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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

09305

Distr.
LIMITED

UNIDO/IOD.318
27 November 1979

ENGLISH

UNITED NATIONS INDUSTRIAL
DEVELOPMENT ORGANIZATION

SELECT AND ANNOTATED BIBLIOGRAPHY ON ALUMINIUM METAL PROCESSING AND USE *

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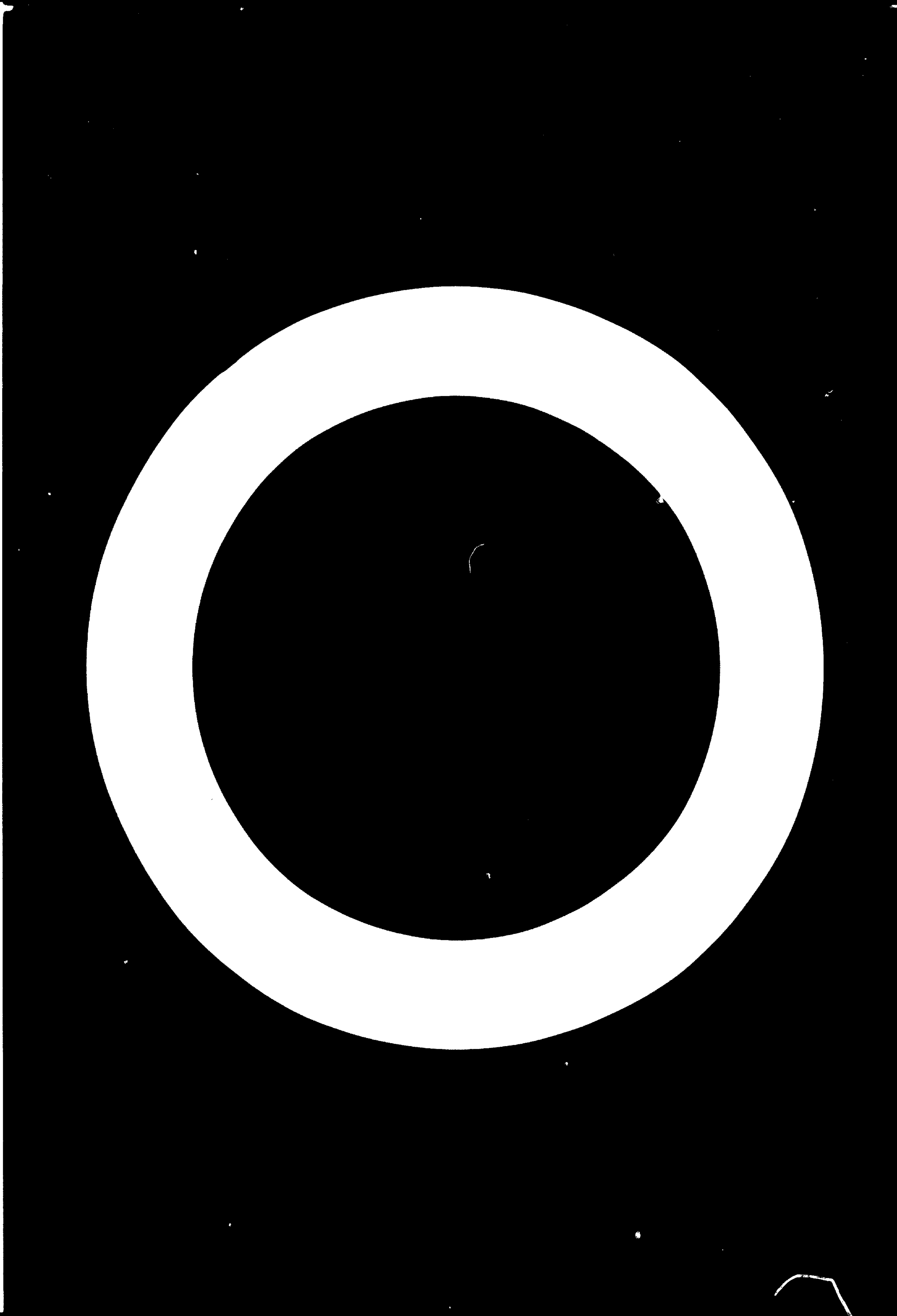

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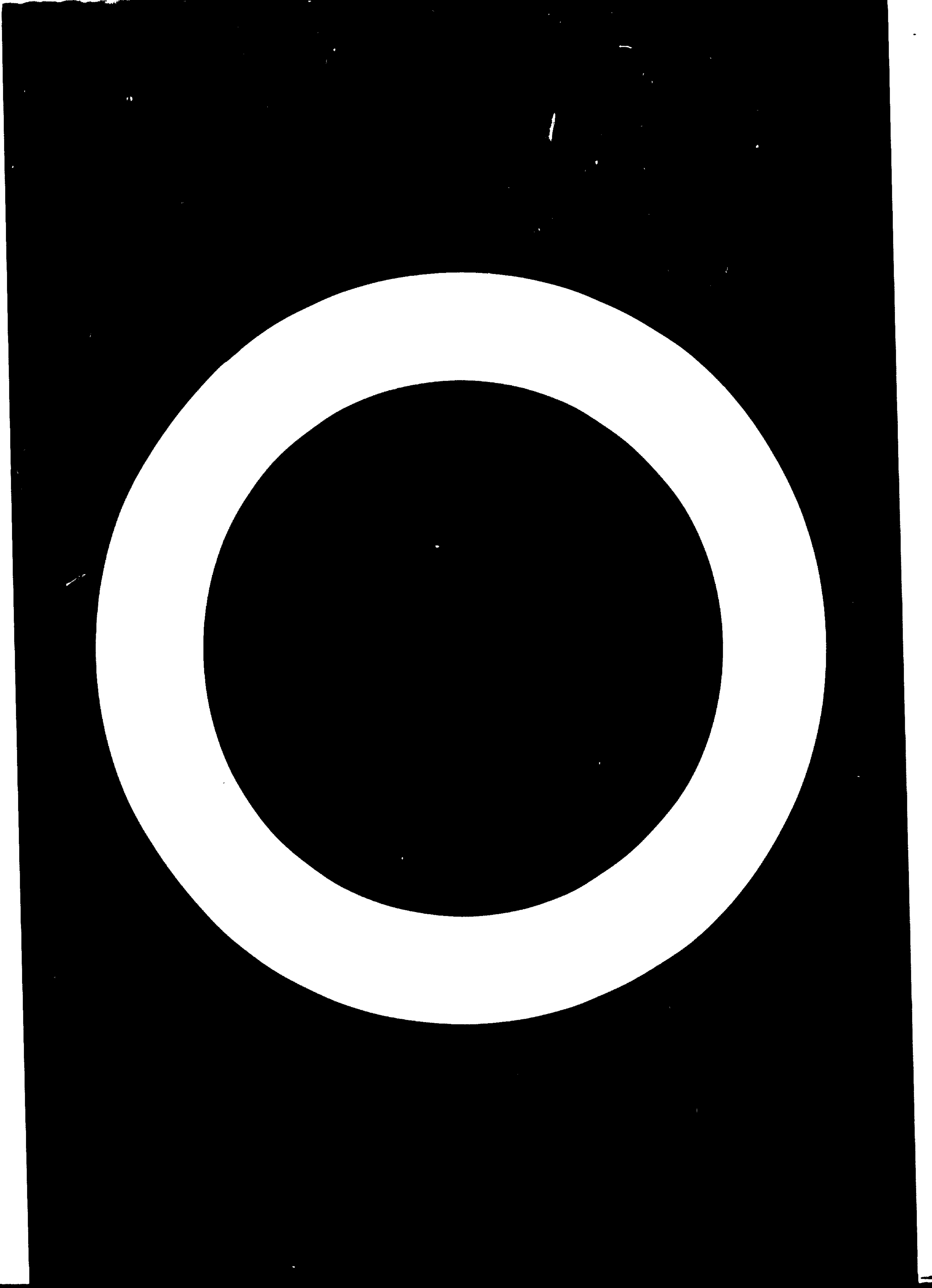

1. ALUMINIUM PRODUCTION AND CONSUMPTION STATISTICS

1. Aluminium in Austria and in the United States. Revue de l'Aluminium, No.457. Dec. 1976. pp. 551-552. /French/

   During 1975 primary aluminium consumption in Austria decreased by 12.2%, while the per capita consumption rose to 9.5 Kg. In the United States the deliveries of electrical transmission cables decreased by 8.4%; that is the only aluminium semi-product which did not participate in the upswing of the first half of 1976.

2. Aluminium Statistical Review 1975. New York, N.Y. 1976. Aluminium Assoc., 67 p. /Pamphlet/

   Industry shipments of Al ingots and mill products were 9928 million pounds in 1975 compared with 13,732 million pounds in 1974. Data are given for total supply, primary production, capacity, plant location, imports and shipments to major markets, per capita consumption by country and year from 1965 /some data from 1942/ to 1975.

3. BAUDART, G.A.: United States: no aluminium left in the American stockpile. Revue de l'Aluminium, No. 436. Jan. 1975. pp. 4-6. /French/

   The American review Metals Week gave out early last September that the total amount of aluminium remaining in the stockpile was now covered by sales commitments and that the greater part of this metal would be delivered before the end of the month. This means that the supply source is now exhausted.

4. BÉS de BERC, O.: The prospects for 1977. Revue de l'Aluminium, No. 454. Aug./Sept. 1976. pp. 384-389. /French/

   Mr. Olivier Bés de Berc, Chairman of Aluminium Pechiney, in an interview commented on the probable trends in aluminium consumption and prices in the world in 1976 and 1977.

5. CHABANNES, L.: The aluminium industry has kept all its trump cards in terms of economics and technology. Revue de l'Aluminium, No. 462. May 1977. pp. 208-210. /French/

   At primary metal level, Western world primary smelter capacities, after having expanded 7.5%/year between 1970 and 1974, only increased 3.4%/year between 1974 and 1978. World demand for primary aluminium will increase by about 10% and reach 12,000,000 t following the very strong 28% growth rate recorded in 1976.

6. HUGUENEY, M.: Aluminium stockpile in Japan. Revue de l'Aluminium, No. 458. Jan. 1977. pp. 8-9. /French/

The stockpile was meant to help the Japanese producers in reducing their metal stock to a normal level /less than 200,000 tons/, which exceeded already 400,000 tons. This stockpile should enable the Japanese to face the serious aluminium shortage foreseen for the coming years.

7. KOVÁCS, P.: Canadian aluminium exports in 1975 and 1976. Revue de l'Aluminium, No. 462. May 1977. pp. 222-223. /French/

According to Canadian export statistics /chapter 451 divided into 5 categories/ covering different aluminium products, the year 1976 shows a slight improvement over the results in 1975. That is due to the improvement in cast and forged products/+40%/ and even more in wire and laminated products /+124%/. However, the respective results of the year 1974 are still far to be attained.

8. KOVÁCS, P.: The French foreign trade of household articles in 1976 as compared with 1975. Revue de l'Aluminium, No. 461. Apr. 1977. pp.170-171. /French/

In 1976 the exports augmented to 9706 tons at an average price of 17.84 French francs per kilogram, as against 7220 tons at 16.80 French francs in 1975. The increase in tonnage reached 21%, while the prices rose in average by 5%. The cast aluminium products represent about 5% of the tonnage, the articles of hygiene only 0,25% in 1976, as compared with 0.5% in 1975.

9. KOVÁCS, P.: International trade: Belgian exports of aluminium semi-products as wires, strips and laminates. Revue de l'Aluminium, No. 456. Nov. 1976. pp. 500-504. /French/

In the period examined the exports have prospered by 27% and rose from 85,314 tons to 108,134 tons in 1976. This upswing is partly due to the integration process within the Community of the Nine European countries.

