Lead News

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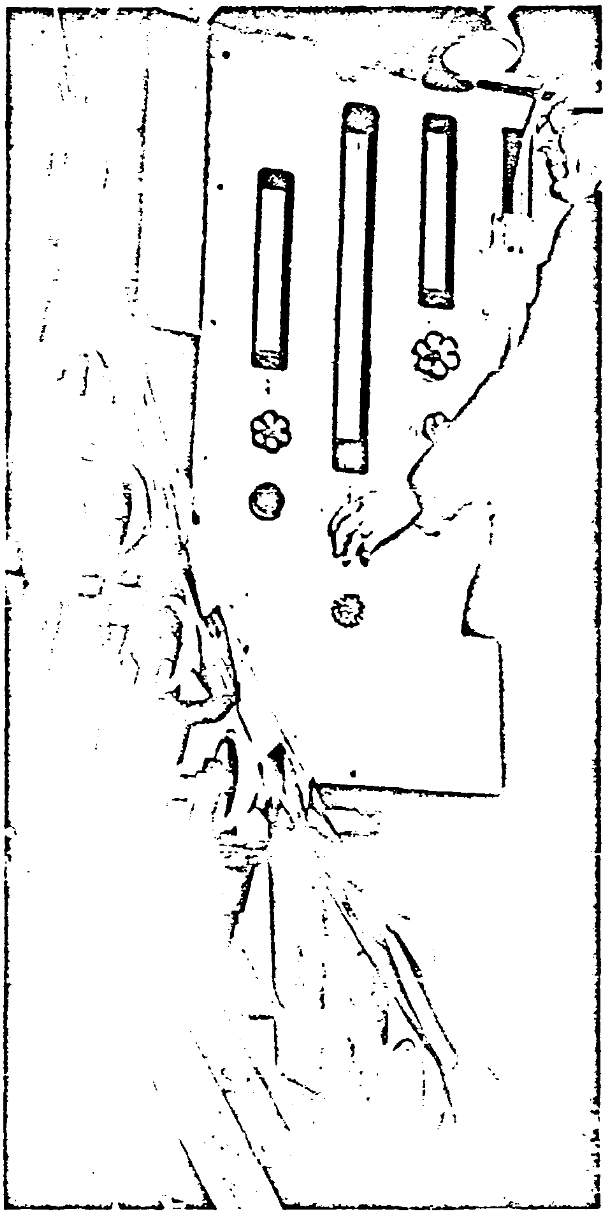
Here and there



Automatic glass
Since 1959 the UK glass firm Chance-Pilkington has [illegible] producing, and selling to all major European markets, lead glass tubing and rod components for cathode ray tubes and incandescent and fluorescent lamps, made on a continuous production line (Figure 1). The Chance-Pilkington plant is the largest of its kind in Europe, and can manufacture lead glass tubing of any required diameter in the complete commercial range—between 1½ mm. and 60 mm.—at an output rate, depending on size, of up to 2,000 ft. a minute. Thirty per cent lead is used in the melts, which are mixed to a special formula and which flow through a channel approximately 25 feet long, automatically controlled to predetermined temperatures. As the molten glass flows through an annulus, which consists of an inner funnel or 'bell' and an outer cylinder or 'ring', air is blown down a hollow shaft through the bell to inflate the glass and keep it in tubular form. The glass is cut into the required lengths after being cooled on a horizontal runway.
Lead has been used in the making of glass for hundreds of years now, and the clarity and bloom of the best crystal is in fact directly attributable to the lead monoxide in the melt.

Foiling damp
Under the name of Molyscaphe, a French firm has recently marketed a very up-to-date form of a traditional use of lead foil—to cover up and effectively seal off damp patches on inside walls. Molyscaphe is a thin lead foil, paper-backed and sold in rolls. Applied with neoprene glue, the foil covers wall stains and at the same time provides a good surface for papering over or painting.

Valley of the Fallen
El Valle de los Caidos, Spain's great monument to the fallen on both sides in the Spanish Civil War, was finally completed in 1959 after 20 years' work. A memorial crypt 262 metres long has been hewn into the solid rock of a hill 30 miles outside Madrid, and the monument is topped with a granite cross 150 metres high. Lead sheet 3 mm. thick was used as a weathering across the total length of the arms of the cross—45 metres—screwed and bolted down to the granite to secure it against the strong winds often met with in the region (Figure 2).

