LIA22499

LEAD INDUSTRIES ASSOCIATION

60 EAST 42ND STREET
NEW YORK 17, N. Y.

COPIES SENT ALSO TO ENGINEERING AND
PURCHASING PERSONNEL OF MEMBER COMPANIES

July 24, 1959

SUBJECT: "LEAD NEWS"

To the Members of the
Lead Industries Association

Through reciprocal arrangements with the Lead Development Association, which is our counterpart in England, we are pleased to send you the latest issue of their semiannual publication "Lead News". They are, in turn, distributing a quantity of our quarterly publication "Lead" in England.

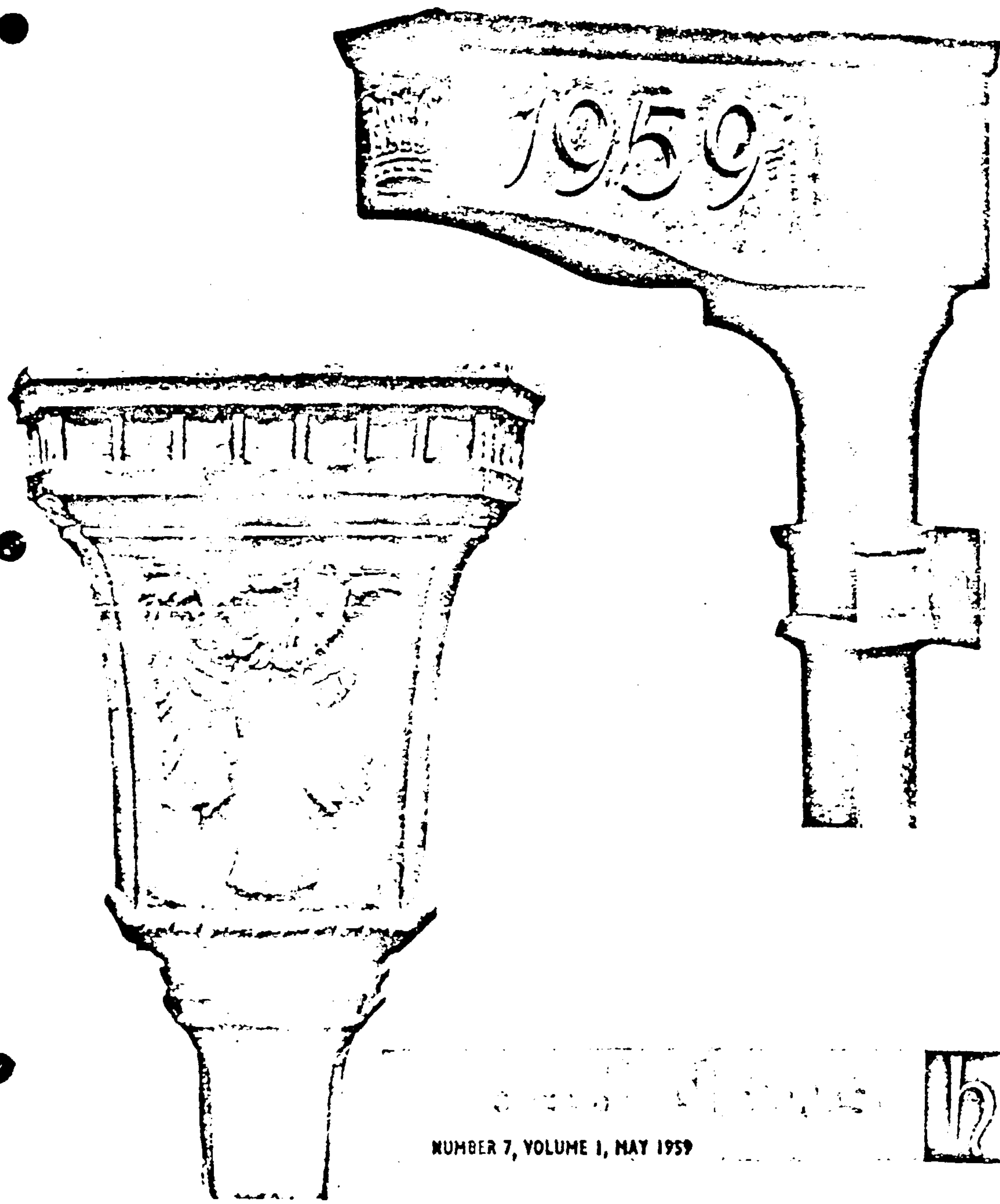
We hope you will find this publication of interest and value. We will plan to send it to you in the future as issued.

