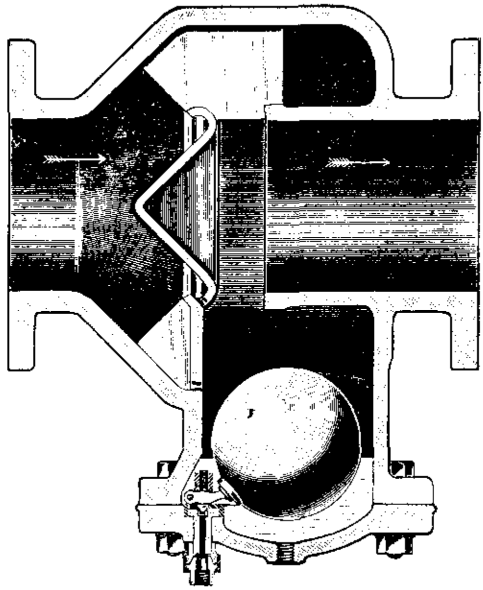
Unit heaters should always be trapped separately and the Bell Trap is a most useful trap for this job as it can be fitted close up to the outlet heater and being so small and light, no supporting brackets are necessary.

The condensate can be run into a common main which may be carried either underneath or above the steam main running along the line of heaters. The condensate main should be enlarged as it gathers the water from the heaters along its run. The same remarks apply in all cases where independent trappping is used, such as Laundry Presses, Hospital Sterilizers, Vulcanisers, and Steam Heated Cavity Tables Etc.

It is impossible to spend any time describing the applications of trapping to each of the hundreds of different machines on which traps are used. If however any engineer would like any information regarding any particular job he has in mind, the author will be pleased to give as much detail as he can during the discussion at the end of this paper.

There is one important trapping application however which warrants special mention in this paper—THE TRAPPING OF POWER LINES :—



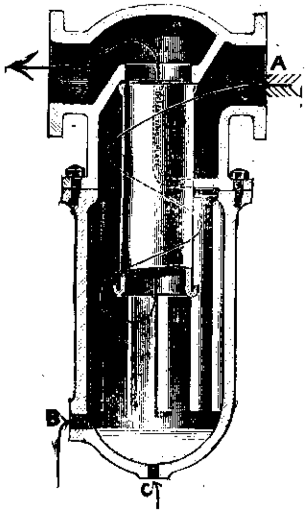


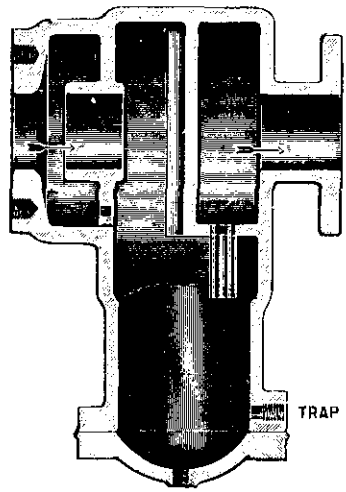

It is most important that steam for Power Production should be free from water. Usually the steam is superheated for this purpose, but this is not general and there are many high and slow speed engines and pumps using saturated steam. Due to several reasons (water level too high, frothing, priming, etc.) it is possible to have very wet steam travelling along a power main even under high superheat and it is necessary to fit some apparatus for collecting this condensate prior to the trap taking charge. In these mains where the speed of the steam is comparatively high, collection by gravity is not effective and centrifugal separation has to be employed by changing direction of the steam flow sharply. The water cannot change direction as quickly and is therefore thrown outwards and can easily be collected. The apparatus used is a Steam Separator, and it should be fitted in the Steam line at the nearest place to where the Steam has to do its work. Its capacity should be as large as possible so as to be capable of holding gulps of water which may come along until the trap which is connected to it can discharge these. No trap could discharge these gulps fast enough unless drawing from a reservoir.

Separators should be well lagged, otherwise they defeat their object and act as CONDENSERS.

## Maintenance.

A steam trap, if properly installed and of correct size and type should operate satisfactorily for a period from five to thirty five years according to the initial cost of the trap. A system of periodical examination and maintenance should be organised especially where large numbers of traps are in use. In such cases each trap should be labelled and numbered and a record kept of the examinations and repair. The record should include such information as follows :— Number of Trap. Size of Trap. Operating Pressure, Position or Department, Date when examined, Necessary repairs, Remarks, Signature of fitter.




With those traps which discharge their condensate to atmosphere, for one reason or another, it is an easy matter to judge whether the trap is operating correctly or not by periodical glances at the end of the tail pipe. If the condensate is discharging into a common main, observation must made at the sight glass or tell-tale connection. Six conditions will be experienced.