Linked springs
In May 1963 a new pipe link was completed between the Kaiserbad and Rosenquelle springs at Aachen, to make possible an interchange of water at this well-known spa. The springs contain sodium bicarbonate, sodium chloride and sulphur compounds, and belong to a group of warm springs believed to be particularly beneficial to those suffering from rheumatism and poor circulation.
After extensive testing of various pipe materials, lead was chosen for the new 265 metre linkage because of its resistance to the high content of free CO_2 in the water, and because on-the-spot welding (Figure 3) made it particularly easy to lay quickly under the busy town centre. In order to conserve the spring water at its natural temperature of 56 C (133 F), the lead pipe was surrounded with a foamed insulation material and laid in compressed cork slabs in a rectangular channel of pre-cast concrete units. 100 mm (4 in.) in bore and 15 mm. (about ⅝ in.) thick, the pipe is capable of withstanding more than six times the no[illegible] internal water pressure.

Robot haulage
Driverless electric tractors are now increasingly used in factories in the USA and the UK, and one big English firm

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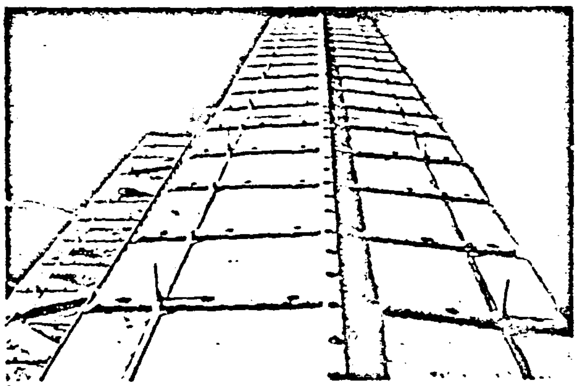

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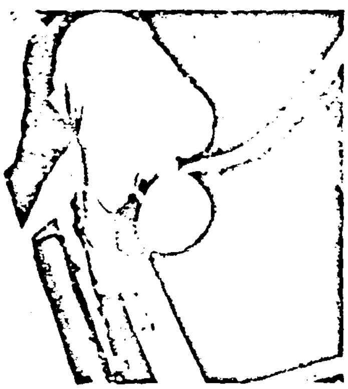

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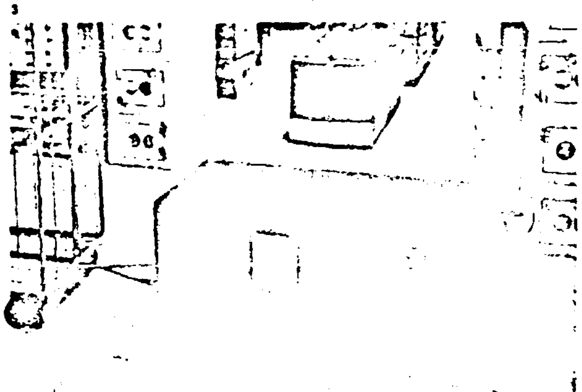

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is reported to have over forty of them on its factory floor. Fitted with the EMI robotug system, the biggest of these tractors are capable of hauling loads up to ten tons along an almost limitless series of programmed routes and stop points inside and outside works buildings (Figure 4). Powered by a 24 volt traction battery giving a ten-hour working day without recharging, the vehicle faithfully follows an energised wire buried half-an-inch below the floor, and a personnel safety device on the front will stop the tractor immediately it is obstructed. The tractor can be manually operated whenever it is necessary to remove it from the wired track. Compact and sealed, the tractor unit is unaffected by dirt or bad weather, and provides all the advantages of conventional conveyor belt installation at a fraction of the cost. Because it dispenses with a driver completely, it is claimed that the savings made enable the initial cost of the system to be recovered in a matter of months.

Pads for Pan Am

The world's largest office block—the new 59-storey Pan Am building towering above New York's Grand Central Station—is isolated from railroad-induced vibrations by the use of lead-asbestos pads placed below the steel columns supporting the building. In the USA great confidence has been shown for some years in the sound-insulating properties of these pads, which are made up of two $\frac{1}{8}$ in. thick layers of asbestos separated by a $\frac{1}{16}$ in. sheet of galvanized steel and encased in a watertight envelope of $\frac{1}{4}$ in. sheet lead. A detailed survey recently carried out on the Place Ville Marie project which spreads over the top of Montreal's Central Station, has confirmed their effectiveness in minimising disturbance in terminal buildings. Similar pads have now been specified for a new building over Sloane Street Station in London, and this important example of their use in the UK may well start a European trend.