Very truly yours,

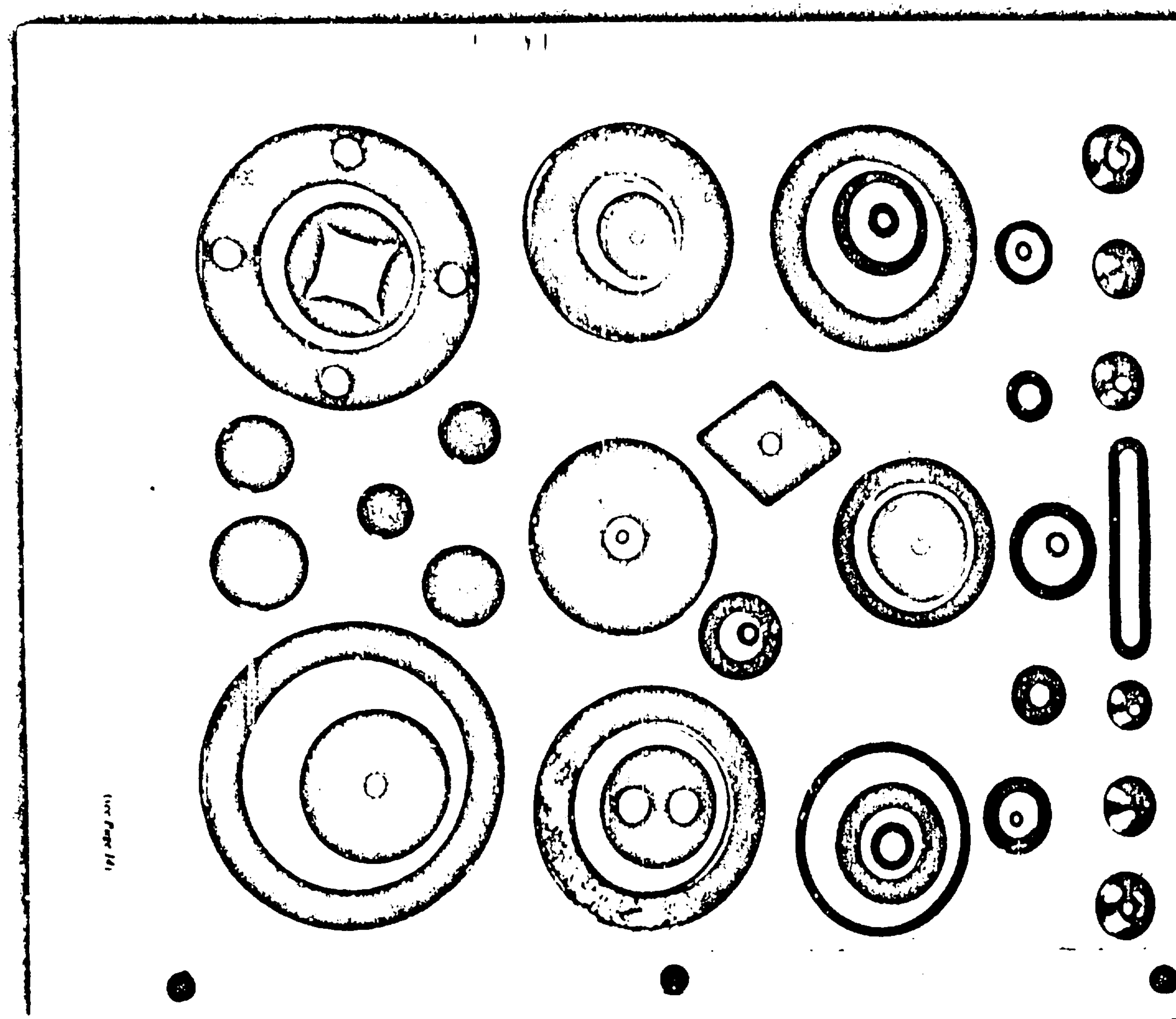
Robert L. Ziegfeld

Secretary

Enc.



NUMBER 7, VOLUME 1, MAY 1959



LIA22502

Lead News

A Periodical Publication of the Lead Development Association

NUMBER 7, VOLUME 1, MAY 1959

CONTENTS

EDITORIAL . . . .

THE Lead Development Association has now published its Review of Services for the year 1958. It describes how important steps were taken during the period to consolidate the fundamental developments in its *modus operandi* which occurred during the previous 18 months. In an endeavour to stimulate a better appreciation of its services, a record has been made of the various ways and means which have been employed to further the objectives of the Association.

The report commences with a brief account of L.D.A.'s background and development, and goes on to recall the stages whereby its interests and influence have grown. The technical activities of the Association during 1958 are covered by paragraphs on field visits, research, library, "Technical Abstracts", lectures, advertising and editorial, and mention the line future policy is likely to take.

In the matter of public relations the Review offers information on current L.D.A. publications and a new film, "Lead The Enduring Metal", which will be available by mid 1959.

Considerable headway was made by L.D.A. during the period under review in the sphere of international relations, and some account is given of the General Manager's visit last April to the United States and Canada and of his tour, accompanied by the Technical Manager, to effect contacts with friends and counterpart organizations in Holland, Germany, Belgium and France in the autumn.

The Review includes a reference to the United Nations Conferences on Lead and Zinc held in London and Geneva in September and November respectively, at which the Association was represented, and a comment on the figures of consumption for lead in the U.K. for 1958.

Finally, the work of the Lead Sheet and Pipe Section of the Association is described in some detail. The document is supplemented by illustrations and five appendices giving details of membership, committees, staff, publications, films and consumption figures for lead for the period 1949-1958.

It is probable that a copy of the Review has been posted with this edition of Lead News, but if this is not the case and you would be interested to read it at length, please do not hesitate to notify your request.

LIA22503

RAIN WATER HEADS

Cast lead "rainwater pipe-heads" are another of the many examples of the remarkable long life of lead for the essential purpose of exclusion and dispersal of rainwater from buildings. From the fourteenth century, lead has been used by the plumber as an expression of fancy, and in later years, to the design of our most famous architects, to make these particularly English features.

The tradition has been well maintained and it is often possible to date a building from the design on the heads or, in many examples, by the actual date included in the ornament. There is at Windsor Castle a cast lead rainwater head dated 1589.

Lead rainwater heads and pipes, properly made and fixed with equally permanent materials, will certainly outlast the surrounding fabric of a building. They do not require any maintenance or protection. Where square section pipes are used, whether on the face of a building or built into a chase, they are unaffected by the inroads of rust or corrosion on the inaccessible faces.

The rainwater heads illustrated on the front cover are two examples of current work; on the left for the Hawker-Siddeley Building at Kingston-on-Thames and on the right for Manchester University both designed by Sir J. H. Worthington.

Those illustrated in the centre pages are:—

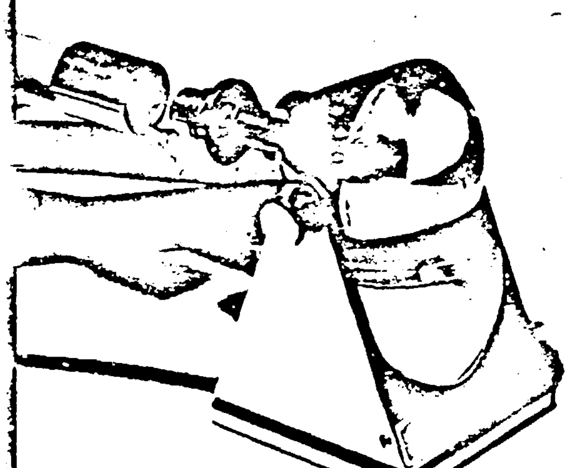
From left to right top:

- Bristol Council Offices (E. Vincent Harris, O.B.E., R.A., F.R.I.B.A.).
- Unity House, London (H. and M. Lidbetter, F/F.R.I.B.A.).
- London University (Adams, Holden and Pearson, F/F.R.I.B.A.).
- Guildford Cathedral (Sir E. Maufe, R.A., F.R.I.B.A.).
- Middle Temple, London (Sir J. H. Worthington, O.B.E., R.A., F.R.I.B.A.).