10. KOVÁCS, P. International trade: Canadian raw, primary aluminium exports in 1975. Revue de l'Aluminium, No. 450. Apr. 1976. p.165. /French/

According to first data published by the Ottawa administration, the Canadian exports of aluminium and its alloys in the form of ingots and foils /plates/ amounted to 509,165 t in 1975 as against 681,500 t in 1974, representing a decline of 25.2%. However, in the first half of 1975 the backlog compared to the data end of June 1974 was still 43%.

11. KOVÁCS, P.: International trade: exports of the Federal Republic of Germany in aluminium semi-products as wires, strips and laminates at the end of August 1976. Revue de l'Aluminium, No. 457. Dec. 1976. pp.556-557./French/

The German semi-product exports show the following figures for the first 8 months of 1976 - as against the same period of the preceding year -:

129,288 tons /of them 33,176 tons of wires and 96,116 tons of laminates/, representing an increase of 47%.

12. KOVÁCS, P.: International trade: the foreign trade of the United Kingdom in aluminium semi-products. Revue de l'Aluminium, No. 459. Feb. 1977. pp. 64-65. /French/

The first eleven months of 1976 seem to be full of prospective chances for the British transformation industry after the difficult year of 1975. In wire products some redistribution was observed.

13. KOVÁCS, P.: International trade: Italian foreign trade of raw aluminium in 1974/1975. Revue de l'Aluminium, No. 451. May 1976. pp. 218-219. /French/

The imports have decreased from 256,065 tons in 1974 to 111,079 tons in 1975, representing a reduction of 57%. As to the exports, the European Economic Community was practically the only client of the Italian exporters, having received 95% of the deliveries as compared to only 74% in 1974. The quantity delivered was 31,783 tons as against 16,739 tons in the previous year, which shows an increase of 90%.

14. KOVÁCS, P.: International trade: Japanese foreign trade in raw aluminium in the first 7 months of 1976. Revue de l'Aluminium, No. 458. Jan. 1977. pp. 9-10. /French/

The raw metal imported to Japan amounted to 234,160 tons in the first seven months of 1976, 133% more than in the respective period of the preceding year, while these figures were 69% in 1974 and 85% in 1973 of the cumulated total. The main supplier of the Japanese industry of raw aluminium was New Zealand in 1976, having delivered 56,961 tons as against 39,887 tons in 1975 /+43%/.

15. KOVÁCS, P.: International trade: statistical data on French foreign trade of primary, raw aluminium. Revue de l'Aluminium, No. 449. Mar. 1976. pp. 114-115. /French/

The French aluminium industry managed to suffer only a global decrease of 10% in their exports, while the imports were cut by 22%, hitting first of all their suppliers outside the Common Market.

16. KOVÁCS, P.: International trade: Swiss foreign trade in aluminium semi-products /first semesters of 1975 and 1976/. Revue de l'Aluminium, No.455. Oct. 1976. pp. 446-447. /French/

The imports amounted to 7080 tons in the first half of 1975, while they increased to 9212 tons in the same period of 1976, due to the upward trend in the economy. The export figures were 18,730 tons by 30 June 1976, showing an increase of 19% as against the first half of 1975.

17. KOVÁCS, P.: International trade: trying to estimate the aluminium semi-product market of the Middle East for 1974 and 1975. Revue de l'Aluminium, No. 453. Jul. 1976. pp. 345-346. /French/

Between 1974 and 1975 the semi-product deliveries to the so-called oil-countries have doubled. However, there are differences in the various product categories caused by the differing development level of the local industries in these countries and their requirements for big investment projects, and, of course, also due to different orientations in their choice of suppliers.

18. KOVÁCS, P.: International trade: United Kingdom exports in aluminium semi-products and alloys. Revue de l'Aluminium, No. 447. Jan. 1976. pp.10. /French/

The United Kingdom occupies among the Common Market countries a fairly modest place in regard to the exports of light metal semi-products as laminates, wires and strips. It ranges far behind the Federal Republic of Germany.

19. KOVÁCS, P.: International trade: United States exports of semi-products in 1975 as against 1974. Revue de l'Aluminium, No. 452. Jun. 1976. pp. 282-283. /French/

The U.S. deliveries to other American countries amounted globally to 120,038 tons as against 96,311 tons. In 1975 the U.S. delivered to Asia 22,579 tons of semi-products, among that 4610 tons to the Near- and Middle East.

20. Metal statistics. 1965-1975. Frankfurt am Main, 1976. Metallgesellschaft Aktiengesellschaft, 362 p.

21. MISSONIER, H.: Trends: the aluminium transformation industry of the Common Market 1976 = 1974? Revue de l'Aluminium, No. 452. 23 Jun. 1976. pp. 286-287. /French/

In 1975 the slump in the activity of the Common Market's transformation industry was considerable: less by 14.5% in wire products and less by 22% in laminates.

22. MISSONIER, H.: Trends: raw, primary aluminium consumption in the Western world and by geographic areas. Revue de l'Aluminium, No. 449. Mar. 1976. pp. 112-113. /French/

In 1975 the consumption of raw, primary aluminium in the Western world reached 8,600,000 tons, being 22% less than in 1974.

23. MISSONIER, H.: Trends reflected in the statistics of IPAI; the balance of the last year. Revue de l'Aluminium, No. 460. Mar. 1977. pp. 104-107. /French/

The raw, primary aluminium consumption of the Western world is shown in separate tables for North America, Asia and the Far East, Europe and the rest of the world.

24. MISSONIER, H.: Trends shown in the statistics of IPAI. Revue de l'Aluminium, No. 454. Aug./Sept. 1976. pp. 398-400. /French/

The raw, primary aluminium consumption reached 3,060,000 tons in the second quarter of 1976, representing the highest consumption level ever attained, and surpassing by 1.6% the previous record of the second quarter of 1974.

25. NIONCEL, J.: Development of aluminium consumption according to final utilization in some Western countries for 1974/1975. Revue de l'Aluminium, No. 455. Oct. 1976. pp. 442-445. /French/

The statistics of the deliveries in the Western world are published in the form of a certain code of repartition, as defined by the OECD and based on the recommendations of CIDA /International Centre of Aluminium Development/.

26. Prospects for base metals. Mining Journal, Vol. 287. No. 7362. 24.Sep. 1976. p. 225.

A further study of metals consumption and production has been prepared by Charter Consolidated Ltd., the metals covered include aluminium, copper, lead, nickel, tin, uranium and zinc.

2. THE ALUMINIUM MARKET AND ITS TENDENCIES

27. Aluminium in Brazil. Revue de l'Aluminium, No. 450. Apr. 1976. pp. 170-172. /French/

The Companhia Mineira de Aluminio /ALCOMINAS/ has in mind to raise its electrolysis capacity from 30,000 to 60,000 tons/year. The new line is foreseen to operate between 1 June and 1 July 1976 and as its result the company's aluminium production will reach 45,000 tons in 1976. Their alumina plant will have an initial capacity of 650,000 tons yearly, to be expanded to 1,300,000 tons per year in the final stage, to be reached in 1979.

28. Aluminium tank fabrication. Tooling and Production, Vol. 42. No. 8. Nov. 1976. pp. 88-89.

Liquified natural gas /LNG/ tanks for Japanese-built supertankers will be assembled in Japan from segments formed, edge chamfered and match marked before shipping, by Phoenix Steel Corp., Claymont, Delaware. Segments for ten tanks have been completed, of 3in. thick Al 40 ft long. Single and double bevelling of edges is done at considerable cost savings by special portable milling machines developed by Master Machine Tools, Inc. Fabrication sequences are described.

29. BEIZER, J.: The aluminium industry has good chances for the future. Iron Age, 9 Aug. 1976. Vol. 218. No.7. pp.21-22.

30. BESNARD et alii: The use of aluminium alloys for power transmission line pylons. -II. Revue de l'Aluminium, No.454. Aug./Sept. 1976. pp.420-432. /French/

The suitability of Al alloys as an alternative to steel for the construction of power transmission line pylons is discussed. Comparison is made between Al alloys and steel in relation to design, fabrication, prototype testing, and economics. The results show that Al alloy pylons are competitive with steel, and recommendations are made concerning the development and use of Al alloy pylons.

31. BONORA, A.: Extruded aluminium irrigation pipes. Alluminio, Vol.44. No.11/12. 1975. pp.587-593. /Italian/

The advantages of Al tubing for irrigation pipes are described. Details are given of extrusion techniques for pipe in Al-Mg-Si, Al-Mg-Si-Mn, and

Al-Zn-Mg alloys, and of the heat treatment cycles. The production of various joints is considered.

32. CHABANNES, L.: Cut back production, build up stocks, use the price lever. Revue de l'Aluminium, No.440. May 1975. pp. 230-232. /French/

The policy consisting in moderately lowering production while at the same time borrowing to finance the surplus stocks is rather typical of Europe.

33. CHURCH, F.L.: Aluminium's next target: cost-competitive food cans. Modern Metals, Vol. 32. No.4. May 1976. pp.81-82,84,87.

Because the 205.5 x 511 mm profile distributes internal pressure over a small-dia.bottom, thinner body stock can be used /0.0125 compared with 0.0165/. This can be produced on existing drawn and ironed lines.A 303 x 406 vegetable can drawn from as-rolled Al rigid container can stock and coated by an electrophoretic process is estimated to cost $ 37.00/1000 cans.

34. DESCHAMPS, R. et alii: New aluminium alloys for automobile body panels. Revue de l'Aluminium, No.448. Feb. 1976. pp.89-97. /French/

Details are given of a series of Al alloy sheet materials contg.Cu and Mg, currently used for automobile bodies in France, which can be age-hardened to high YP.

35. DuMOND, T.C.: Aluminium's new entries in auto materials race. Iron Age, Vol.218. No.19. Nov. 1976. pp.56-57.

Aluminium Co. of America has developed two new sheet alloys intended for car hood and other automotive body applications. Known as 6009 and 6010, the new alloys offer several mechanical and economic advantages over alloys 2063 and 5182. These alloys appear to possess the optimum combination of formability and strength.

36. GALAND, J.: Advantages for substituting aluminium for copper in power transmission lines. Revue de l'Aluminium, No.460. Mar. 1977. pp.134- /French/

Provided that aluminium is of higher resistivity than copper, which necessitates multiplying intersections by 1.6 for the same voltage-drop, its lower density, however, results in a by 50% reduced weight for aluminium cables as against copper cables with the same performance. In addition, the use of aluminium has another economic advantage for the industry, which should not be disregarded, which is the consistency of the price.

37. GÉRARD, A.: Can aluminium meet the requirements of automotive construction trends? Revue de l'Aluminium, No. 457. Dec. 1976. pp.547-548. /French/

Aluminium alloys exhibit a combination of properties which designate them as being able to provide in many cases the most appropriate answer from technological aspects, expressed in terms of improved weight/consumption ratio, safety, life duration, rational use of raw materials, to the problems.

38. GUINARD, C.: Highlights of the crisis. Revue de l'Aluminium, No.459. Feb. 1977. pp.51-52. /French/

If the competitiveness of aluminium is measured by its price in relation to that of competitive materials it can be noticed that it deteriorated in 1976. Taking this short period as reference one might therefore be tempted to set aside this metal in favour of another one.

39. High-lustre aluminum is functional, attractive. Metal Stamping, Vol.10. No.10. Oct. 1976. p.21.

Aluminum treadplate of Reynolds Al alloy 3003-H12 is a new, light-weight, high lustre product used on running boards and similar applications by Pierce Manufacturing, for their utility vehicle bodies and firefighting equipment. The treadplate, called 'Tread-Brite', is offered for non-structural uses by Reynolds Metals Co.