Eiffel Tower

Lead-pigmented paints have played an important part in the maintenance and protection of the Eiffel Tower, the relatively coarse particle size of the pigment being particularly suitable for coatings on deeply pitted steel and iron alloys. Red lead has been used as a primer on rusted parts—after scraping and scouring—at each major overhaul since 1892, and every addition or replacement to the structural steel work has first been primed with two layers of linseed oil paint incorporating red lead, the second coat slightly darkened by the addition of a small quantity of graphite. Further, paints used for intermediate coats have contained lead chromate.

In 1952 when repairs were last made to the well-known Paris landmark, the joints of all important assemblies were covered with an oily leaded paste, and lead gutters and baffles were incorporated into the structure to protect the most exposed junctions from rainwater.

Konti-Skan

The Swedish State Power Board and Elsam—the Danish Power Organisation—have planned a high voltage direct current link across the Kattegat, via the Island of Laeso, between Aalborg in Jutland and Billdal on the west coast of Sweden. Submarine cables will be required for 50 miles out of the total length of 85 miles, and lead sheathing has been specified. The underwater cable between Sweden and Laeso will be of the oil-impregnated solid type, manufactured in lengths of 5,000 to 8,000 metres and flexible-jointed

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before armouring. Between Jutland and Laesø the cable will be of the Mollerhoj flat type, in which two conductors are used to obtain a flat cable. Oil-filled, with corrugated bands on the flat sides of the cable to compensate for variations in pressure, it will be manufactured in 800 m. lengths, flexibly-jointed in the factory after armouring.

Scheduled for commissioning in 1965 at a cost of 100 million Swedish Kroner (approximately £7 million) the Konti-Skan Project will be the third major submarine cable linkage, the other two being the link between Sweden and Gotland, and that between England and France.

Reactor wastepipe

The need to dispose of radioactive waste was one of the reasons for the siting of the Netherlands Reactor Centre on the north coast. Waste material is carried out to sea beyond the regulation 4 km. limit in a high-density polythene pipe, sheathed in an E type lead alloy (lead containing 0.4% tin and 0.2% antimony) applied by techniques similar to those used in underwater power cables. When it came to laying the pipe-line, the outlet nozzle was first mounted on the sea-bed in a concrete emplacement, and the cable then paid-out from large drums back to the shore (Figure 5). Manufactured by N.V. Hollandsche Draad-en Kabelfabriek, the installation is very similar in design to PLUTO the flexible lead-sheathed pipe-line laid between England and France to carry oil supplies across the channel on D-Day 1944.

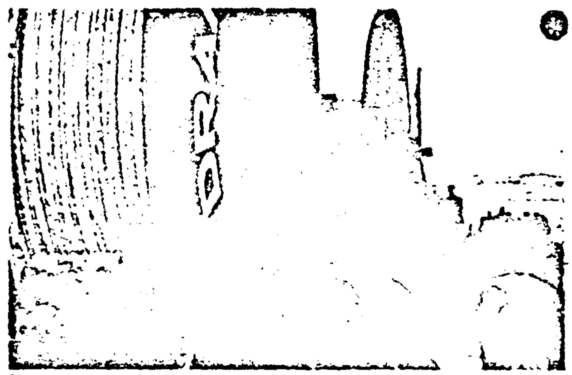
Screen for Trail

An interesting three-dimensional sculptured screen forms part of the main entrance to Trail City Hall in Vancouver, Canada. Standing out from a decorative zinc background depicting actual city buildings, a number of figures represent the major human activities and services of the city (Figure 6). The figures were beaten out of a 51-pound lead sheet, backed with a polyester paste and polished with liquid wax. The work of young Canadian artist George Norris, the screen is a gift to the city from the Consolidated Mining and Smelting Co. of Canada Ltd., one of the world's largest lead zinc producers, whose main works are at Trail.

Pray Silence

Setting: The 1963 Radio and TV Exhibition, Paris. *Problem*: RTF, the French Broadcasting Authority, had set up two studios to make it possible for selected music programmes to be heard in them throughout the exhibition. However, as is common with exhibition structures, the walls of the 'studios' were of timber-framed hardboard, possessing little or no sound insulation qualities.

Solution: Excellent insulation was achieved by covering the walls, and lining the ceilings and doors, with 1 mm. (2½ lb.) lead sheet, and a decorative effect was achieved by the arrangement of various metal shapes on the surface of the sheet (Figure 7). The whole project was a remarkable demonstration of lead's sound-insulating properties, particularly when one considers the competition from the jostling crowds, and the many radio and TV sets in action outside the studios.