From left to right bottom:

- Sissinghurst Castle, Kent (Sir E. Maufe, R.A., F.R.I.B.A.).
- Royalty Court, London (Thos. and Peter Braddock, F/A.R.I.B.A.).
- Houses of Parliament, London (Sir Giles Gilbert-Scott, O.M., R.A., F.R.I.B.A.).
- University College, London (Sir A. E. Richardson, R.A., F.R.I.B.A.).
- Kings School, Canterbury (Braddell and Lawrence, A.R.I.B.A.).

All these examples were made by Stoner and Saunders Ltd under the personal direction of Mr. S. D. A. Saunders.



ISOTOPE CONTAINERS

A recent addition to the now long list of lead filled containers used in industrial radiography has come to notice. The main bulk of the unit comprises a cast-lead shield. In addition to being used for radiography *in situ*, the isotope can be used in conjunction with a handling rod for "open source" techniques.

Two sizes of container are available for use with Iridium 192 or Thulium 170. The smaller may be accompanied by a lead lined box for extra protection during transport, and the larger is completely "self-protecting", having sufficient thickness of lead "built in" all round.

These containers consist of two adjacent parts, which mate along a spherical surface. When closed, the radioactive capsule is located centrally at the join. To open, the top pivots about an axis located at the centre of curvature of the mating surfaces, so that rays can be directed horizontally. The illustration portrays the container in the open position.

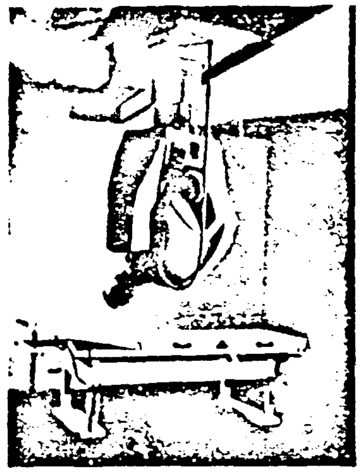
LEAD IN MEDICAL IRRADIATION

The use of lead as the shielding medium in Medical Irradiation Units is now well established. As new instruments appear in this field, the tendency is increasing to accept without comment that their shielding will consist of lead, and the inherent properties of the metal are, as a result, inclined to be overlooked.

In the treatment of tumours close to the skin, such as those in head and neck, the vital problem is to deliver an adequate dose of radiation to the tumour, without exposing the neighbouring healthy tissue to excessive irradiation.

The general practice employed to achieve this has been to use a narrow "focussed" beam of the radiation. This method normally employs a spherical lead shielded container for general protection and a lead shielded treatment nozzle.

Early units were the well-known radium guns which contained up to 10 gms. of radium. With their massive lead shields, they were later converted for use with up to 100 curies of Cobalt 60. New units have since been designed and one which has been developed specially to provide a range of short and medium distance techniques is of special interest.

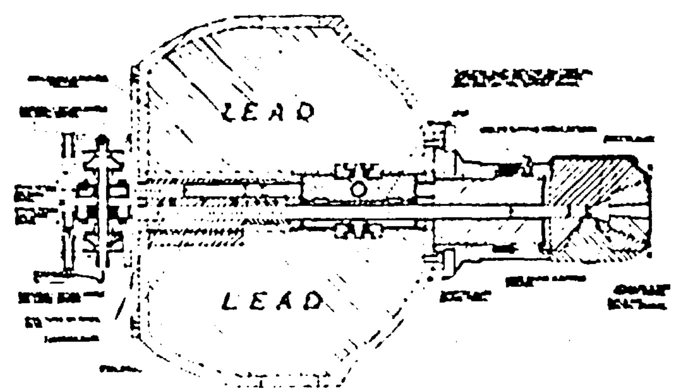


Twin-source Cobalt 60 unit

The instrument, known as a twin-source Cobalt 60 teletherapy unit, has a total source strength of 1,000 curies of Cobalt 60. It is illustrated (right) and a sectional diagram (below) shows the massive lead filled steel shielding container. The shield is capable of containing the source so efficiently that the radiation at the surface of the instrument is only about 6 milliroentgens/hr. In approximate terms this implies that an operator would have to stand in contact with the unit for a six-day week, of eight hours per day, in order to receive the accepted maximum permissible dose of radiation.

Perhaps an even more impressive indication of the protection given by this lead shield is the fact that it would be necessary to stand at a distance of over 500 yards from the unshielded source to be as safe as an operator in actual physical contact with the unit.

[Extracted from a paper entitled *New Medical and Chemical Research Irradiation Units*, by D. S. Beard and G. Munday, presented at the "Atoms for Peace" Conference held in Geneva in September 1958.]



Section through twin source Cobalt 60 teletherapy unit

ILLUSTRATIONS BY COURTESY OF NUCLEAR ENGINEERING LTD

LIA22505

LEAD SHIELDING IN A NUCLEAR WHALER

Whilst Nuclear Energy as a source of propulsion may be considered at present to be somewhat uneconomic, the special situation which arises in the case of a whaling factory ship makes this type of power unit a very practical proposition. In this kind of vessel a reactor can be used not only to provide the motive power for the ship itself, but also steam for the various processes carried out on

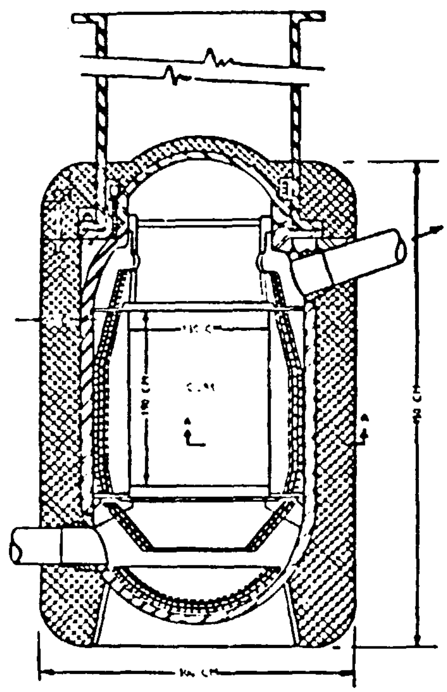


FIG. 1 *Section through reactor*

board as well as for isotopes for irradiation of the products of the factory.