40. HUGUENEY, M.: Japan is interested in producing aluminium outside Japan: the respective projects. Revue de l'Aluminium, No.442. Jul./Aug. 1975. pp. 339-342. /French/

The Japanese aluminium consumption has considerably grown in the last 15 years. However, the expansion of electrolysis capacity in Japan causes many problems due to the high energy costs and the great population density, the latter necessitating a rigorous environmental control. These are the reasons why the Japanese aluminium producers are more and more ambitious to exploit alone or in cooperation aluminium plants outside their own country in order to have adequate supply sources of the metal.

41. IRVING, R.R.: Truck builders tool up for weight reduction. Iron Age, Vol. 218. No.1. Jul. 1976. pp.31-34.

To reduce weight, Al and plastics are being increasingly used in truck cabs. The most popular Al alloys for cab construction are 5052-O, 2036-T4 and 5182-O. The alloy with the best dent resistance is 2036-T4, while 5182-O Al is probably the closest to steel from the standpoint of formability. A 'lüder-less' version of 5182 has also been developed recently and is drawing considerable attention from builders.

42. KOVÁCS, P.: International trade: will there be a change in the pattern of West German foreign trade in aluminium? Revue de l'Aluminium, No.454. Aug./Sept. 1976. pp.396-397. /French/

According to West German industrialists the crisis in the aluminium industry has apparently been overcome. At the end of March 1976 the exports amounted to about 86% of the raw, primary aluminium imports.

43. LORIN, M.: A steel-cored almelec /aluminium/ electric cable with a 3114 metre span installed in high mountains. Revue de l'Aluminium, No.450. Apr. 1976. pp.191-193. /French/

A 225 kV power line with the largest span in France is described. Installed in 1973, the line takes current from the Emosson dam scheme in the Mont Blanc Massif. Altitudes in the region are 1500-2700 m.

44. MARIN, C.: Utilization of aluminium in power transmission lines. Revue de l'Aluminium, No.460. Mar. 1977. pp.135-137. /French/

France and the United States are the Western countries, where the utilization of power transmission lines from aluminium is most widely spread.

45. NIONCEL, J.: The reorganization of the German aluminium industry in the last two years. Revue de l'Aluminium, No.447. Jan. 1976. pp.5-6. /French/

If the production of aluminium semis continued to progress, it can be attributed to the heavy sacrifices of the industry.

46. PATRIE, J.: Japanese techniques for the protection of aluminium for use in building. Revue de l'Aluminium, No.448. Feb. 1976. pp.77-88. /French/

The results of a study-tour of $\sim$20 Japanese manufacturers of Al door and window sections are reported. Unlike European practice of anodized films 15-25 um thick, the Japanese employ an anodized film 8-9 μm thick, sealed with a clear varnish film 7-8 μm thick, usually acrylic.

47. PEMBERTON, D.L.; LENTZ, A.H.: Materials innovations in highway trucks. Metals Park, Ohio, 1976. ASM Rep. System Pap. No.76-52. 5 p. /Pamphlet/

The requirements of the transportation industry to reduce fuel consumption and improve payload have resulted in a need for lighter materials for the truck cabs and bodies. The strength-to-weight ratio of Al has resulted in increased usage of this metal. The report presents discussions of new usages of and manufacturing processes for Al sheet alloys.

48. PETROV, P.: Developments in the application of aluminium-wound transformers. Magyar Aluminium, Vol.13. No.2. 1976. pp.46-52. /Hungarian/

Developments in Al-wound power transformers rated at 6300-40,000 kVA, 110 kV are discussed and compared with Cu-wound transformers.

49. RAKOWSKI, L.R.: Building products outlook: not booming, but bright. Modern Metals, Vol. 32. No.7. Aug. 1976. pp.36, 38-39, 42.

A survey of full-range building products manufacturers predicts a 15% sales increase in the second half of 1976, to be followed by another 15% increase in 1977. This upsurge will be reflected by increased Al usage in new or expanded product lines such as thermally improved doors and windows. Growth in the factory-built housing market will spur greater use of more efficient building materials, one example of this is the use of steel to replace wood and Al for construction of framing studs, doors and windows.

50. RAKOWSKI, L.R.: Aluminium in auto bodies? Europe shows the way. Modern Metals, Vol.32. No.9. Oct. 1976. pp.37-38, 41-42, 46-48.

The Al body components used by European automobile manufacturers are described, with the manufacturers' experiences cited on problems and benefits. Design rules for Al body sheet are explained. Aluminium bumpers, die-cast steering column housings, Al-coated sheet steel and Al electrical windings and wiring are discussed. Although production is in lower quantities in Europe, their experience is viewed as a guide for U.S. automakers.

51. RAVEGLIA, M.; BAVARO, A.: The use of aluminium in the production of automobile body stampings. I. - Results of a research project. Rivista Meccanica, Vol.27. No.624b. Sept. 1976. pp.3-13. /Italian/

Experiments were carried out on Al alloy contg. Cu 1.89, Mg 1.02, and Si 0.43% in the solution-treated and naturally aged condition, having the capability of further age-hardening during paint stoving. Cold-deformation characteristics were established and joining processes, using spot welding and adhesives, investigated.

52. SUMNER, J.: Superplastic aluminium alloy has developed big markets, with wide range of products. Engineer, Vol. 242. No.6271. May 1976. p.51.

An improved method of forming superplastic sheet, replacing the vacuum technique, is described. A positive pressure of 150 lbf/in^2 is applied to wrap the sheet around the mould at a temp. of 450°C. The use of the technique for forming the Al alloy Supral, contg. Zr and having a small grain size, is outlined and applications of the products are detailed.

53. Survey gauges aluminium's gains in electric motors. Modern Metals, Vol.32. No.7. Aug. 1976. pp.59-60, 62, 64.

Housings, bases and end pieces, traditionally cast iron parts, are increasingly being switched to cast or extruded Al since they weigh only 1/3 to 1/2 as much as the parts they replace. An Al motor, including windings, can weigh as much as 40% less than a motor made with traditional materials. Aluminium also offers 2-4 times the thermal conductivity of cast iron which, in a motor housing, means cooler, more efficient operation.

54. Tough, slick hide expands markets for aluminium parts. Modern Metals, Vol.32. No.4. May 1976. pp. 46, 48.

A hard anodized Al coating is impregnated with a fluorocarbon or molybdenum sulphide to produce a surface resistant to alkali cleaners with no pitting or corrosion problems and able to withstand 1000 to 2000 V with no change in the conductivity of the base metal. Applications include: food handling, office copiers, packaging, high-speed compressors and fire extinguishers /inert to bromochlorodifluoro methane /BCF//.

55. WILLIAMS, R.N.: Why autos are turning to aluminium. Welding Design and Fabrication. Vol. 49. No.6. June 1976. pp. 71-76.

The switch from steel to Al alloys in automotive applications is discussed with examples given. Alloy 2036 in thickness from 0.040 to 1/8 in. is most widely used. Alloys 5552 and 5182 are extensively used in truck cabs. One manufacturer has switched to 2036-T4 because the higher Cu produces better weldability and dent resistance.

56. WRENCH, M.C.: Aluminium - an element of change. In: 1975 Metals Congress, 1975. pp. 395-400.

The growth in the consumption of Al in Australia is traced from 1930 to 1974. A dissection of the total Al consumption into major market areas is shown for 1968 and 1974. A discussion on the major and uses within these market areas is included.

57. WRIGHT, T.E.: New trends in buried aluminium pipelines. Materials Performance, Vol. 15. No.9. Sept. 1976. pp.26-28.

History of Al pipeline installations, uses and experience in Canada from 1945 to 1975 is reviewed along with reports on installation practices, coatings and cathodic protection. Major problems have occurred from inside pitting leading to perforations and it is postulated that early formation of an oxide layer is essential. Aluminium is generally approved for water from produced oil and gas; high-energy explosively bonded joints are not affected.

3. ALUMINIUM SEMIS PRODUCTION AND COMMERCE

3.1 Rolling mill, foil production

58. AFON'KIN, M.G. et alii: Formation of macrostructure in the original material during the combined casting and rolling /of aluminium/, and the mechanical properties of the resultant strip. Cvetnye Metally, No.4. Apr. 1976. pp.61-63. /Russian/

    The mechanisms underlying the formation of macrostructure in the original material during the combined casting and rolling of metal and alloy strip /'ingotless rolling'/ are discuseed theoretically and eome practical examplee are given for the caee of Al.

59. BABA, T. et alii: Effects of lubricant composition on aluminium hot rolling. Proceedings of the JSLE-ASLE International Lubrication Conference, 1976. pp.564-572.

    Surface quality of rolled Al eheet is determined during the hot rolling etage. Hot rolling lubricant plays a very important role in hot rolling of Al. Therefore, the determination of hot rolling oil is a key point to get high surface quality. Up to now hot rolling oil has been determined by trials in production mills at considerable expense.

60. BAZAN, J. et alii: Investigations of the process of roll forming of aluminium sheets. Rudy Met. Niezelaz., Vol.21. No.6. June 1976. pp.196-198. /Polish/

    Results are presented of experimental tests on the procees of roll forming of Al sheets in a hard etate. Model tests were carried out on presses to determine bending angle values. The results obtained were verified on teets carried out on a laboratory rolling mill and were then used to work out a specific industrial roll-forming procese.

61. New foil mills successfully commissioned. Sheet Metal Industriee, Vol.53. No.10. 1976. pp.310-312.

    The main features of an Al-foil rolling plant, opened recently in South Wales, are described, and the many usee of Al foil are outlined.

62. A new Russian water-based emulsion for oold rolling aluminium. Light Metal Age, Vol. 33. No.9-10. Oct. 1976. p.25.

    The use of 59Te /83-85% transformer oil, 9.5-10.5% oleic acid and 5.5-6.5% triethanolamine/ in an aqueous emulsion results in a high cooling rate. Rolling mill trials were conducted on 1680 and 2800 cold rolling, four-high reversing mills. The high lubricity of the new emulsion eliminated such cold rolling defects as 'herringbone' and 'embossing'. Data are given for AD, AD1, ADO, ADOO, AMTs, MM and D16 Al alloys.

63. NOWAK, S. et alii: Thermal parameters of aluminium and aluminium alloy strip rolling. Rudy Met. Niezelaz. Vo.21. No.5. 1976. pp.150-153. /Polish/

Results are presented on investigations into the relationship between temp. changes of rolls and strip and major cold-rolling parameters of Al and its alloys. Temp. variation /and its stability with time/ was influenced by roll pass design, rolling speed, down time, and roll resetting. The results were used to draw up a thermal balance and to formulate conclusions aimed at improving the rolling process.

64. Old time foil maker keeps on growing. Modern Metals, Vol.32. No.4. May 1976. p.88.

The standard Al foil /0.00025 to 0.008 in. thick/ is made from continuous cast folling stock on a proposed four-high foil rolling mill 9 1/4 and 22 in. x 44 in. wide at 3000 ft/min /max/. The porosity is low so that the resulting foil is less prone to pinholes and has a bright finish.

65. PAGE, C.F.: Some recent developments in /aluminium/ foil container production. Sheet Metal Industries. Vol.53. No.5. May 1976. pp.286-288.

The massive increase in the demand for foil containers, the designs of which have become more sophisticated has produced interesting tooling set-ups. Ref. is made to the use of a compound draw/reverse redraw tool in conjunction with a patented resilient punch. Methods used in the production of foil containers, have, in some cases, been used on thicker materials.