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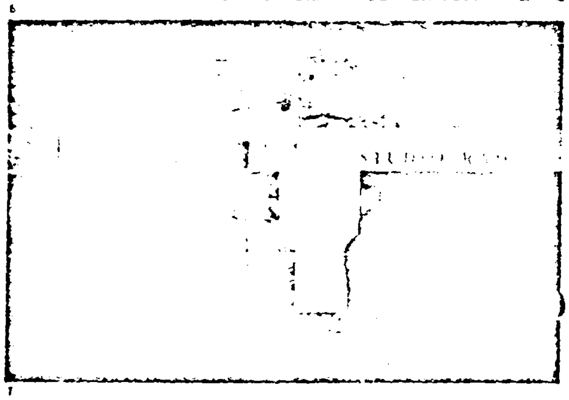

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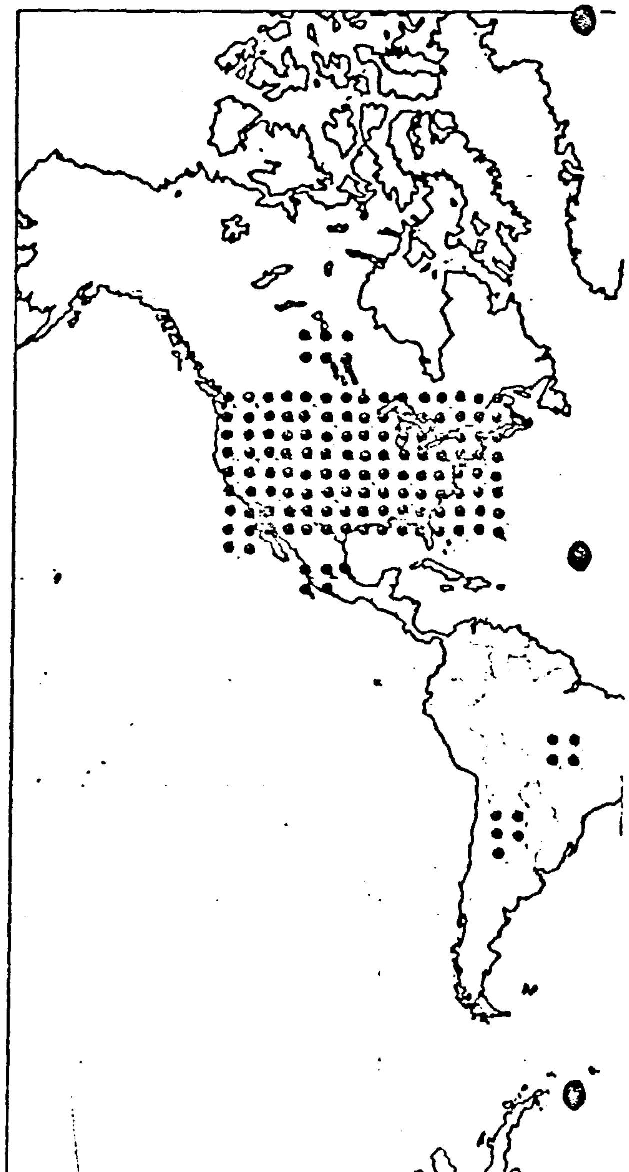
The consumption of lead

Canada 1.5
United States 30.5
Others 0.5

Netherlands 1.5



Lead has proved a highly versatile metal throughout the very long history of its use, and this is particularly so today when in one form or another it is required for a very wide range of applications in industry and everyday life. The supply of new lead from mines throughout the world has in fact increased one hundred fold* since the beginning of the 19th century, to meet the ever increasing demand for the metal.

Annual world consumption of lead has now risen above 3 million metric tons, taking into account both primary lead (new metal from mines) and secondary lead (recovered from scrap). Since in many of its applications lead is virtually indestructible, there is a high recovery of used metal and the proportion of secondary to primary lead is gradually increasing. At present it probably accounts for about 15% to 20% of the total world consumption, though the figure is almost certainly nearer 40% of total consumption in the more highly-developed European countries and in the USA.

There are two ways in which the general consumption of lead by different countries is recorded. Usually it is quoted as the amount of refined lead, whether home-produced or imported, that is obtained from smelters and refineries regardless of whether the source of the metal is primary or secondary. Alternatively it may be given as the amount of lead used at the first stage of processing, the figures in this case covering all forms of lead used including that recovered directly from scrap by the processing industries. This information, which perhaps gives a better overall picture, is at present only published for some Western European countries and for the USA, Canada and Japan.