The type of reactor at present proposed follows a study by an international team of engineers as part of the Nuclear Engineering Programme at the University of California. A cross section is depicted diagrammatically in Fig. 1. The core consists of 198 plate-type fuel elements and is arranged as indicated in Fig. 2. The overall diameter of the core is 130 cm. and its height 190 cm. This is immediately surrounded by a 3 cm. water reflector which in turn is blanketed by a 1 cm. layer of indium providing the isotopes employed for irradiation of the products of the factory. Circulating around it is the water which is used both for moderation and cooling.

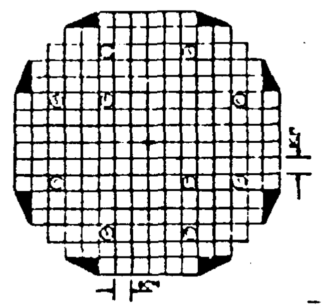


FIG. 2 *Plan of core*

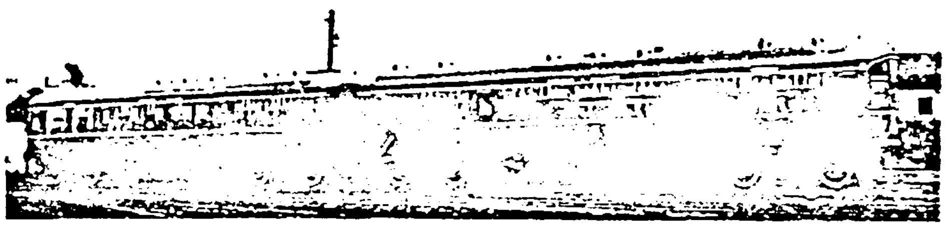
Three 5 cm. steel plates with 2 cm. coolant passages between provide the necessary thermal shield, and a further 6 cm. space outside the shield is similarly water-cooled.

The core, with its indium blanket, cooling water and steel plate thermal shield, is contained within a 12 cm. thick pressure vessel, the whole of the installation being surrounded with 30 cm. of lead, which is reduced to 10 cm. on top of the reactor. The bottom is unshielded.

Fast neutron shielding is, of course, supplied by the water in the reactor and the lead provides gamma shielding. The installation will embody approximately 135 tons of lead, and a further quantity will be used as a container in which damaged fuel elements can be off-loaded for storage when the ship returns to port.

ILLUSTRATIONS BY COURTESY OF NUCLEAR ENGINEERING LTD

A BATTERY RAILCAR



The first twin-car battery railcar to be seen in Great Britain has been on trial on the Aberdeen-Ballater line of the Scottish Region of British Railways and appears to have proved successful.

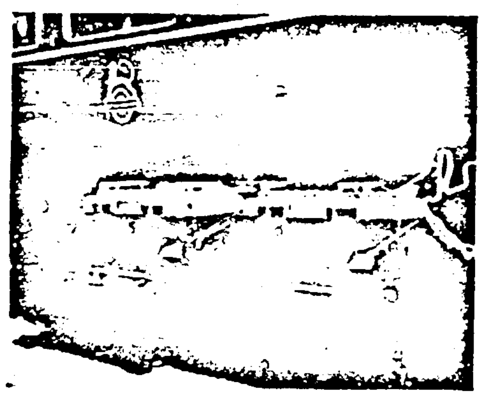
The photographs show the full train with the batteries in position.

The batteries, each weighing 8 tons, are carried in two half sections under the vehicles and comprise 216 lead-acid cells with a voltage of 440 and capacity of 1,070 ampere hours. They are housed in cradles so arranged that they can be partially withdrawn for maintenance and inspection.

With lead-acid batteries, the operating voltage rarely varies by more than 5 and 10, and this facilitates the design of the traction equipment. In addition, there are none of the interruptions in the motor circuit due to jumping of a collector shoe or pantograph.

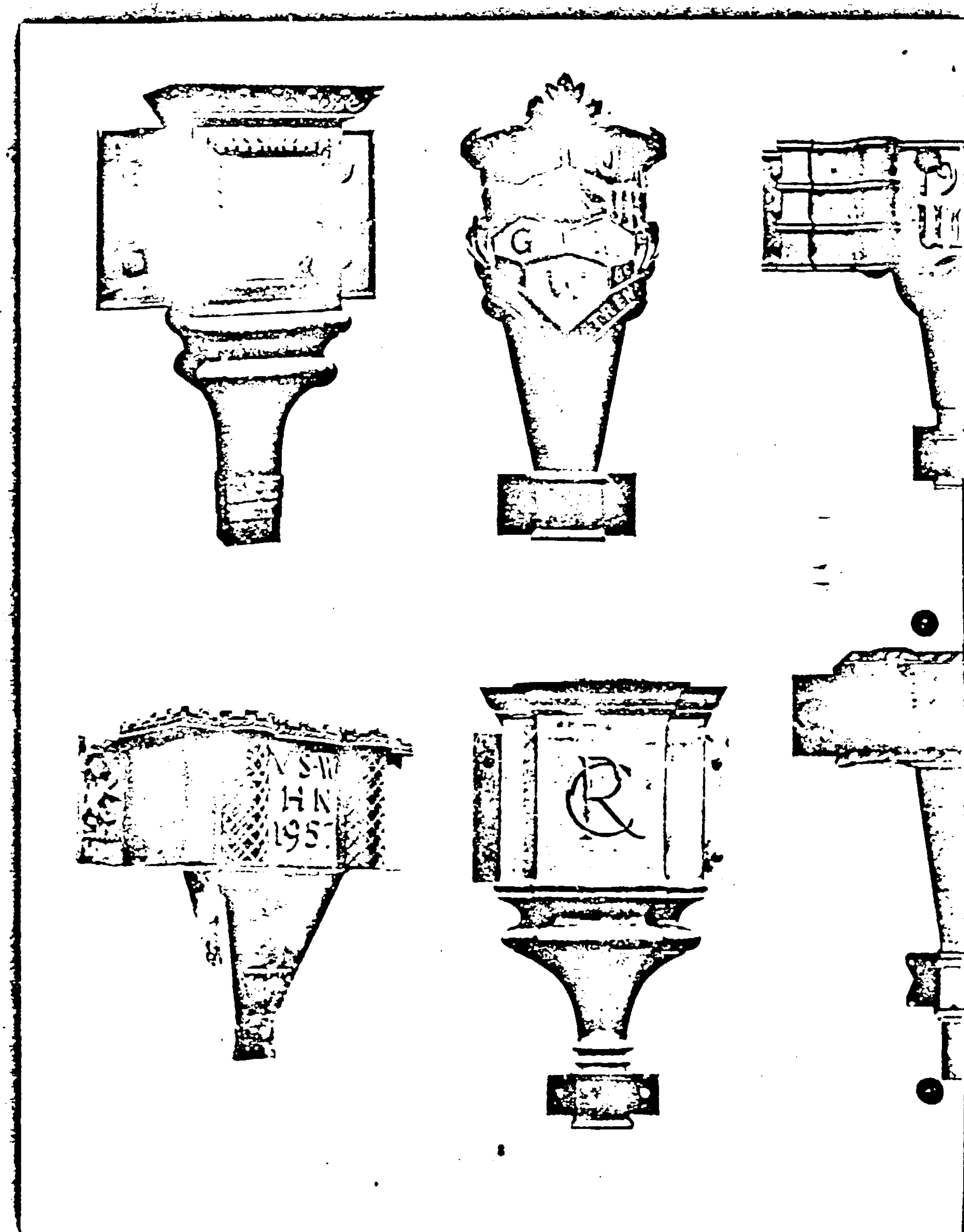
Battery-charging equipment comprising circuit-breakers, transformers and rectifiers are provided at Aberdeen Joint and Ballater Stations.