66. SCHIPPERT, L.; SCHAPSCHAL, V.: Effect of strip tension on the neutral angle in cold rolling of aluminium alloys. Aluminium, Vol.52. No.3. Mar. 1976. pp.179-183. /German/

Using Al 99.5% and an Al-Mg-Si alloy, experiments were performed to determine the effect of neutral angle on the grab angle, roll friction coeff. without tension, and strip tension. The degree of deformation was altered and the results are compared with calculated values.

67. WEBER, H.: Physical and technological properties of "thin" aluminium foil and strip. Revue Suisse de l'Aluminium, Jul./Aug. 1975. pp.170-175. /French/

Under laminated aluminium foil a flat sheet of 0.0045 to 0.020 mm thickness is understood. When the thickness is 0.021 to 0.035 mm - also manufactured within the aluminium foil programme - the product is called "thin laminated strip".

68. WILLCOCK, J.M.: Alcan aluminium's powerful new 88 in. cold mill at Oswego. Light Metal Age, Vol.33. No.9/10. 1976. pp.5-9.

In the cold mill described, an 8000 h.p. drive provides adequate torque for heavy reductions. Working a gauge range from 0.010 to 0.200 in., the mill can operate at 2500 ft/min for breakdown rolling and up to 5500 ft/min for finishing. The single-strand, four-high mill also features an all-hydraulic gauge control that is three to ten times faster than electric screwdown systems. The rated capacity is 150,000 tons/year.

69. WOOTTON, E.A.: The pretreatment and lacquering of aluminium strip for packaging applications. Sheet Metal Industries, Vol.53. No.10. Oct. 1976. pp. 297-305.

Details are given of a typical line for the production of pretreated and lacquered Al strip for packaging applications, with particular ref. to an electrolytic pretreatment process.

70. YOSHIHARU MAE; YO TAKEUCHI: Prevention of edge cracking in sheet rolling of aluminium alloys. Journal of the Japan Institute of Light Metals, Vol. 26. No.6. June 1976. pp.280-285. /Japanese/

Edge cracking in sheet rolling often causes a lower yield due to edge trimming, surface damage of the sheet by fragments and sheet breakage in the case of tension rolling. Several methods to prevent edge cracking have been proposed. In sheath rolling, the sheet is sheathed with other material.

3.2 Extrusion and anodizing plant, production of tubes

71. BAKER, B.R. et alii: Sealing of anodic oxide films on aluminium. Aluminium, Vol.52. No.4. Apr. 1976. pp.244-245.

The sealing of anodically formed films on Al surfaces is partly attributable to the hydration of some of the oxide film in situ, and this has been explored for films made in H_2SO_4 by evaluating the distribution of the water of hydration through the depth of the film.

72. BLACK, J.T. et alii: Linex-linear continuous extrusion of metals. Dearborn, Mich. 1976. Society of Manufacturing Engineers, 21.p. /SME Tech. Paper No. MF76-141/ /Pamphlet/

Linex is a new friction actuated, continuous extrusion process for metals. It is fundamentally a linear continuous extrusion process using two-sided gripping of feedstock /Al, Cu, etc./ with the opposed sides being lubricated. The feedstock is carried into a unique die configuration called a diefork, where it upsets and develops sufficient pressure for extrusion to take place.

73. BRYANT, A.J.; SHORT, E.P.: Faults in anodizing: material defects in aluminium fabrications which can become visible after anodizing. Galvanotechnik, Vol.67. No.6. Jun. 1976. pp.444-451. /German/

The manner in which defects in the surface of fabricated Al products can be amplified by anodizing is discussed. The nature and origins of streaks and discoloration are discussed, and typical examples are illustrated. Suggestions for overcoming the problem are made.

74. BURNHAM, J.H.: Control of aluminium extrusion sawing noise. Light Metal Age, Vol.33. No.9-10. Oct. 1976. pp.18-19.

Typical conformations that cause particular noise problems include thin wall /1/8 in. or less/ extrusions, which may or may not have fins that vibrate during the sawing operation. Techniques of noise control are described involving saw table liners, clamps, use of blade lubricant or coolant and sound barriers as enclosures.

75. EGERHÁZI, S.: How to influence thin anodic oxide films by variation of field-strength and by employing aluminium of different specifications. Magyar Aluminium, Vol.13. No.6. 1976. pp.180-183. /Hungarian/

The use of Al and its alloys by the food industry has called for special surface protection with resin films. Problems associated with the adhesior of resin films to Al are discussed. In particular, the brittleness of anodic coatings may result in damage to the upper resin film as a result of mechanical effects. Thin anodic oxid structures, however, may promote adhesion.

76. EPSHTEIN, G.G. et alii: Semi-continuous cold extrusion of /aluminium alloy/ tubes. Cvetnye Metally, No.4. Apr. 1976. pp.64-66. /Russian/

The conditions required for the routine production of Al alloy tubes with dia. of 55-68 and wall thicknesses of 4-4.5 mm by semi-continuous cold extrusion are considered. A special hydraulic press is employed for this purpose, with a working production rate of 500 mm/s and drawing coeff. of 12-22. The extruded tubes are easily and naturally divided into sections of specified length by making an appropriate choice of lubricant and matching the hydrodynamic effects of the lubricant to the inertial forces involved in the extrusion process.

77. HIROAKI NAKAGAWA et alii: Effect of precipitation on black-spot formation in aluminium alloy 6063 extrusions. Journal of the Japan Institute of Light Metals, Vol.26. No.5. May 1976. pp.231-241. /Japanese/

The effect of the cooling process after hot extrusion on black-spot formation in 6063 alloy extrusions was studied from the metallographical point of view. Black-spot formation is attributed to the precipitation of the β'-Mg_2Si phase, irrespective of the size of the precipitates. The precipitation of the β' phase is accelerated by the process of rapid cooling and reheating. The black spots were not induced by slow cooling due to the retardation of the precipitation of the β' phase.

78. How to combine spot-welding with adhesives. Magyar Aluminium, Vol.13. No.6. 1976. pp.186-187. /Hungarian/

Methods of producing joints in Al alloy sheet by employing a combination of spot-welding and adhesives are reviewed, and the results of an investigation into the joining of Al alloy AlMgSi discs with various combinations of welding and adhesives /vinyl, epoxy, polysulphide-modified epoxy and polyamide-epoxy/ are presented.

79. HUNTER, E.: Continuous extrusion by the CONFORM process. Dearborn, Mich. 1976. Society of Manufacturing Engineers, 15 p. /SME Tech. Paper No. MF76-407/ /Pamphlet/

Operation theory, materials, tooling /abutment die and drive segments/ and development tests associated with the CONFORM continuous extrusion process from the UKARA Laboratories are discussed. The process is based on the friction grip which exists between the feed stock and the grooved periphery of a rotating wheel which functions as an extrusion container.

80. JOHN, S.; SHENOI, B.A.: Integral color anodizing of aluminium and its alloys. Metal Finishing, Vol.74. No.9. Sept. 1976. pp.48-51., 57.

Integral colour anodizing processes require no separate dyeing, and the films are extremely weather resistant, hard and lightfast. This stability makes them particularly well-suited to architectural applications.

81. JOHN, S.: SHENOI, B.A.: White finishes on aluminium. Metal Finishing, Vol. 74. No.10. Oct. 1976. pp.52-54.

Methods for producing clear finishes on Al and its alloys are: chemical, electrolytic and a combination of these methods. The coatings prepared by the chemical method are thin and not corrosion resistant. The electrolytic and combined methods produce thick coatings with a high whiteness level that give good corrosion protection.

82. KIYOMI YANAGIDA et alii: Direct current colouring of anodized aluminium. Journal of Metals, Vol.28. No.9. Sep. 1976. pp.3-5.

The use of direct electrical current in the colouring of anodized Al alloys /1100 and 6063/ is discussed. Many aqueous metal-salt electrolytes, including nickel sulphate, cobalt acetate, ferrous sulphate, stannous chloride and cupric sulphate produce colours of light brown, deep brown, blackish brown, reddish brown, brown, yellow and black.

83. LACHUGIN, F.S.: Manufacture of welded tubes from heat-treated aluminium alloys. Cvetnye Metally, No.8. Aug. 1976. pp.73-74. /Russian/

Improvements in the method of producing welded tubes from heat-treated Al alloys are described. The tubes are manufactured in a conventional tube-welding machine from strip which has been recently quenched in the coiled state; in this way several operations normally required are eliminated: annealing of the coils, trimming and straightening the tubes. The strength of the tubes is greater than that of conventional tubes owing to the work-hardening which occurs in the tube welding machine.

84. LERRO, J.P.: Coating gives aluminium surface new hardness. Design News, Vol.31. No.17. Sept. 1976. p.66.

A patented anodizing process called 'Tufram' synergistic coating converts an Al surface to one that is harder than most steels, is resistant to corrosion, abrasion and moisture and permanently lubricates the surface. This is accomplished with close control of tolerances and with the ability of the coating to hold performance characteristics in vacuum /up to 10^{-8} torr/ at temp. from -100 to 350°F. The coating is nontoxic and approved by the USDA for use in good handling equipment.

85. LION, K.E.; TROPEA, L.C.: A state-of-the-art review of anodizing waste treatment. In: "Light Metals 1976". Vol.11. New York, 1976. AIME, pp.585-613.

The potential discharge sources associated with the anodizing process are rinse waters and spent process solutions. The contaminants present in the rinse water vary, but for the most part are dependent upon the type of the anodizing process and the solutions employed. The process solutions contain high concentrations of various chemical constituents such that the proper disposal of these solutions necessitates the use of well-planned environmental control procedures.

86. NAGPAL, V.; ALTAN, T.: Design and manufacturing of dies for lubricated extrusion of shapes. Dearborn, Mich. 1976. Society of Manufacturing Engineers, 19 p. /SME Tech. Paper No. MF76-389/ /Pamphlet/

Techniques for design and manufacture of dies for lubricated extrusion of noncircular shapes are studied. Formulation of design procedure for determining optimal extrusion die shape is developed from a simple analysis of the direct-extrusion process. Special computer programmes are written to manufacture complex dies by NC /numerical control/ machining and EDM /electrodischarge machining/.

87. NOBUYOSHI BABA et alii: Colour anodizing aluminium and its alloys: basic investigations and uses in Japan. Surface Technology, Vol.4. No.4. Jul. 1976. pp.343-354. /German/

Recent advances in Japanese research on the colour anodizing of Al and its alloys are reviewed.

88. NOBUYOSHI BABA et alii: Progress in research over the past five years. II. - Anodizing. Journal of Metal Finishing Society of Japan, Vol.26. No.11. Nov. 1976. pp.506-509. /Japanese/

The literature is reviewed for research on film formation, colour development mechanisms, and the electrical, magnetic, optical, catalytic, and electrochemical properties of anodized Al surfaces.

89. PATRIE, J.: Colouring processes for anodized aluminium. Revue de l'Aluminium, No.440. May 1975. pp. 265-274. /French/

The cellular structure of the anodized Al oxide film is described. Colouring processes available are compared including: /i/ chemical immersion using organic and inorganic pigments, /ii/ electrolytic processes, and /iii/ autocolouring during anodization. Industrial colouring processes are classified. Electron-microscope studies of coloured anodized films are illustrated and theories of colour formation put forward.

90. Processes of interest to companies engaged in the finishing of aluminium prior to anodizing. Electroplating and Metal Finishing, Vol.29. No.7/8. Jul./Aug. 1976. p.9.

Proprietary processes and chemicals are described briefly. They include pre-cleaners for paint pre-treatment or pre-anodizing cleaning, the Permanetch process for providing matted etched surfaces, additives to caustic soda for satin etched finishes, a chromate-free solution for smut removal, and chromate coating solutions.