The consumption of refined lead throughout the world has almost trebled over the last thirty years, despite severe restrictions on its use during World War II, and in 1963 had reached nearly 2½ million metric tons, excluding Soviet Bloc countries (whose consumption is estimated to exceed a further half million tons). The map (Figure 1) shows the amounts used in the main areas of the world as a percentage of the whole, and indicates the high proportion consumed by the developed countries of Western Europe and North America.

In Europe the consumption of refined lead has risen steadily in recent years, and in the USA, where it was fairly level for a period, there has been an upward trend since 1962. Figure 3 gives total annual consumption of refined lead in Europe over the decade 1954-1963, and the percentage changes (taking 1954 as 100).

The tonnages of refined lead used in 1963 by all countries with a significant consumption are tabulated in Figure 2. It can be seen that the annual consumption per head of population in the most industrially-advanced countries is around 5 Kg. or 11 lb. although it should be noted that this figure refers to lead that has come from the refineries, and does not include scrap lead processed by the lead-using industries direct. This additional consumption can be quite considerable in countries where lead has been widely used for a long time. In the UK for example, overall consumption of lead in all forms was 366 thousand metric tons in 1962, thus raising the use *per capita* to around 7.4 Kg. or 16 lb.—the highest in the world. The consumption for Germany increases to 276 thousand metric tons, for Belgium to 54 thousand and for the Netherlands to 61 thousand metric tons, the last named giving a *per capita* consumption between 5.5 and 6 Kg. or 12 and 13 lb. For France the figure is 202 thousand (4.5 Kg. or 10 lb.); for

* See article on 'The Growth of Lead Production' in *Lead News* Autumn 1962

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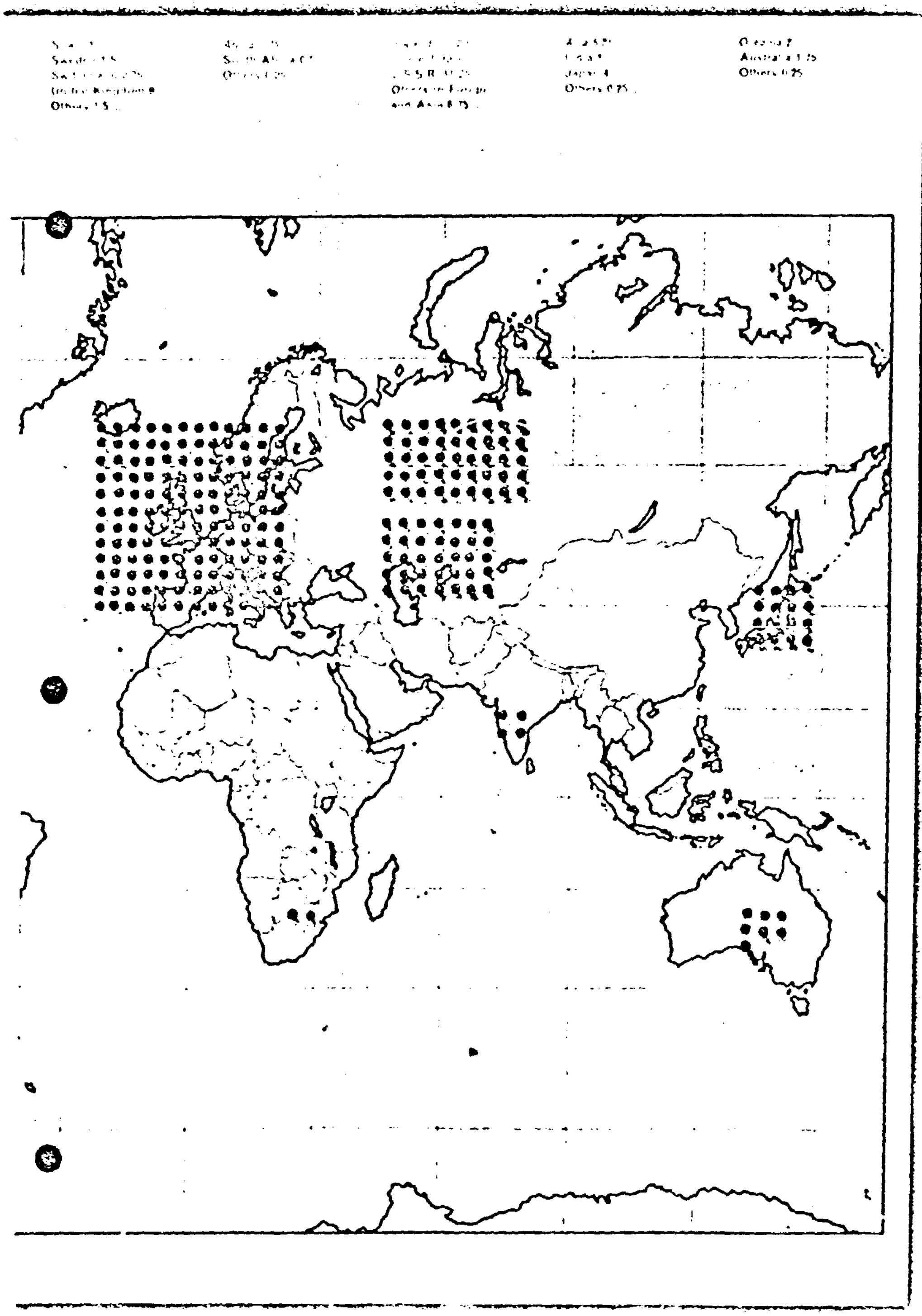
Others 1.5
Others in Europe
and Asia 0.75
Japan 4
Others 0.75
Oceania 2
Australia 1.75
Others 0.25