The batteries are charged at a high rate whilst the train is standing at the platforms during lie-over periods. By special arrangement of the electrical circuits, the charging cables cannot be connected or disconnected from the train while they are alive, nor can the train be moved while these are connected. Air is circulated through the battery compartments by electrically operated blowers to prevent the batteries overheating during charging.



Cradle housing for the batteries partially withdrawn for maintenance and inspection

PHOTOGRAPHS BY COURTESY OF BRITISH RAILWAYS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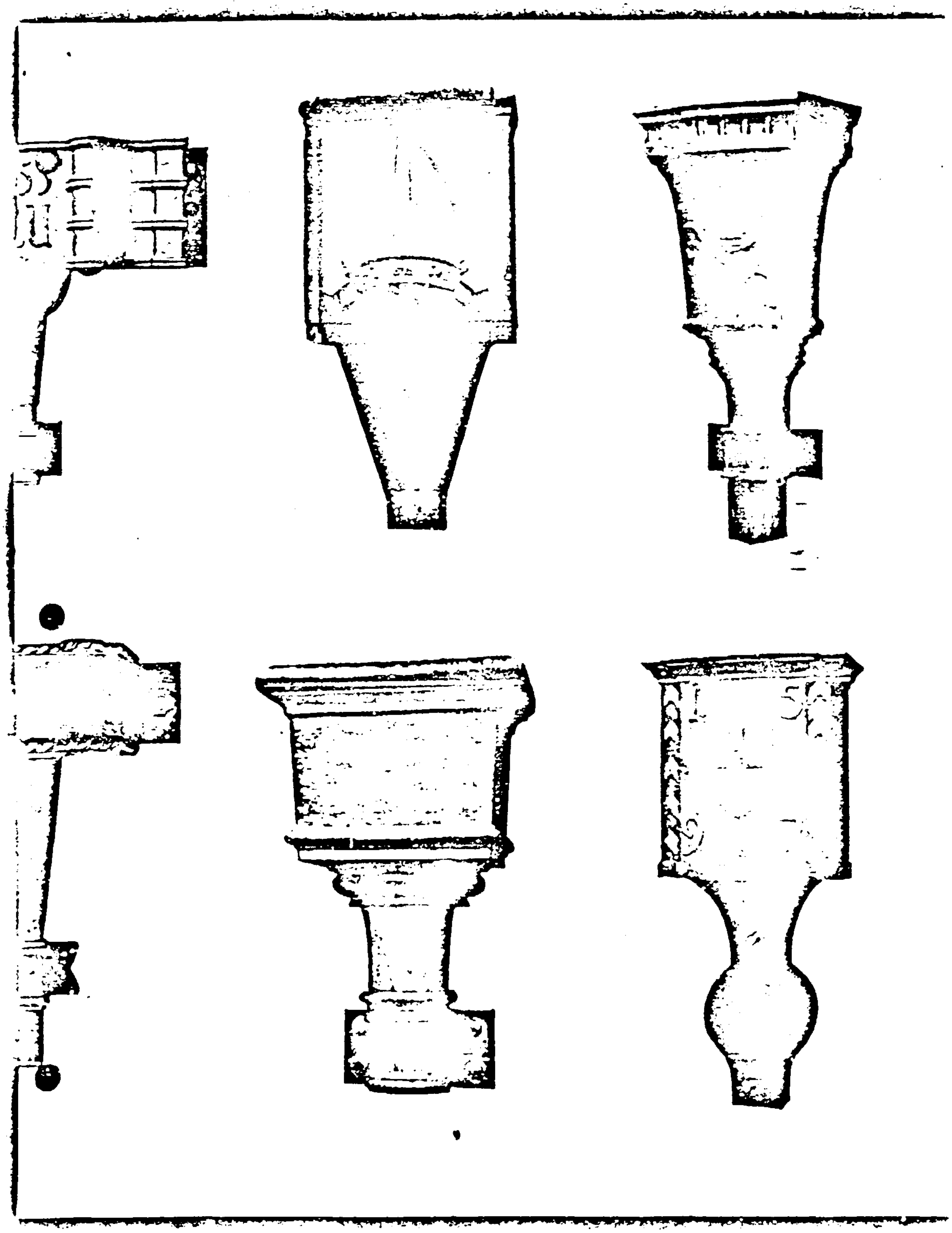


CALCIUM PLUMBATE —

A PIGMENT OF GROWING IMPORTANCE

There are many factors to observe when using paint to protect a steel surface from corrosion, and neglect of any of these will usually accelerate failure. The advent of a new and effective pigment in this field is not, therefore, the solution of all difficulties, but it does place a powerful weapon in the hands of those concerned with these problems.