91. ROBERTS, P.R.: The extended application of the extrusion process using encapsulated billets. Dearborn, Mich. 1976. Society of Manufacturing Engineers, 22 p. /SME Tech. Paper No.MF76-39/ /Pamphlet/

Selection of can material for thermomechanical and metallurgical compatibility with its contents, the use of reactive or toxic materials in can centres to improve billet lubricity and arrangements which isolate tooling from reactive materials are key aspects of billet design discussed.

92. SATEE, R.: Sealing anodized aluminium. Product Finishing, Cincinnati, Vol.41. No.1. Oct. 1976. pp.62-69.

Sealing of anodized Al pores is discussed. The mechanism of hot water sealing involves the formation of the hydrate $Al_2O_3.H_2O$ and its expansion to fill the pores. However, the mechanism of sealing in hot salt solutions, such as nickel acetate, is not as well understood. The need for a uniform standard of measurement of seal quality is indicated.

93. STRECKE, H.: Modern automatic plant for anodizing and colouring aluminium. Aluminium, Vol.52. No.8. Aug. 1976. pp.503-506. /German/

Modern plant for the chemical and electrochemical surface treatment of

Al is discussed in relation to the requirement for uniformly high quality and high rates of productivity. The design and layout of installations for the anodizing of extruded profiles and for the anodizing and colouring of components for doors, windows, panels, etc. are described.

94. THOMPSON, D.A.: Production of hard anodic films. Transactions of the Institute of Metal Finishing, Vol.54. No.2. 1976. pp.97-103.

Three hard anodic processes and the behaviour of the Al alloys involved are described. Alloys are for convenience divided into groups. The effects of alloying additions on hard anodic films are discussed. Official and company specifications, drawings, data sheets and design considerations are discussed. Testing methods and their limitations are outlined. Areas suggested as being worthy of research and development are reviewed. Jigging techniques and pre- and post-treatments are described.

95. THOMPSON, R.: Glass-fibre-reinforced aluminium alloys formed by hot extrusion. I. - Preparation and properties. Powder Metallurgy, Vol.19. No.4. 1976. pp.181-188.

The preparation and properties of glass-fibre-reinforced Al alloys have been studied. The composites were prepared by the hot /720-820°K/ extrusion of pressed billets, consisting of a mixture of metal powder and glass particles. The softening-point of the glass used was below the temp. of extrusion, hence the glass particles were elongated on extrusion to form discontinuous fibres.

96. THOMPSON, R.: Glass-fibre-reinforced aluminium alloys formed by hot extrusion. II. - Heat-treatment. Powder Metallurgy, Vol.19. No.4. 1976. pp. 189-193.

Procedures for the heat-treatment of Al alloys /HE9 and HE30/ reinforced with glass fibres, were investigated. The fibre-reinforced composites were formed by the hot extrusion of pressed billets consisting of a mixture of alloy and glass powders /the softening-point of the glass being below the extrusion temp. used, so that discontinuous glass fibres were formed in situ on extrusion/.

97. VOLCANSEK, V.: Nitriding of tools for pressing aluminium alloys. Strojirenski Vestnik, Vol.21. No.9/10. 1975. pp.203-205. /Slovenian/

Experience obtained in nitriding pressing tools by the 'Tenifer' process is reviewed. The chemical principles, the preparation procedure, and the advantages of the process are described. Hardness/depth distribution is plotted.

98. WHITE, J.N.: Pollution control for a modern anodizing facility. In: "Light Metals 1976". Vol.11. New York, 1976. AIME, pp.615-621.

Waste water treatment at an anodizing facility was accomplished with a simple three-phase approach-pH control, clarification and sludge concentration and disposal. All present Environmental Protection Agency guidelines can be met with some modifications to the present system; change in cleaners and addition of an effluent polishing unit, such as an additional clarifier or polishing pond.

99. WRZECIAN, M.: The present status of aluminium anodizing. Galvano Organo, Vol.44. No.455. May 1975. pp.413-416. /French/

The question of whether anodizing has reached its final state of development, or is capable of further improvement is discussed. The use of special additives, and of satin finishing processes is considered.

3.3 Wire making

100. ANDRUS, P.; SCHMEHL, G.: Continuous hydrostatic wire extrusion. Dearborn, Mich. 1976. 15 p. Society of Manufacturing Engineers. /SME Tech. Paper No. MF76-409/ /Pamphlet/

Western Electric's Mod III continuous wire extruder is described and operation results with the machine are presented and discussed. The basis for the Mod III extruder is an endless pressure chamber designed to extrude 5/16 in. dia. feedstock. The machine has extruded both Al and Cu wires continuously, achieved wire speeds $>12,000$ ft/min and operated at extrusion pressures above 286,000 lb/in^2.

101. BEATON, C.: A new glow-discharge furnace anneals quickly. Engineer, Vol. 243. No. 6277, Jul. 1976. pp.20-21.

A new technique is described and illustrated for annealing H-drawn wire in a vacuum. The discharge energy used for lighting in Ne tubes is changed to heat, and wire is fed continuously through seals at each end of a vacuum chamber. The electrodes are two concentric cylinders. Energy from an electron beam is focused onto the cylinder axis and transferred as heat to the wire. The required temp. is attained in microseconds and wire remains bright. Al wire, 5.58 mm dia., and 25 mm^2 section Al-alloy wire, at speeds >0.5 tonne/h, were annealed in a 100 kW system.

102. CHIA, E.H. et alii: Investigation of wire breaks in aluminium. Wire Journal, Vol.9. No.12. Dec. 1976. pp.46-53.

Wire breaks are listed in two main categories: those which originate from material defects and those from processing faults. Defects are listed which originate during melting, casting and hot working together with those which originate during wire drawing. Sources of defects are listed in each instance.

103. HARPER, S.: Lubrication aspects of drawing non-ferrous wire. Wire Industry, Vol.43. No.512. Aug. 1976. pp.623-626.

Improvements in wire-drawing machines have resulted in heavy coils of $>$ 1 ton travelling at speeds of $\sim$10,000 ft/min. requiring improved lubricant properties. Lubricity and heat extraction requirements are quantified. Problems of lubricant contamination, disposal, toxicity, chemical compatibility and stability, volatility and foaming tendencies are discussed and the requirements for an ideal lubricant for non-ferrous wire drawing established.

104. HUTH, P.: Production of aluminium conductors on a high-speed wire-drawing machine. Wire World, International, Vol.18. No.4. Jul./Aug. 1976. pp.187-190.

A plant for the production of bare Al wire, 2-4 mm in dia., in 2-tonne coils at 40-50 m/s. is described. Problems encountered and solutions adopted are considered, including: /i/ starting with long coils to reduce the number of welds, /ii/ design of the pay-off stand; /iii/ reduction of maintenance on the drawing machine; /iv/ selection and circulation of drawing oil; and /v/ preparation of dies.

105. KORYAGIN, N.I et alii: Production of wire rod from deformation-resistant aluminium alloys by combined casting and rolling. Cvetnye Metally, No.11. Nov. 1976. pp.54-56. /Russian/

The production of wire rod by the combined casting and rolling technique /the material being fed in molten form directly into the rolling system/ is described for the case of a number of Al alloys contg. Mg, Mn, etc. which are particularly difficult to work in the ordinary way owing to their adverse rheological characteristics.

106. MOREAU, M.; DRAPIER, C.: A new annealing unit for continuous heat treatment of aluminium or alloy wire. Revue de l'Aluminium, No.450. Apr. 1976. pp.194-198. /French/

An annealing unit with these special features can be employed for full or partial annealing of aluminium or alloy wire at linear velocities of up to 1500 metres per minute. This type of unit could be integrated, as in the case of copper wire, into a production-line sequence of operations.

107. TAKAO KINO et alii: Zone refining of aluminium. Transactions of the Japan Institute of Metals, Vol.17. No.10. Oct. 1976. pp.645-648. /English/

99.999% Al was zone-refined in a vacuum better than 1×10^{-6} torr, and various zone speeds, zone lengths, and numbers of passes were tried to determine the optimum refining conditions. The impurity content was estimated from the residual resistivity, and the highest resistance ratio in bulk, $R_{300}/R_{4.2}$, obtained was 50,000.

108. YASUHIKO MIYAKE et alii: The properties and uses of 'EFT-AS' /Extrusion with Front Tension-Aluminium-Coated Steel/ wires. I. Draht-Welt, Vol.62. No.4. Apr. 1976. pp.137-140. /German/

Al-coated steel wire produced by extruding with front tension is compared with Al-coated wire produced by other methods. A greater Al: steel ratio can be obtained and increased use of the wire in electricity transmission cables is expected. The mechanical and electrical properties of the wires are given.

4. THE USE OF ALUMINIUM IN FOUNDRIES

109. AARFLOT, A.; PATAK, F.: Dynamic vacuum treatment of molten aluminium and its alloys. In: "Light Metals 1976". Vol.11. New York, 1976. AIME, pp. 389-400.

The dynamic vacuum treatment is a method of treating the melt in which metal transfer, alloying and vacuum treatment are combined in one operation. The whole process is performed by means of vacuum and under vacuum. This method offers a good alternative to the Cl treatment of Al melts. The method permits high productivity and has no environmental problems.

110. AFANAS'EV, V.K.; NIKITIN, V.I.: Structure and properties of aluminium alloys in relation to the conditions of preparing the charge materials. Litejnoe Proizvodstvo, No.4. 1976. pp.16-17. /Russian/

Al-Zn alloys were studied in relation to the conditions of preparing the charge materials in so far as these affected purity and particle size. For example, special treatment to produce a fine-grain structure of the original charge led to a 15-60% increase in UTS and PS. This effect was noted over and above any influence of ultrasonic or heat treatment. The nature of the atmosphere in the melting of the charge materials also influenced the final result.

111. Aluminum 308.0 /Aluminum casting alloy/. Alloy Digest, No. AL-224, Jul. 1976. p.2.

Properties of Al 308.0 casting alloy were reviewed. The alloy features good casting characteristics and pressure tightness. Composition, physical constants, and mechanical properties for both sand and permanent-mould castings are cited.Heat treatment, machinability, castability mechanical stability, weldability, corrosion resistance, general characteristics and applications are discussed.

112. Aluminum standards and data 1976. New York, 1976. Aluminum Assoc. 212 p.

Data on mechanical, physical and other properties, tolerances and other useful information on Al wrought and cast products in general use are presented. The revised manual adds data on new alloys and products and deletes those which have become inactive or whose usage has become limited.

113. ANSPACH, H.: Liquid pressing /pressure die casting/ of aluminium alloys and the material savings effected by the process. Giessereitechnik, Vol. 22. No.8. 1976. pp.259-263. /German/

Liq. pressing is defined as pressure die casting with solidification under a pressure ≮ 700 bars. The equipment and the product quality are considered. Min. values for tensile strength, ductility, and hardness are proposed. Examples of the use of the process and the economics that can be effected compared with shell-mould casting are discussed.

114. APSLEY, S.D.: Technological trends in the U.K. Aluminium Foundry Industry. British Foundryman, Vol.69. No.6. 1976. pp.152-157.

Annual U.K. outputs of Al-alloy castings are tabulated and trends in coremaking, moulding, melting, holding, investment and gravity casting, and low- and high-pressure die-casting methods and equipment are reviewed. Developments in materials and alloy compositions are discussed, with mention of suggestions for financing and extending research activities.