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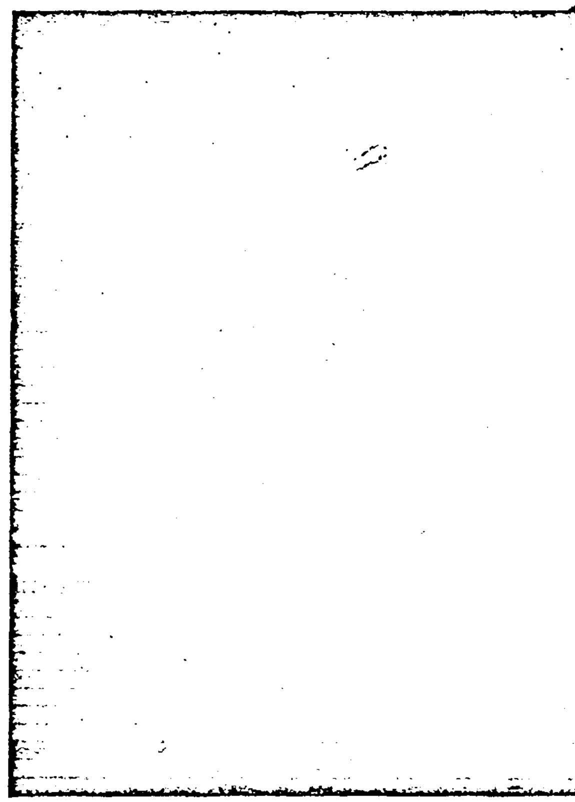
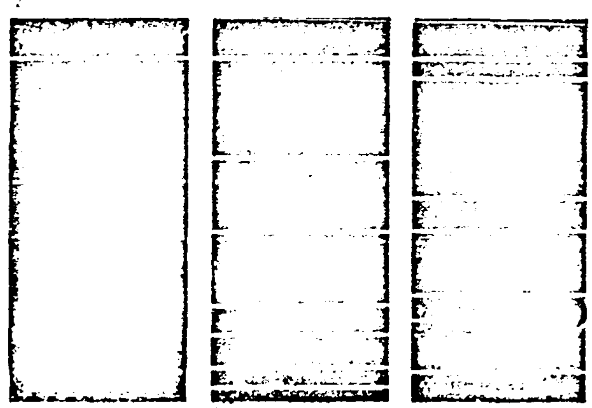
Italy 110 thousand (2.3 Kg. or 5 lb.); and for Spain 60 thousand (2 Kg. or 4.5 lb.). By comparison, the overall consumption of lead in the USA in 1962, just over a million tons, works out at 5.7 Kg. or 12.5 lb. per head of population.
The current pattern in the consumption of lead in all forms for its main uses shows some variation from country to country in Western Europe, and between Europe itself and North America. This is partly due to differing degrees of development and partly to differing industrial practice. Thus the very high consumption of lead in the UK compared with other developed countries is a direct result of the large traditional use of lead sheet for building applications. *Building accounts for about 12%* of the overall consumption in the UK compared with only 5% in Germany. Figures 4 and 5 compare the pattern of use in Europe with that in the USA.
The most important world outlet for the metal is in lead-acid batteries, a vital part of the motor car and also widely used as the primary power source of power for electric vehicles, emergency lighting, etc. Accounting for 30% of the present total world consumption, this outlet is likely to increase in importance as more and more vehicles come on to the roads—it is expected that by 1970 there will be 80% more cars in circulation in the Free World than there were in 1962. The use of tetraethyl and tetramethyl lead as anti-knock additives in petrol will also increase proportionally, the present European figure—5% of the total—still falls well behind the US figure of 15%.
Cable sheathing is another major outlet, particularly in *Europe where it is still accepted as the most satisfactory* sheathing material for various forms of electric power and trunk telecommunication cables, and where it accounts for 30% of the total. In the USA, where other materials are more extensively used and the overall pattern of consumption is different, cable sheathing takes only 5% of the total.
Other smaller but nevertheless important uses of lead are in alloys (for solders, bearing metal, type metal, etc.) in pigments (such as red lead and white lead used in paint manufacture), in a number of semi-finished products (collapsible tubes, shot and rod for ammunition, etc.) and for sound insulation and radiation shielding.