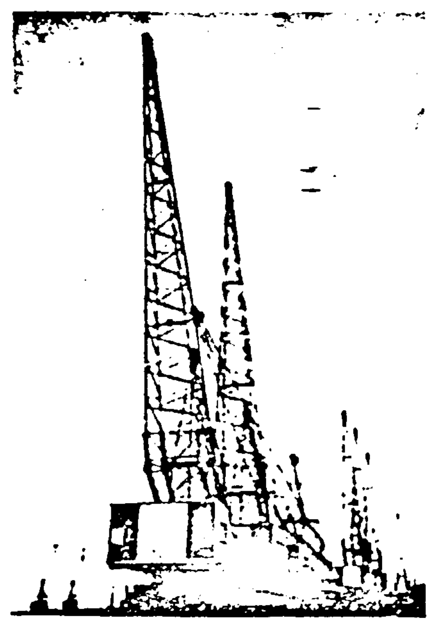
Calcium plumbate has been known for over sixty years, but its use as a pigment in priming paints was not suggested until the middle of the last war during an investigation into measures for economising in the use of lead. There is a strong suggestion of a marked similarity between calcium plumbate, which is really calcium orthoplumbate, $2CaO \cdot PbO_2$, and red lead which is lead orthoplumbate $2PbO \cdot PbO_2$. When made into a paint with linseed oil, it was found experimentally to have rust-inhibitory properties of the same order as those of red lead, and it was clear that it had considerable promise.

Manufacturing methods were devised to give a consistent product and large-scale field trials were put in hand. About 1950, the material became available commercially and its use in priming paints for iron and steel has grown steadily since.

It is now widely accepted that the rusting of iron or steel is an electrical phenomenon. The surface of a commercial steel article is not absolutely uniform, but contains some areas which are more active, electrically, than the bulk of the metal, while other areas are less active. If the surface is wetted, small electrical currents will flow spontaneously from some points of the metal (called anodes) into the liquid and then back once more into the metal at other regions (known as cathodes). At the anodes, atoms of the metal are taken into solution by the current and a secondary chemical reaction subsequently converts these metallic ions into the familiar rust. Rusting of a steel article can therefore be prevented if this electrical circuit can be destroyed. Painting offers several ways of doing this.

One method is to try to displace the liquid in contact with the surface by the substitution of a paint film having a high electrical resistance. This is not particularly efficient, since all paint films are permeable by moisture to some extent, and the electrical current can continue to flow, though possibly at a lower value.

A better system is one in which the paint suppresses the anodes. In these cases the active pigment alters the constitution of the anode areas and the flow of current is stifled at its source. One drawback to this process is that if a breakdown occurs and one anode becomes unprotected, then all the neighbouring cathodes will concentrate their influence on this one spot and corrosion at that point will be unusually rapid. A requirement, therefore, of a paint which protects by this method is that it should possess good powers of sealing off any breakdown which may accidentally occur in practice. There are a few paints in this class, chief of which are primers based on red lead, and the outstanding reputation which the latter have earned in centuries of use would not have been acquired had they been deficient in this important property.



Cranes at Avonmouth Docks, Bristol, primed with calcium plumbate

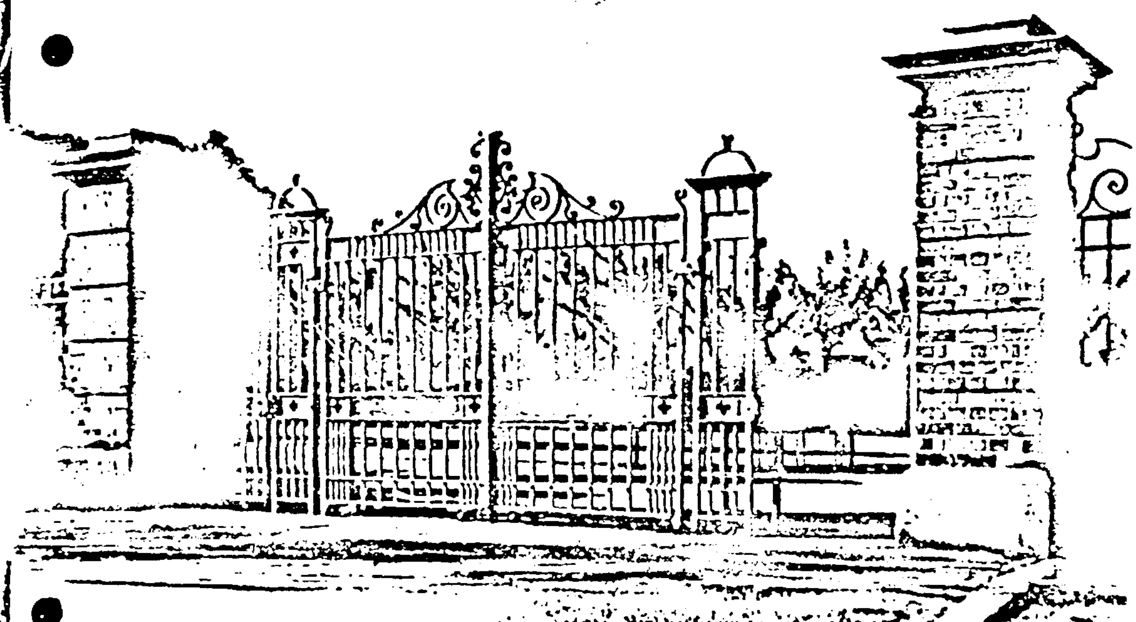
Yet another method of protection would be to destroy or inhibit the cathodes. This would have the effect of stopping the flow of electricity and in addition would provide a safeguard against breakdown. Should breakdown occur, then the exposed cathode would certainly attract current from all the nearby anodes, but the destructive effect of this current (corrosion at anode areas) would be spread over a large number of points and the damage at any one spot would be small. Unfortunately, the properties required by a pigment to meet these requirements often render it unsuitable in other directions as a constituent of a paint, and there are few materials which prove satisfactory in all respects when put to the test.