115. ASATUROV, V.A. et alii: Foam polystyrene patterns of risers for aluminium and magnesium alloy castings. Litejnoe Proizvodstvo, No.5. 1976. p.22. /Russian/

The use of foam polystyrene patterns of risers for Al and Mg alloy castings is discussed. Examples are given of a number of light machine parts /levers, cams, etc./ produced in this way. Particular attention is paid to metallographic and chemical analysis, mechanical properties, gas porosity, and anti-corrosion properties. The use of the proposed risers leads to the production of alloy parts entirely up to normal standards, but there is a substantial economy as regards the consumed metal, and the net cost falls accordingly.

116. BÜCHEN, W.: The present status of the low-pressure die-casting process. Alluminio, Vol.45. No.6. 1976. pp.307-312. /Italian/

The development of low-pressure die-casting techniques is sketched and processes currently available described, together with technical requirements for furnaces and feed tubes. The automation of the casting line to improve productivity and quality is considered and details given of process improvements in sprue feeding metal to the die, controlled solidification with die cooling systems and core and die movements within the solidification period. New developments including the use of electromagnetic pumps and gravity feeding are indicated.

117. Cast heat-resistant aluminium-alloy ATsR1U. Vestnik Mašinostroenija, No.10. 1976. p.86. /Russian/

A new heat-resistant Al-alloy ATsR1U suitable for use in air-conditioning systems working at temp. up to 400°C under fairly high pressures is described; as regards casting properties it is similar to alloys of the "silumin" type and it has excellent hermetic characteristics. The use of this alloy greatly eases the manufacture of complex-shaped light-alloy parts for replacing stainless steels and Ti alloys.

118. CORMARY, D. et alii: Rational use of crucible furnaces for the melting and holding of light alloys. Fonderie, Vol. 31. No.354. Mar. 1976. pp. 101-106. /French/

Heat energy consumption in the pressure die casting of light alloys is relatively high due to melting and holding operations. To reduce energy consumption in the holding furnaces feeding dies or the pressure die-casting machines, certain rules regarding the proper adaptation and utilization of these furnaces must be complied with. Two actual examples of the application of these rules are given.

119. Design of aluminium alloy casting dies. Colada, Vol.9. No.3. 1976. pp. 93-100. /Spanish/

The principles to be followed in the construction of dies for Al alloy casting are outlined. The materials to be used, thicknesses, cores, running system, heating and cooling procedures, chills, closing and ejection mechanisms are dealt with.

120. DORE, J.E. et alii: New low emission process for degassing and treating aluminum alloy melts. In: "Light Metals 1976". Vol.11. New York, 1976. AIME, pp. 567-583.

A new low emission process developed for treating and refining Al alloy melts utilizes a mixture of 97% N and 3% Freon 12 /CCl_2F_2/. Melt treatment is carried out under a protective molten salt cover. In general, the process is employed in the same fashion as fluxing with gaseous Cl.

121. DROUZY, M.; SCIAMA, G.: Natural cooling of simple metallic forms: application to the study of thermal conditions of dies for the die-casting of aluminium alloys. Fonderie, Vol.31. No.353. Feb. 1976. pp.49-55. /French/

Experimental and theoretical studies were carried out on the cooling of blocks of cast iron and steel in still air in the temp. range of the operation of dies for the casting of Al alloys /250-500°C/.

122. GETSELEV, Z.N.: Problems and prospects of the development of continuous casting in an electromagnetic mould. Cvetnye Metally, No.10. 1976. pp. 56-59. /Russian/

The merits and demerits of existing designs of electromagnetic moulds for the continuous casting of Al and Mg alloys are discussed. The dimensional accuracy of the castings depends on the stability of the magnetic fields employed and considerable improvements are required regarding stability before the process may be regarded as economically justified."

123. IWATA, T. et alii: Study on anticorrosive aluminium casting alloy. Mitsubishi Technical Review, Vol.12. No.3. Oct. 1975. pp.193-202. /English/

The development of Al-base alloys contg. Si, Cu, and Zn for use in automobile engines is described. The alloys are resistant to corrosive attack from antifreeze solutions, particularly those contg. borax, and have good mechanical properties. The high resistance to corrosion is attributed to the fact that the Zn content forms a stable protective film on the metal surface when it comes into contact with the antifreeze solution.

124. KREYSA, E.: Heating equipment for the aluminium industry. Aluminium, Vol. 52. No.6. 1976. pp.371-375. /German/

The demand for modern furnaces in Al fabrication and production is reviewed. Melting and casting furnaces are more widely used than hot-working and heat-treatment processes,and there are also special furnaces for continuous production of aluminized steel strip. The use of induction furnaces is replacing gas ovens in all these fields. Examples are given of the planning of a wire-drawing mill and of a bar-casting plant.

125. KRYLOV, V.N. et alii: Use of filters in the gravity-die-casting of aluminium alloys. Litejnoe Proizvodstvo, No.2. 1976. pp. 43-44./Russian/

Reasons for the high failure rate of AL9 Al alloys with 3-5 mm thick walls produced by gravity-die-casting were studied by analysing fracture surfaces under the microscope and subjecting various parts of the castings to X-ray examination. The chief cause of failure lay in the presence of oxide scabs and blemishes, together with a small number of moderate-sized cavities. The use of specially designed filters greatly reduced the number of such non-metallic inclusions and the failure rate fell dramatically /from 35 to 4-5%/.

126. LAWRENCE, R.R.: Cross-section shape control of D.C. /Direct Chill/ sheet ingot using a flexible mould. In: "Light Metals 1976". Vol.II. New York, 1976. AIME, pp.457-463.

Flat sheet Al ingot 18-25 in.thick is produced with a uniformly rectangular cross-section by changing the mould contour during casting to continuously compensate for ingot shrinkage. The 6351-T6 Al alloy mould is attached to an extruded plastic water box, spray ring and baffle combination fastened together in such a way that the mould is flexible. The process reduces scalping, reduces Al melt loss, allows several different alloys to be cast with the same mould and permits higher casting speeds without forming a large ingot butt.

127. LECH, Z.; SEK-SAS, G.: The effect of charge materials and technological parameters on the production of light-alloy cast parts. Giessereitechnik, Vol.22. No.8. 1976. pp.270-273. /German/

The effect of the Al charge and Si, the amount of scrap, and the type of furnace on the quality of the ingot, as well as the production parameters and ancillary materials on the quality of the castings, were investigated using G-AlSi12 CuNiMg alloy as an example. The characteristics and statistical analysis of castings defects are discussed. The quality is considerably affected by the nature of the Al and the Si.

128. LEONI, M.; FOMMEI, F.: The causes of 'hard spots' in pressure die castings and technological remedies. Alluminio, Vol.45. No.5. 1976. pp.246-253. /Italian and English/

Hard spots in Al-alloy die castings are considered and five distinct types are recognized: oxides, agglomerated oxide skins, oxides and intermetallic compounds, large intermetallic compound segregates, and chilled droplets. The optimum process cycle to avoid hard spots is considered.

129. LIVANOV, V.A.; SKUCHILOV, A.I.: Continuous casting of aluminium alloys in a mould with a gas-forming lining. Cvetnye Metally, No.10. 1976. pp. 52-54. /Russian/

An improved method of continuously casting Al alloys /e.g. Al-Mg/ in a mould with a gas-forming lining is described. In effect a thin layer of material such as Teflon or one of its analogues or derivatives is applied to the inner wall of the mould. As the melt enters the lining decomposes and a gas pressure is set up, separating the casting from the walls and imparting an improved shape and surface quality.

130. LOSSACK, E.: Practical experience with the use of hot top molds in d.c. /direct chill/ casting of Al billets. In: "Light Metals 1976". Vol.11. New York, 1976. AIME, pp.413-422.

A new casting system to produce high-quality billets at low costs is described. The VAW Hot Top Mould System consists of a specially designed D.C. mould with a suitable header box on its top which is supplied with molten metal in a level pouring manner. The problem of lubrication was solved by a newly developed integrated self-lubrication system. High-quality billets are cast in multistrand casting units with a low meniscus effect.

131. MALINOVSKII, R.R.; SILAEV, P.N.: Casting small aluminium alloy D16 and V95 bars. Cvetnye Metally, No.11. 1976. pp.56-58. /Russian/

Problems encountered in the casting of small Al alloy D16 and V95 bars are considered. The casting of these alloys is particularly difficult as they are strongly susceptible to the formation of internal cracks as a result of an unfavourable combination of thermal and mechanical characteristics. The structure may be improved and crack formation prevented by slightly modifying the composition.

132. MARKOV, V.V.; BELYAVSKII, G.I.: Double pressing in a pressure casting process. Litejnoe Proizvodstvo, No.3. 1976. p.41. /Russian/

A special problem which arises in the pressure casting of light-alloy parts is discussed; in a typical case by virtue of the presence of a projecting flange the temp. distribution is uneven and different parts of the metal are in different states at the same time. To avoid inhomogeneity and the possible formation of hot cracks, a double pressing operation is recommended.

133. MEDANA, R.: Recent developments in automobile casting productions in an aluminium foundry. Fonderia Italiana, Vol.25. No.10. 1976. pp. 249-256. /Italian/

A highly automated foundry for the production of Al alloy automobile castings at Carmagnola, Italy is described. Details are given of the automatic productions of shell moulds and the carousel pouring of cylinder-head castings, with metallurgical control of the composition temp., gas content, and microstructure. The die-casting division includes robot die-casting machines requiring no manual attention.

134. MISHAGIN, A.M. et alii: Use of secondary aluminium AK9 for casting in metal moulds. Litejnoe Proizvodstvo, No.5. 1976. p.40. /Russian/

The possibility of using a secondary Al alloy of the AK9 type as part of an AL4 Al alloy charge for the die-casting of tractor engine parts was studied on an industrial scale. The material so produced has mechanical properties /UTS, PS, etc./ differing by ±10% from those of parts made of pure AL4 /not incorporating any secondary alloy/, the increment or decrement being almost solely determined by the mode of heat treatment applied.

135. MISHAGIN, A.M. et alii: Casting aluminium alloys in water-cooled gravity dies. Litejnoe Proizvodstvo, No.6. 1976. pp.40-41. /Russian/

The casting of Al alloys in gravity dies is considered. Under conventional conditions the material is subjected to severe thermal shock and by virtue of this effect and the unfavourable geometrical conditions of the mould a considerable loss of metal may ensue. In order to eliminate these and other disadvantages, a transition to water-cooled gravity dies is recommended.

136. MITTMANN, E.: The importance of melting losses for the economic viability of aluminium melting furnaces. Giesserei, Vol.63. No.1. 1976. pp.4-7. /German/

137. MONDOLFO, L.F.: Aluminium alloys: structure and properties. London-Boston, 1976. Butterworths, 971 p. /Book/

The structure and properties of pure and commercial Al and of binary, multicomponent, and commercial Al alloys are described.

138. MORRIS, J.: Gravity die dressings. Alluminio, Vol.45. No.5. 1976. pp.262-271. /Italian and English/

The use of die dressings for the control of heat flow and metal flow, easy stripping and long die life is considered. The characteristics of dressings for the different applications are noted, together with the selection of dressings for Al-, Mg- and Cu-base alloys, and for low-pressure diecasting. Improvements in surface finish and productivity are discussed, together with the control of the coating flow index and graphite top coatings for easy stripping.

139. NOËL, H.: How to choose /aluminium/ casting alloys. Revue de l'Aluminium, No.453. Jul. 1976. pp.361-366. /French/

The application of value analysis to determine the optimum material and moulding technique for a casting is considered. The contribution of material, moulding, patterns, heat treatment, fettling, inspection, machining and surface treatment to the overall cost of the part is described. Dimensional instability and means of minimizing it are discussed.