1. Condensate will be discharged by very erratic pulsations with a clean cut off after each.
2. Condensate will be discharged by even and regular pulsations with a clean cut off after each.
3. Condensate will be discharged by pulsations as in (1) and (2) but steam will pass during each.
4. Condensate will be discharged continuously with no pulsations.
5. Nothing will be discharged at all from the trap.
6. Steam will be passing all the time with little or no condensate.

As a general rule these conditions can be analysed as follows :—

In (1) the trap is working all right but the rate of condensation in the machine or pipe line is either very variable or else the system is not designed correctly and pockets of condensate are forming here and there.

In (2) the trap is working perfectly.

(3) Either a leaky valve or the mechanism is "sticky."

(4) This condition is generally experienced during warming up periods. If, however, after a short period of time pulsations do not commence the trap is too small for its job or it has a valve and seating designed for a higher pressure.

(5) The steam may not be "turned on". The trap is made up with dirt, scale ar oil. The valve and seating may be designed for a much lower pressure than is present. The steam pipe or strainer may be choked or the bore of the pipe at a flange may be covered by the flange jointing. May be an air lock.

(6) Valve and seating erroded. Joint faces on outlet of trap faulty. Blow holes through the body of the fitting or box. Air valve passing steam. Float corroded away or stuck.

Many engineers still have the idea that a steam trap should pass nothing but "hot" water and do not appreciate that a certain amount of steam is re-evaporated from the condensate discharged from a trap, especially of the bucket type working on the higher pressures. Immediately water at steam temperature passes the valve and falls to atmospheric pressure its temperature must fall to approximately 212°F, and in so doing, between 3% and 20% (according to the pressure) of the condensate flashes into steam again. For average pressures it is usual to allow for 10%. This must be taken into account when examining the conditions at the outlet of any steam trap. It must not be confused with live steam. It must also be taken into account when measuring the amount of condensate discharged from a trap during any test or experiment.

**Conclusion and Summary.**

Before concluding it would be perhaps interesting to summarise the most important considerations which the engineer in charge will have to study when about to erect some new or alter existing steam plant.

1. Design the steam main large enough for the particular job with a little "up the sleeve" for any extension.
2. High pressure steam necessary for power work but low pressure good for heating and most processes.

3. See that the trap is the correct one for the pressure at which it has to work.

4. A trap can be too big or too small. Find out the approximate amount of condensate before ordering. Allow for warming up period.

5. For heating and low pressure process the most economical trap is " The Lancaster " Float type (Lifting or non-lifting).

6. For power mains and high pressure process work the bucket type of traps should be used (Valve on outlet side of trap).

7. Fit the traps at the lowest point of system but leave pocket for dirt.

8. Fit a " Y " strainer to each trap, but don't forget to clean these periodically.

9. If collecting water in common main use a sight glass on the outlet of the trap, alternatively fit a " tell-tale " connection.

10. Design the common main so that it is large enough to carry condensate plus flash steam. Test occasionally with pressure guage.

11. If the working steam pressure is very low and the pressure at the trap is not sufficient to exert a desired lift with a margin it is better to run the condenaste by gravity to a Pumping Trap, and lift from this point.

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## LONDON BRANCH VISIT TO BECKTON GAS WORKS.

BY

A VISITING MEMBER.

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A visit arranged by Mr. Woolsey with the Gas, Light and Coke Company for the London Branch of the I.H.E. to the Beckton Gas Works on April 26th, 1947, was very much appreciated.

The rendevous was at the work's gate at 2.15 p.m. Our party was met by Messrs. Ward and Johnson and we proceeded along what one might call a main road with lawns and even beds of tulips at the base of the gas holders.

Here our party split up into two groups. We proceeded to the top of the Coke ovens, incidently heated with producer gas. A large building used as a Coal service bunker, with a battery of 30 ovens on either side was then viewed. Each of these ovens is 41 ft.

10ins. long, 14 ft. 1½ ins. high, 17¾ ins. wide with a taper of 1⅝ ins. to the discharge side. Each oven is charged by a travelling mechanical stoker with about 18 tons coal, the normal carbonising period being 19 hours. On the discharge side we witnessed the removal of the door and the discharge of approximately 12 tons of red hot coke. This operation is carried out by a ram, operated from an 80 h.p. electric motor. A quenching car, (a long truck propelled by an 80 h.p. electric locomotive) conveys the coke under a concrete quenching tower, it is then discharged to a wharf, allowing time for surplus water to evaporate, then on to the screening and grading plant. The gas leaves the oven through off take cast iron tubes 16 ins. diameter.

Passing to the gas production plant which consists of 9 producers of 8 ft. 6 ins. internal diameter, 8 were in operation. The fuel coke and breeze is fed by small skips into the producer at intervals of 20 minutes. A mechanical distributing device ensures even fuel bed, with a revolving grate and water seal, the ash is scooped out and discharged into waiting tubs. These producers are water jacketted and generate steam for saturating the blast with a surplus that could be used for water heating. The gas leaving the producer is washed in water scrubbers and freed from tar, etc., and is mainly used for heating the Coke oven furnaces Coal Handling Plant.