Calcium plumbate appears to be one of the few. Although the mechanism of its protective power is not fully elucidated, there is a growing weight of evidence that in a priming paint it protects the steel by suppression of both the anodic and cathodic areas of the structure.

Apart from these obvious advantages, there is another consequence which is not so apparent at first sight. It concerns the behaviour of linseed oil paints with sea water. Paints containing this very useful vehicle will blister and soften when they have been applied to a steel structure and later exposed to saline spray. It is commonly held that the activity at the cathodic areas is responsible for this. When calcium plumbate is incorporated in the paint, this effect is not observed (believed to be due to the suppression of cathodic activity) and as a consequence the paint has a much longer life. The paints are now finding extensive use in the priming of ships' superstructures.

Calcium plumbate has a number of other characteristics of advantage to a paint pigment. Its colour is light buff, which permits a wide range of colours to the finished paint; it has a comparatively low specific gravity, thereby giving a paint with a low weight per gallon; it mixes well with oil to give a paint of good texture, although a small amount of a dispersing agent is usually added to preserve this property on storage; its rust-inhibitory properties are so pronounced that the incorporation of a fair amount of extender in the paint is possible; paints made with this pigment cover well and leave few brush marks—these often being a source of weakness in a priming paint; and, finally, a film of a calcium plumbate paint on steel will continue to harden and toughen long after coats of other paints have been applied on top, although no case has been reported where the hardening has proceeded to the point of cracking.

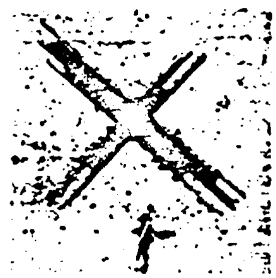
The alkaline nature of the pigment calls for some comment. It is probably this feature which is mainly responsible for its beneficial suppression of cathodic activity on steel, and it is also useful as a neutralising agent for the harmful



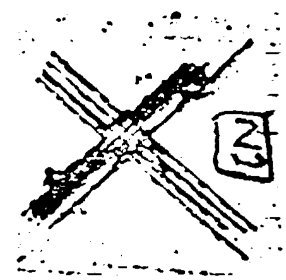
Wrought Iron Gates, Norwich, protected by calcium plumbate acidic breakdown products of the organic constituents of the paint. Despite this alkalinity, it is possible to use calcium plumbate with a fair range of media, and further, it does not seem to affect alkali-sensitive pigments such as Prussian Blue.

Probably one of the features of calcium plumbate paints which has the greatest appeal to the practical man is their ability to adhere satisfactorily to a variety of 'difficult' surfaces. Thus, they can be applied directly to new galvanised iron without the prior use of a mordant or recourse to weathering. Galvanised iron has always presented one of the biggest challenges to paint technologists and many combinations of treatments, media and pigments have been tried in the past with indifferent success. The advent of calcium plumbate has solved these difficulties without the use of special techniques or unusual formulations. As far as is known this remarkable adhesion to galvanised iron is unique among paints. Practical tests have shown that these primers also adhere well to hardwoods, such as oak, and further that light alloys (e.g. aluminium alloys) can be primed with every confidence.

This article, which is written to introduce this versatile pigment to a wider public, does not purport to give working details of interest to a paint manufacturer or chemist. The makers are Associated Lead Manufacturers Ltd., Clements House, 14-18 Gresham Street, London, E.C.2, who will gladly forward particulars on request.

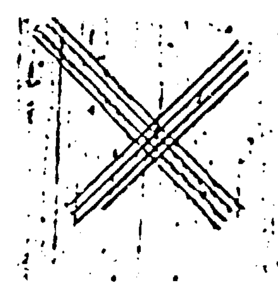


Red Oxide primed on new galvanized iron untreated



Red Oxide primed on new galvanized iron worked with white paint

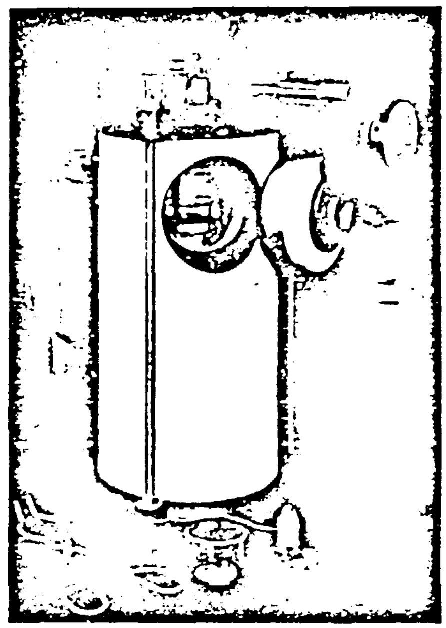
Calcium Plumbate primed on new galvanized iron untreated



Calcium Plumbate primed on new galvanized iron worked with white paint

LIA22512

OLD LEAD FOR NEW ATOMIC SHIELDS



Several references have recently been made to the necessity for using old lead to shield certain instruments used in the detection and measurement of various ionising radiations such as X and gamma rays, giving rise in some quarters to the false impression that only old lead is effective in shielding applications generally. This, of course, is not correct, and new or freshly mined lead is widely used for shielding purposes, being entirely satisfactory in all but a very small minority of cases. The exceptions concern a few specialized instruments designed to detect radiations of low intensity levels.

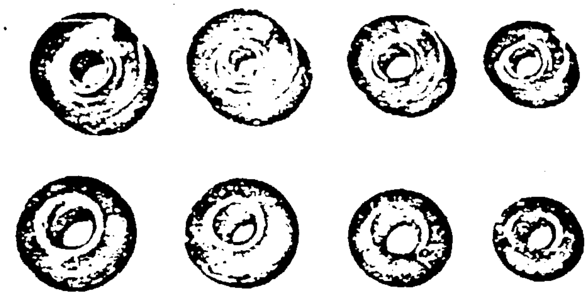
The circumstances in which lead ore is found in the natural state are responsible for this situation. Most ore bodies are associated with rock formations, such as granite, which have a small degree of natural radioactivity. Hence, newly mined lead is slightly contaminated and emits a very feeble radiation, which is not affected by the subsequent smelting and refining processes. The resultant primary lead is therefore very slightly radioactive and the activity is such that within 50 years of its production it may be considered to have "died".