140. PARKHUTIK, P.A.; OCHERETYANYI, V.S.: Die-casting of solid-liquid aluminium alloys. Litejnoe Proizvodstvo, No.5. 1976. pp.24-25. /Russian/

The die-casting of Al alloys in the intermediate solid-liquid state /solid phase with a complex network of liquid interlayers/ is described. This process enables castings with much thinner walls to be successfully produced than would be possible with ordinary casting from the molten state. The probability of shrinkage defects and gas porosity is also greatly reduced, and the wear on the moulding equipment is less severe.

141. PARODI, G.: Automated unit for the production of aluminium-alloy pressure die-castings. Fonderia Italiana, Vol.25. No.9. 1976. pp.221-228. /Italian/

A pressure die-casting machine for the production of automobile components on which all manual operations have been automated, is described. The reasons for introducing automation are discussed, together with the technical problems involved, alternative possibilities and solutions adopted, and the results achieved. The principal benefit is a productivity increase of 35%.

142. PILLAI, R.M. et alii: Some aspects of feeding LM-16 /aluminium/ alloy. Aluminium, Vol.52. No.6. 1976. pp.360-362.

Billets were cast from Al alloy LM-16 /contg.Si 5, Cu 1.5, and Mg 0.5%/ and cut into pieces at various distances from the casting feeder in the range 70 to 210 mm. Porosity determinations based on the density of the samples showed a max. near each end and higher density at the middle of the billet.

143. POLOVINCHUK, V.P.: Effect of the viscosity of the lubricant used in die casting on the properties of aluminium alloy parts. Litejnoe Proizvodstvo, No.3. 1976. p.39. /Russian/

The influence of the kinematic viscosity on the graphite-contg. fatty lubricants used for the production of Al alloy castings on the micro-structure and mechanical properties of the latter was studied.

144. REINHARDT, A.: Experiences with low-flammability hydraulic fluids in pressure diecasting machines. Giesserei, Vol.63. No.20. Sept. 1976. pp. 553-558. /German/

The properties and applications of HSC /water-glycol/ and HSD /non-aq. phosphate ester/ low-flammability hydraulic fluids are described. The features of plant design and maintenance needed when these fluids are used are discussed, with recommended modifications to die-casting machines in converting from conventional hydraulic fluids.

145. ROGOSS, H.; LEUE, M.: The self-hardening of copper-containing aluminium casting alloys. Giessereitechnik, Vol.22. No.8. Aug. 1976. pp.264-269. /German/

The factors influencing the self-hardening properties of secondary Al alloys were investigated with a view to optimizing their relatively high Cu content. The Cu and Mg contents for specific min. hardnesses were determined, and their use in die-casting and shell-mould casting considered. The effects of Zn content, melting and casting temp., and heat treatments are examined. Testing procedures, quality control, and standardization are discussed.

146. SAEBO, T.: The ASV level pour system for casting sheet ingot. In: "Light Metals 1976". Vol.11. New York, 1976. AIME, pp. 425-440.

Aluminium alloys with up to 3% Mg are cast in thicknesses of 205-600 mm and widths of 550-1750 mm using a level pour system developed in Sweden. Features of the process include a wide range of possible casting rates, an easily adjustable bare mould length and a very small overhang from the hot top, thus minimizing cold shuts and inverse segregation. The process does, however, require close control of temp. and heat balance during all stages of the casting cycle.

147. SUZZANI, R.: The investment casting of aluminium alloys. Alluminio, Vol. 45. No.2. 1976. pp.95-98. /Italian/

The production of precision Al casting using the lost-wax process and ceramic shell moulds is considered. Problems with the use of conventional alkali solutions for dissolving the ceramic from Al castings are described and alternative procedures indicated. Dimensional tolerances which can be achieved are tabulated and examples given of a number of intricate castings produced in Al-Si and Al-Zn-Mg-Fe alloys.

148. SUZZANI, R.: The rational design of investment castings. Alluminio, Vol. 45. No.3. 1976. pp.160-162. /Italian/

The replacement of complex assemblies by single investment castings is considered, as is the design of castings to avoid defects. Correct and incorrect solutions to design problems are given to eliminate sinks, porosity, incomplete filling, and internal stresses. The production of castings of high surface quality is considered, together with dimensional tolerances and the production of undercuts and blind and through holes.

149. The pressure-diecasting plant seen as a complete system. Alluminio, Vol. 45. No.5. 1976. pp.272-282. /Italian/

A pressure-diecasting plant is considered as a system of integrated disciplines and is analysed in ten parts: the diecasting machine; casting design; alloy metallurgy; the die; the ladle system; the ejection and extraction system; the finishing system; the injection system; control; and plant layout. The concept is applied to the "Progression".

150. Third report of working group P4 /of the Institute of British Foundrymen/: Dimensional tolerances in aluminium alloy gravity die-castings. British Foundryman, Vol.69. No.3. 1976. pp.53-61.

Results of multiple-regression analyses of 220 and 70 sets of dimensions of gravity and low-pressure Al die castings, resp., are reviewed. Special ref. is made to deviation of the mean dimension, from the drawing dimension, and the distribution of the measured dimensions around the drawing dimension.

151. TOKAREV, Zh.V.; KOSINTSEV. V.A.: Automation of a system for casting by vacuum suction. Litejnoe Proizvodstvo, No.9. 1976. pp.40-41. /Russian/

A semi- automatic installation being used in the Chelyabinsk tractor factory for producing Al alloy AL4 compressor and pump wheels by a vacuum process is described. The complete automation of the system is effected by introducing standard elements of electrical, pneumatic, and vacuum devices. Even the assembly of the associated moulds may be effected mechanically /manual assembly is also envisaged/.

152. TSYGANENKO, G.I.: Effect of vacuum treatment on the quality of die-cast aluminium alloys AL2 and AL28. Litejnoe Proizvodstvo, No.6. 1976. p.22. /Russian/

The effect of vacuum treatment on the surface quality and corrosion resistance of die-cast Al alloys AL2 and AL28 was studied. Vacuum treatment greatly reduced the heights of the residual asperities, which amounted to ∠ 2 μm or half the value obtained in the absence of vacuum treatment.

153. VASSILY, G.: The hunter continuous-casting process. Alluminio, Vol.45. No.2. 1976. pp.91-94. /Italian/

A machine is described for the continuous casting of Al in slab section suitable for immediate conversion into Al sheet. The melting unit can deal with a pure solid or molten charge or with a high scrap charge. The metal passes to a casting machine through a degassing chamber and filter to a constant level tundish and is cast between water-cooled rollers with an upward inclination.

154. VLASOV, K.R.: Choice of material for a charging device for /the continuous casting of/ aluminium alloys. Poroškovaja Metallurgia, No.9. 1976. pp.93-96. /Russian/

The choice of material for the parts of a continuous-casting apparatus used in the production of Al and Al-alloy bars is considered. Essential features include adequate mechanical strength and heat resistance as well as high chemical inertness with respect to the metallic melts and the absence of wetting by these.

155. WEAVER, C.H.: An empirical model to explain cross-section changes of D.C. /Direct Chill/ sheet ingot during casting. In: "Light Metals 1976." Vol. ll. New York, 1976. AIME, pp.441-456.

A mathematical model which would predict the cross-section changes of D.C. sheet ingots during casting was developed and successfully tested. It expresses the relationship between rolling face pull-in, ingot thickness and casting speed. Accurate predictions of the mould opening required to produce a flat ingot of any desired thickness can be made.

156. WILLIS, W.E.: Mechanical aluminum pouring at central foundry. Metals Park, Ohio, 1976. pp.2. /ASM Rep.System Pap. No.76-12/ /Pamphlet/

The total casting system for Al pistons consists of three subsystems: a holding furnace for the molten metal, a permanent mould machine to support the dies and remove the solidified castings, and a pouring unit to transfer a premeasured mass of molten metal from the holding furnace to the dies on the permanent mould machine.

157. YEAGER, J.L.; REDINGER, R.L.: Waste water disposal from a primary aluminum cast shop. In: "Light Metals 1976". Vol.II. New York, 1976. AIME, pp. 557-565.

A waste water discharge system utilizing spray irrigation has been designed and placed into operation at Anaconda's new primary Al smelter. Spray irrigation is an accepted method for the disposal of liquid waste. It meets the requirements for waste water discharge and contributes to a pollution-free environment.

5. RECYCLING AND SECONDARY ALUMINIUM PRODUCTION

158. BROOKS, C.L. New technology in recovery and reuse of aluminium scrap. In.: "Light Metals 1976". Vol.II. New York, 1976. AIME, pp. 353-363.

A new technology in recovery and reuse of Al scrap is presented. The important objectives of the system are: separation of undesirable materials prior to melting, operation at a point as close to max. metal recovery as practical, operation of an efficient, low-cost recovery operation, max. energy saving of both fuel, metal and other resources and sound use of recovered product into new materials for the same market which generated the scrap.

159. BRUNER, R.W.: Contemporary aluminum recycling. In: "Light Metals 1976". Vol.II. New York, 1976. AIME, pp.337-351.

A differentiation between Al recycling by primary and secondary producers is presented along with the current scope of each within the Al industry. 'Primary' and 'secondary' metals are defined and categories of end products from recycling are discussed. Types of scrap Al available today and modern processing methods are presented.

160. CHABANNES, L.: Secondary aluminium in the United States. Revue de l'Aluminium, No.440. May 1975. pp. 233-235. /French/

According to the Aluminium Association, secondary aluminium will play an increasingly important role in the automobile industry of the United States, as by the years 1985 or 1990 the cars are supposed to contain in average about 230 kg aluminium.

161. COLE, J.C.; FLEMING, W.F.: Application of a baghouse to an aluminum remelt facility. In: "Light Metals 1976". Vol.II. New York, 1976. AIME, pp. 623-631.

The control requirements of black smoke emission created from melting oily scrap can be filled by a baghouse. A Fuller/DRACCO dust collector with 54,000 ft^2 of Nomex bags was chosen for this new application to meet Federal emission standards. The baghouse is fed by a common duct from seven furnaces.

162. DETOCHKA, V.I. et alii: Conditions for the passage of iron into the melt in the remelting of aluminium scrap. Cvetnye Metally, No.11. Nov. 1976. p.62. /Russian/

The remelting of Al and Al scrap is considered with special ref. to the question of composition; it is particularly important to control the proportion of Fe passing into the secondary metal as excessive quantities have an unfavourable effect on the mechanical properties. The main factors affecting the amount of Fe passing into the melt include the temp. of the melt and the holding time, as well as the effective surface area of contact between the Al scrap and Fe-contg. materials.

163. DIVILIO, R.J.; CALDWELL, H.S.: Design and operation of a minipilot plant for processing salt slags from an aluminium dross furnace. In: "Light Metals 1976". Vol.II. New York, 1976. AIME, pp. 323-336.

A hydrometallurgical process was developed for treating salt slags from Al dross furnaces. In this process, the salt slag is leached with water at room temp. Filtering the leach solution recovers an Al-rich fraction, which is returned to the dross furnace, and a fine Al_2O_3 fraction.

164. European classification of aluminium scrap and rejects. Colada, Vol.9. No.5. May 1976. pp.177-179. /Spanish/

The terms of an agreement between the European secondary metal industry and scrap suppliers are summarized. Eighteen grades of scrap have been standardized. The homogeneity and tolerances for each group laid down in specifications for transactions between European countries are given.

165. Extrusions from scrap without costly remelting. Modern Metals, Vol.32. No.4. May 1976. pp.43-44.

Shredded /to ~100 mm/ and degreased /to remove contaminants trapped in the grease/ Al scrap foil, canmaking, press blanking or extrusion is compacted to a dense /80-90% of cast/ billet which is heated to 400-500°C and extruded to produce wire or other extrusions. The energy saving is 160 kWh/ton of processed scrap. The material saving is 100% compared with a remelt yield of 92-96%.