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Lead in building

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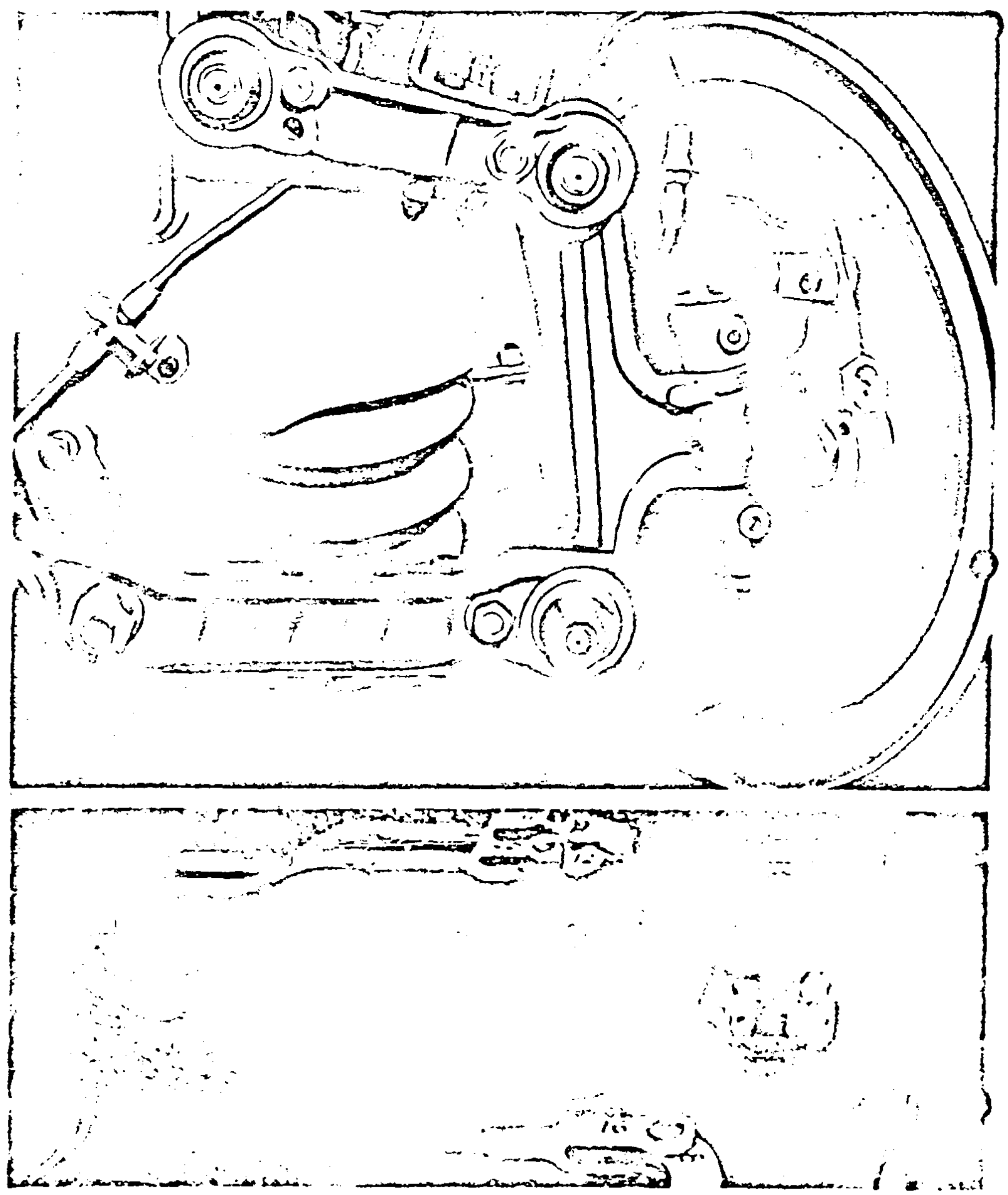