We next took a long walk to the Coal handling plant at the wharf where two colliers were seen discharging their loads (An appropriate name was noticed on the stern of one of the colliers " Mr. Therm.") Eight electrically operated jib cranes carrying grabs of 3½ tons capacity discharged the coal into hoppers on to conveyor. The belts after passing over continuous weighers delivers the coal into barges and to a second rubber belt conveyor of 54 in. width, which takes the coal ashore to a 6,000 ton concrete service bunker. From here the coal is conveyed to the storage bunkers in the retort houses, on to the storage ground in 5 ton wagons with bottom discharge. We watched sixteen wagons pushed by a steam locomotive enter one of the six railroads below the service bunker. By an automatic discharging device the wagons were loaded and on the way within two minutes. Our guide informed us at this point that 70 miles of railway existed around the yard with 30 steam locomotives in service.

**Retort House.** Our next visit was to one of the 14 retort houses of which 9 are equipped. This retort house had 300 horizontal retorts in settings of 10 of D. section 22 ins. x 16 ins., 23 ft. long with a loading of approximately 18 cwt, of coal. Electrically driven projector machines were used for charging and discharging. We watched the discharge of coke into the producer with step grates and water cooled bars.

**Work Shop.** Leaving the retort house we passed the loco shed and on to one of the workshops. Here, everyone seemed to be even more interested. Machines of various types and sizes with a capability of taking care of any breakdown on the works were viewed. Large shafts and crankshafts were noticed to be in various stages of repair. Large bolts, heavy rakes, hoes, heavy guage fans and screens in the making. After the heat of the day and the fumes and dust we refreshed ourselves with a wash before taking tea, kindly provided by the Gas, Light and Coke Company in their canteen. A very enjoyable afternoon ended at 6 p.m. In conclusion, I should state that *Beckton Gas Works* is the largest in the world and cannot be seen in one afternoon, (if from the air not from an engineer's point of view), and we had not time to inspect the Gas Purification, Condensers and Exhauster, Tar and Ammonia recovery, Station Meters, Naphthaline Extraction plant, Benzole Extraction plant, and above all the Steam and Electric Power Station. The works are capable of producing daily 120 million cubic feet. (500 B TH U per cb. ft.) 600,000 Therm.

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## A STEAM ADVISORY SERVICE.

The bad effects on industrial economy and production of the recent fuel and power breakdown are plain to be seen. The problem of overall shortages of materials, manpower and plant capacity has been greatly intensified.

Fuel, for example, must now remain in short supply, in relation to requirements, for a long time to come. We cannot expect any early improvement in fuel quality and the price of fuel will tend to go up rather than down.

There will need to be at individual works an even greater concentration on the manner in which available steam supply is utilised. The need is not merely one of fuel saving. Time saving and and improved efficiency of output from steam-heated manufacturing and processing plant are equally vital to recovery. We hospital Engineers, must seek all the expert technical guidance and assistance which is offering on this prominent question of steam utilisation.

A notice, issued jointly by two Cheltenham firms, Siprax Manufacturing Co. Ltd. and Sarco Thermostats Ltd., both specialising in matters of steam control and utilisation, reads as follows :

"Our two Companies, working in close collaboration, have extended and strengthened our Technical Advisory Services. This has been done in order to meet as far as may be possible the increasing and pressing needs of industrial steam users for adivce on methods and technique of improved steam utilisation. The specialist advice covers every aspect of steam control and usage for process and heating, including thermostatic temperature control (for hot water systems and process liquors as well as for steam), steam trapping installations, air venting installations, flash steam recovery methods and systems, condensate return systems, combined flash recovery and condensate return systems, and so on. In addition to the Technical Staffs at our Cheltenham Headquarters we have established at all key points of industry, throughout the United Kingdom, area services in the immediate charge of our own Regional Engineers who are full competent to survey a steam system or individual plant and to put forward recommendations likely to result in a more efficient use of steam and an improved output economy."

This seems to be an excellent opportunity for Hospital Engineers to obtain specialist advice on pressing problems concerning their installations, with a view to getting a better productive result from every pound of steam consumed.

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## NEW BULLETIN ON STEAM TRAPPING AND AIR VENTING.

Among the most popular of the Technical Bulletins issued by Spirax Manufacturing Co. Ltd., Cheltenham, Glos., is that dealing with steam trapping and air venting installations for space heating systems and cooking and hospital equipment.

The latest issue (the fourth edition in the series) is Bulletion No. 15. Comparing it with Bulletin No. 13, which it supersedes, the new work brings existing material up-to-date and includes much new information. So far as we know it is the only reference work in the country covering specifically methods of draining condensate and venting air from heating, cooking and hospital equipment.