Developments in atomic energy and the use of radio-isotopes have necessitated the detection and measurement of very weak radiations. One of the instruments used for this purpose is illustrated. It is a high efficiency scintillation counter in which a liquid phosphor (a substance which detects radiations) contained in a glass receptacle is used to count the radiations from an immersed weak radio-active source.

The whole unit is surrounded by a massive lead shield of minimum thickness 1½ in., to prevent external radiations from interfering with the experiment proceeding inside.

When experiments are being performed involving extremely low intensity levels, it is found that new lead used to shield equipment from external influences may give rise to sufficient extra radiation from the metal itself to interfere with the measurements. As a consequence it is necessary to specify that the shields for this type of apparatus should be made from old lead. Such instruments are comparatively uncommon, and the market for old lead which they offer is quite small. The amount of lead available from normal demolition work is quite adequate to supply the quantity required, and old lead has, therefore, no enhanced commercial value in this or any other field.

LEAD WASHERS



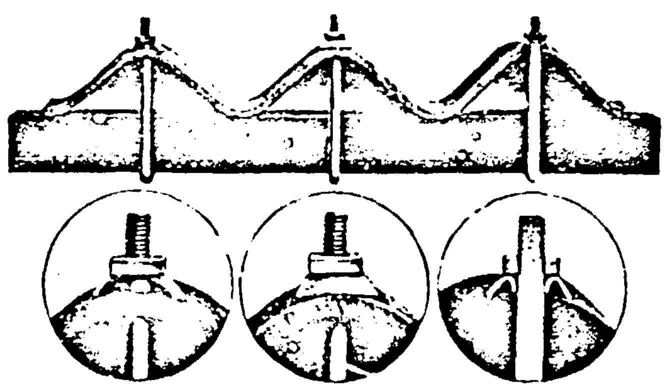
Inner and outer views of the sleeve washer in four different sizes

The illustration on the inside front cover of this edition shows a selection of some of the many types of lead washers which are currently available.

It has been the practice in small laboratories and workshops to satisfy special requirements by cutting from pieces of sheet lead. Nowadays, many different types are in regular production and are used in a number of industries.

The two photographs illustrate the use of one particular patented type of washer. It is a sleeve washer, used for corrugated roofing applications and is an improvement on plain cupped examples which have been used because of their ready adaptability to irregular shapes. If extreme pressure is exercised on the nut and bolt used with the washer, the plain cupped type can lose its conical shape, reducing the efficiency of bedding down. In roofing applications, this can cause looseness to develop, with resultant instability and tendency to leak.

The introduction of a sleeve washer was designed to overcome these drawbacks. Here, the hole is not cut but is pressed in such a manner that the material from the centre of the washer is forced inwards, producing a solid neck or collar. When pressure is applied on the nut and bolt assembly, the tubular centre meets the roofing sheet at the same time as the outside edge is adapting itself to the contours of the corrugation. At this point, only the most vicious application of pressure will cause further spread or collapse, and the washer retains its original conical shape, thus giving a double-seated, permanent, solid and waterproof joint.



Section showing collar; Outside of washer in screwed down position; Section through centre of nut, bolt and washer

This picture shows the use of sleeve washers for fixing corrugated sheet to roof purlins

LEADED STEELS

An increasing interest in the merits of leaded steels is becoming apparent. Information from the U.S.A. suggests that nearly 50 of the bar steel used in that country now contains lead, and extra plant is being brought into commission to cope with a growing demand. From Australia, too, there is news of rising consumption, and it is understood that steps are now being taken to establish production in that continent.

Lead is added to steel to improve its machinability. The lead, which is present as minute spheres homogeneously distributed throughout the steel, acts as an internal lubricant by smearing over the buried tips of cutting tools. The amount of metal required is only about 0.3% (i.e. 7 lbs. per ton of steel). It is found in practice that this addition makes no difference to the physical or metallurgical properties of the parent steel and that the ease of machining arises solely from a lubricating action and not because the steel is in any way made softer.

It is evident, however, that in a number of countries, including the U.K., there is still a lack of appreciation of the commercial merits of this material and it is considered that the time is opportune for L.D.A. to assist in the dissemination of information and to stimulate interest.

LEAD-BASED AMALGAMS

Amalgams, such as are used for many industrial and dental processes, are produced from mercury and a variety of alloying elements. In most of these, mercury is one of the minor ingredients, and in a recent example the principal constituents are 32 lead, 27.4 tin, 16.1 chromium, 15.4 mercury, and 9.1 cobalt.

The new amalgams are described as "silver-like" alloys, and are apparently equivalent to silver for many industrial processes. They are used both in dentistry and in the production of silverware and art articles.

An interesting application of a lead amalgam is the subject of a recent German patent. This describes battery grids made of 6 mercury and 94 lead, and claims that they have 53 greater durability than those made from the conventional lead-antimony alloys. For general purposes it is sufficient to make only the positive grid of this alloy, but in cases where low self-discharge is important, it is an advantage to construct the negative grid also from this material.

ELECTRICITY SUPPLY

We must defer giving further details of the cables which will link the British and French electricity supply systems as indicated in our last issue. Full-scale trials took place last Autumn, but sufficient data to form the basis of a report is as yet unavailable.

TECHNICAL PUBLICATIONS

A selected list of titles of recently published literature
obtainable from the sources indicated at individual references

Direct Study of Eutectic Alloys by means of Electron Microscope
S. Takahashi and K. Ashinuma
J. Inst. Metals, Sept., 1956, 85(1), 19-23.

The Solid Solutions of Gallium in Lead
J. N. Greenwood
J. Inst. Metals, Nov., 1956, 85(3), 91-93.

Determination of Copper, Lead, Tin and Antimony by Controlled-Potential Electrolysis
(1) General Method of Analysis
(2) Application of the Method to the Determination of Cu, Pb, Sn and Sb in Bronzes and Brasses
R. Olsson
Analyt. Chim. Acta, Sept., October, 1956, [illegible], 236-251, 389-396.

Rapid Determination of Tin, Copper, Lead, Iron and Nickel in Gun-Metal and Bronzes
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