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Dry bearings

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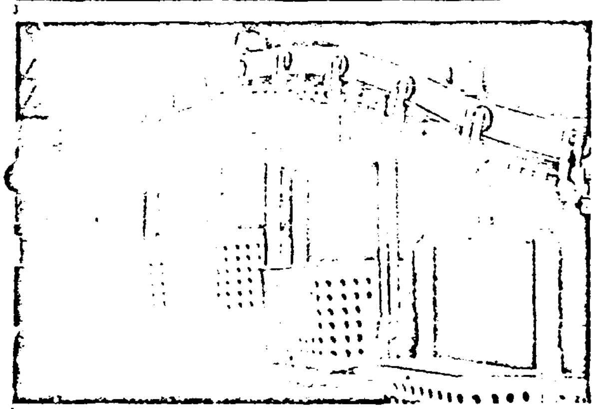

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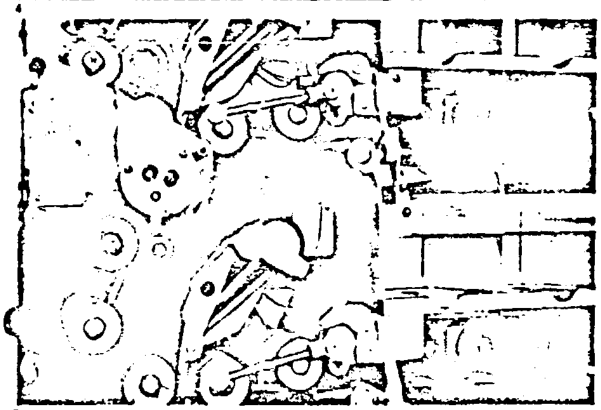

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The good frictional properties of the plastic PTFE (polytetrafluorethylene) have been successfully exploited in bearing surfaces for a number of years now. PTFE has a high softening temperature, is chemically inert and resistant to both solvents and water. However, the material's low thermal conductivity, high thermal expansion and relatively poor mechanical properties have until recently limited its use to applications involving small loads and operations at low speeds. These disadvantages have been overcome by the incorporation of lead into the PTFE.

The lead plastic bearing consists of a steel backing on to which is sintered a thin tin-bronze lining. This porous lining is then impregnated with a mixture of PTFE and lead, and a thin layer of the same mixture forms the final surface of the bearing, which requires no lubrication whatsoever. During the running-in period—the first 30 hours or so—some of the lead plastic surface layer (which is normally about 0.0008 in. thick) is worn away, being either transferred to the journal or shed from the assembly in the form of thin flakes. Very little further wear on the bearing will occur after this, and even under the most severe conditions is unlikely to be higher than 2 $10^{-[illegible]}$ in. per thousand hours.

A further safety factor in this type of bearing is provided by the tin-bronze matrix, which serves to conduct heat away from the bearing surfaces and acts as a reservoir for the lead plastic mixture. If the surface 'bedding-in' layer wears away at any point during the running-in, allowing the journal to come in contact with the matrix, the mixture softens and expands under the heat so generated and is extruded through pores in the bronze to form a new bearing surface. Since the bronze and the lead plastic mixture together have a compound thermal conductivity about 60% of that of solid bronze, and a co-efficient of expansion between those of cast iron or steel, and aluminium or bronze, the relative expansions of the bearing and journal on heating-up will not result in seizure or in the development of a large gap between the two surfaces.

Lead plastic bearings have a low friction co-efficient (0.10–0.18) with complete absence of 'stick-slip', will accept heavy loads or high speeds, and are not subject to fretting corrosion. Although felt seals are usually fitted under very bad conditions, the bearings are highly tolerant of dirt, grit and other particles, and their performance is not affected by the accidental ingress of liquids and gases. As a result of these impressive advantages, they are widely used throughout industry (in road vehicles, aircraft assemblies, electrical, domestic and general engineering equipment, etc.) in positions where lubrication may be highly inconvenient or even impossible, or where wide variations in temperature and extremely dirty conditions preclude the use of conventional lubricants.

Some of the many applications for which lead plastic bearings are now specified are illustrated opposite.

1 King pin assembly (photo: AEC Limited)
2 Railway points
3 Ships cargo pulleys
4 Heavy duty foundry conveyor (photo: Ewart Chain Belt Company Limited)
5 Detail of GPO mail sorting machine