An introductory section of the Bulletin gives a concise description of the operating principles of the thermostatic type and mechanical type steam traps most commonly is use. Following this is a most useful section on the subject of steam trapping troubles, how they may arise and how they should be dealt with. These troubles are under the headings of pipe dirt, waterhammer, corrosive condensate, steam locking, air binding, freezing, the wrong drainage point, and group trapping. In this section is a timely reference to the value of Sight Glasses as an essential part of good steam trapping.

Subsequent sections give authoritative recommendations for the drainage and air venting arrangements on the particular equipment used in various forms of hot water supply and steam heating, Additional sections deal similarly with kitchen equipment and hospital equipment and at the end of the Bulletin a number of pages are devoted to graphs of condensate discharge capacities of various types of steam traps.

Every section in the Bulletin is well illustrated by photographs and very clear diagrams.

This Spirax Bulletin No. 15 is a departure in the matter of size. Whereas previous Bulletins have been in pocket size the new edition has been produced in the size 10 ins. x 8 ins. following an extensive inquiry on the question.

The new Bulletin should prove to be an extremely useful work of reference.

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## LETTERS TO THE EDITOR.

Sir,

I was delighted to read in January's issue a letter from so experienced a Hospital Engineer as Mr. F. Arkle whom I have had the pleasure of hearing at an Annual General Meeting. I was somewhat concerned, however, to read his definite statement that all Hospital Staffs will come under an Administrator either Medical or Lay. I sincerely hope not! In my opinion Hospital Administration should be a Trinity or Triad—Medical, Commercial and Engineering, each responsible in his own sphere direct to the Governing Body and in touch with same. Each ones word authoritive in his own Department with an understanding that co-operation and efficiency for the smooth running of the Hospital and the welfare of the patients absolutely essential and at all times desirable.

Mr. Arkle takes it for granted that the Engineer will be responsible to the Administrator, that would be quite all right if the Administrator was a qualified Engineer but not otherwise. Too long have other Executive Officers in Hospitals picked the brains of the man looking after the mechanical and electrical end to the detriment of that individual and the aggrandisement of the "picker." I sincerely hope that this state of affairs will be brought to an end anywhere that it exists, now and for all time.

I am looking forward with interest to the granting of Charter which I hope will not be long delayed and the M.I.H.E. become as important in the Hospital world as B.Sc., F.R.C.S., etc.

Yours faithfully,

MATTHEW McN. GRAY,

*Hon. Sec.*, (Northern Ireland)

## ANNOUNCEMENTS.

The next Annual General Meeting will be held at Newcastle on Saturday, September, 6th, 1947. Should you require accommodation, please communicate with L. Thomas, Esq., 28 Hillside Gardens, Sunderland, as early as possible.

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## BRANCH NEWS.

**Scottish Branch.** On the 16th May, the Chairman and Secretary of the Glasgow and District Branch visited Gogarburn Mental Institution, Edinburgh, and gave a brief summary of our activities at the opening of a Branch in Edinburgh.

Mr. Robertson, Rosslyn Lee Mental Institution, was elected Branch Secretary, to whom all communications should now be sent.

After answering many questions, Messrs. Watson and Smith of the Glasgow Branch were thanked for their assistance.

R. H. Smith.
*Hon. Sec. : Glasgow Branch*

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**Northern Ireland Branch.** The Branch held its inaugural meeting on 12th April, 1947, in the War Memorial Hostel, Belfast ; 80% of the members attending. Mr. William Gillespie, Chief Engineer of Purdysburn Fever Hospital was unanimously elected President and the Secretary's position was confirmed. Proposal Forms were presented and approved by the Branch and discussion on several relevant matters took place ,the most important of which being the question of recogintion by the Northern Ireland Government. Progress has been made in this respect with the Ministry of Health, N.I., and the Hon. General Secretary of the Institution of Hospital Engineers.

The serving of a High Tea brought a most successful and enjoyable meeting to a close, the large majority of the members having to travel from the country hospitals by Bus, Rail and Car.

Matthew McN. Gray,
*Hon. Sec., N.I. Branch.*

Freer & Hayter, Printers, High Wycombe.

Institution of Hospital Engineers.

2, Glenside Villas,
Blackberry Hill,
Fishponds,
Bristol.

10th September, 1947.

Dear Sir,

The next meeting of the West of England branch of the above Institution will be held in the Committee Room, of the Taunton Rural District Council, Mary Street House, Mary Street, Taunton. on Saturday 27th September, at 3.p.m.

Buses run from Taunton G.W.R. Station to the Parade, then about two minutes walk up High Street to Mary Street.

I hope as many members as possible will make every effort to attend, as Branch Chairman, Branch Secretary, and Council Representatives for the year 1948 will be elected.

Yours sincerely,

H A Adams

Hon. Branch Secretary.