166. HUGHES, D.: The recovery of copper and aluminium from scrap cable. Draht-Welt, Vol.62. No.3. 1976. pp.99-102. /German/

The difficulties of recovering Cu and Al are discussed. Stripping and burning are inadequate for many types of material. A plant based on the mechanical comminution of the complete cable by revolving cutters followed by separation of the valuable items by sieving, air separation, and fluidized bed treatment, is described.

167. MOSER, C.J.: Furnace dross - its formation and recovery. In: "Light Metals 1976". Vol.II. New York, 1976. AIME, pp.299-311.

After removal from the Al melting furnace, dross is charged through a vibratory feeder into a rotary barrel containing a KCl/NaCl mixture. Metal is tapped through an opening in the side of the barrel and the salt residue is removed for recycling. The importance of minimizing dross formation during smelting is emphasized.

168. NUSSBAUM, A.I.: Remelt shop systems for aluminum mill scrap. Dearborn, Mich. 1976. /Society of Manufacturing Engineers/ 17 p. /SME Tech. Paper No. MM76-913/ /Pamphlet/

Mill scrap accumulation represents a major problem for the independent Al extrusion and rolling mill plant. Early operating practice called for scrap sale on the open market or conversion of scrap into billet or slab on a toll basis at regional specialist secondary Al smelters. The trend now is to invest in a remelt shop as part of the mill, so that scrap reclamation becomes an 'in-house' operation.

169. Out with the irony and on with the aluminium. Material Reclamation Weekly, Vol.127. No.25. Jun.1976. pp.24-25.

A Becker-type installation in East Germany for large-scale separation of Fe from Al scrap is illustrated and described. The scrap, including baled material, is ripped to approx. uniform size, shredded, and passed through two electromagnetic separators and a final magnetic field, which reduces the Fe fraction to $\leqslant 0.1\%$ as compared with 14-15% in the as-received material. Present throughput is $\sim$ 15,000 tons/year.

170. Recovery of aluminium and copper from plastics- or rubber-covered cables. Revue de l'Aluminium, No.454. Aug./Sept. 1976. pp.413-416. /French/

The requirement is stated for improved methods of recovering Al and Cu from covered electrical cables to avoid toxic fumes and to improve metal quality and economics. Deficiencies of thermal methods of recovery directed attention to methods based on shredding scrap cable and employing mechanical separation. A system utilizing screens and vibrating tables for separation is described.

171. SPOEL, H.: The recovery of metal and chemical values from aluminium drosses. In: "Light Metals 1976". Vol.II. New York, 1976. AIME, pp.313-322.

Dross is formed when Al ingot or scrap are melted and when molten Al is handled. These drosses must be skimmed periodically from the surface of the molten metal. The primary constituents are Al metal and Al_2O_3 but drosses also contain significant and widely varying quantities of other compounds.

172. TOSHIRO TAKAHASHI et alii: Reclaiming aluminium scrap by extrusion. Journal of the Japan Institute of Light Metals, Vol.26. No.6. Jun. 1976. pp.261-265. /Japanese/

Small pieces of Al alloys H4100 and A6063 were cut from extruded shapes and placed in a laboratory extrusion apparatus. The pressure of the atmosphere in the equipment was reduced before extrusion was carried out. The extruded products were subjected to metallographic examination and mechanical tests.

6. ECONOMIC AND COMMERCIAL ASPECTS OF ALUMINIUM FOUNDRIES FABRICATION

173. ALEXANDER, F.: Use of heat recovery equipment in the aluminum industry. Light Metal Age, Vol.34. No.7/8. Aug. 1976. pp.13-15.

As now designed, most melting furnaces are the least efficient heating furnaces in the industry because of the high exit gas temp. into the stack. Preheating the charge with flue gases is the most efficient use of energy, but the logistics of having the next charge available for preheating at the time of the greatest amount of the highest temp. flue gases may not be compatible with operating techniques.

174. Anaconda returns to profitability. Mining Journal, Vol.287. No.7358. Aug. 1976. p.161.

The aluminium divisions 1976 second quarter earnings were the second highest in its history.

175. BARTLETT, W.C.: Weight savings using aluminium castings. Metals Park, Ohio. 1976. ASM Rep. System Pap. No.76-77. 2 p. /Pamphlet-English/

Aluminium pistons, cylinder heads, intake manifolds and air conditioning components are currently manufactured using the permanent mould process. Although fast cycle times are not achieved with permanent mould casting as compared to die casting, excellent casting integrity and high material strength are attained.

176. BENNETT, R.L.: Fuel economy through automatic pressure control /in Al melting/. Light Metal Age, Vol.34. No.7/8. Aug. 1976. pp.5-6.

To maintain the furnace pressure at a preset, slightly positive level regardless of firing rate, the flue is fitted with an automatically controlled damper having a positioning device. The positioning device is a relay that compares the furnace pressure to a desired setting and corrects the damper to maintain that setting. Two systems are in general use - hydraulic and pneumatic.

177. BROCKS, C.L.: Possibilities of energy economy in remelting operations. In: "Light Metals 1975". Vol.II. New York, 1975. Metallurgioal Society AIME, pp.69-80.

It seems that electrosmelting in great induction furnaces presents an attractive alternative, due to an increased rapidity of metal-melting and further technical advantages, as reduced metal losses during the melting process.

178. CAPPON, I.R.A.: Energy in the foundry industry and means for economizing. Fonderie, No.338. Oct. 1974. pp.358-360. /French/

Full utilization of possibilities offered by casting techniques is a valuable contribution to and immediately realizable for reducing the consumption of primary materials and energy. Some examples are given - based on a study - on power used in foundries.

179. CHURCH, F.L.: Northwest power crisis could black out one-third of U.S. aluminum capacity. Modern Metals, Vol.32. No.8. Sept. 1976. pp.25,27, 29-30, 33-34.

Increased demand for electric power with delays in construction of thermal generating plants threatens to shut down primary Al smelters in the Northwest. Lack of alternative fuel has made electric power the main and cheapest energy in the area but its max. potential will soon be exploited.

180. FLORESCU, V.: Ways of decreasing metal consumption during the production of aluminium. Metallurgia, Vol.27. No.6. Jun. 1975. pp.293-295./Rumanian/

The main stages in Al production are reviewed, noting the operations where metal is lost. Practical measures for reducing the metal losses are emphasized.

181. A furnace ensuring power economy. Iron Age, 24 May 1976. pp. MP-40-41.

Smelting experiments realized by the J.A. Koznia Co. at Royal Oak, Michigan, have proved that it is possible to economize 50% of energy when using an immersion furnace for aluminium fusion.

182. GODDARD, C.B.: Economic utilization of energy by electric melting and reheating. In: Energy and Waste in the Non-Ferrous Metals Industry, 1975. 14 p.

The efficiency of electrical power for melting, heating and reheating furnace operations on Al and its alloys, brass and other nonferrous metals is discussed, including the influence of electrical processes on yield and metal loss. New developments, such as a side tapping coreless induction furnace, multilayer induction furnace coil design and a channel injection furnace are also described.

183. GUINARD, Ch.: Aluminium versus new industrial challenges. Revue de l'Aluminium, No.439. Apr. 1975. pp.175-176. /French/

The numerous cases where the major requirement is for lightness, heat or electrical conductivity, corrosion resistance etc. aluminium

provides the technical answer and the possibility of saving energy. The energy saving achieved through aluminium represents in all 1.25 times the quantity of energy taken up in the overall constitutive components of the original vehicle.

184. KAECHELE, D.A.: Technical advances in aluminum related to appliances. Metals Park, Ohio, 1976. ASM Rep. System Pap. No.76-56. pp.5./Preprint/

Topics reviewed are flux soldering, fluxless soldering, fluxless brazing, new high-strength sheet alloys and spot welding techniques for them, prepainted Al sheet, Al magnet wire, fin stock and castings. Energy conserving devices using Al are discussed, including solar collector panels, heat pipes and waste heat exchangers.

185. LESTER, M.D.: Perspectives in regard to energy for electrolysis in the Western countries. Aluminium, No.52. 3 Mar. 1976. pp.217-219.

186. McDONALD, F.: The prospects for aluminium. Electrical Review. Vol.198. No.20. 21 May 1976. pp.27-29.

It is shown how recent economy changes have made Al a more feasible proposition for many electrical applications. Extended use of Al is anticipated for overhead lines, insulated cables, telephone cables, windings, and domestic wiring cables.

187. MILLER, H.E.: Energy utilization in aluminum melting furnaces. In: "Light Metal 1976." Vol.II. New York, 1976. AIME, pp.285-296.

Energy conservation measures for a reverberatory Al furnace holding $\sim$ 20,000 lb of molten Al should begin with development of an energy consumption accounting and reporting system. Further steps include examination and repair of door seals, refractory breaks, plugged stacks, dampers and instrumentation and optimization of the combustion conditions. Air/fuel ratios should be adjusted for max. flame temp. and a slightly positive pressure should be maintained during holding periods to reduce heat loss up the stack.

188. MISSONIER, H.: Trends: the fluctuation of stocks - the major phenomenon in 1975. Revue de l'Aluminium, No.448. Feb. 1976. pp.62-63. /French/

The aluminium industry - similar to other primary industries /metallurgy, copper etc./ - has in 1975 considerably suffered from the squeezing of stocks by the processing industries.

189. MITTMANN, E.: The importance of melting losses for the economy of aluminium melting furnaces. Giesserei, Vol.63. No.1. Jan. 1976. pp.4-7. /German/

The costs of melting Al and its alloys in crucible-type, gas- and oil-fired, rotating or o.h. furnaces, on o.h. plus gas- and oil-fired shaft

furnaces, and in mains-frequency induction furnaces are examined. An analysis of cost factors is made and it is shown that the cost of melting losses is a decisive factor in furnace choice.

190. Nonferrous metal works of the world. Park House, Surrey, 1974. Metal Bulletin Books Ltd., 1012 p. /Book/

Reviews 2300 smelting, refining and semifabricating works throughout 90 countries, with detailed and comprehensive production data.

191. ODOK, A. et alii: The potential for energy conservation by strip casting of aluminium. In: Energy and Waste in the Non-Ferrous Metals Industry, 1975. 4 p.

Energy consumption is compared for three continuous strip casting processes for Al, the conventional direct chill casting and hot rolling process, the Caster Type A process for continuous strip 15-40 mm thick and the Caster Type B process for strip 6-10 mm thick. The Caster Type B process is shown to require the min. amount of energy for manufacturing reroll material.

192. SPRENG, D.; BLOCH, F.A.: Energy aspects of recycling. Revue Suisse de l'Aluminium, Apr. 1975. pp.90-101. /French/

Considered are the calculation methods of power requirements of and the advantages presented by the recovery of certain materials. Especially the recuperation of aluminium boxes and foils is dealt with.

193. STEPHENS, W.E.: Improved methods and equipment for energy savings in the aluminum industry. I. Light Metal Age, Vol. 34. No.5./6. Jun. 1976. pp. 5-7.

An integrated facility consisting of a kiln, a melting furnace and a combustion chamber is used primarily for remelting of crushed scrap. Material is conveyed into the kiln which has the dual function of preheating the scrap for removal of air pollution contaminants and preheating of the charge prior to entering the furnace melting well.

7. ALUMINIUM BONDING, FORMING, COATING ETC.

7.1 Welding of aluminium

194. ARIKAWA, M. et alii: The most efficient automatic welding for thick aluminium alloys plate. In: Advanced Welding Technology, 1975.pp.369-374.

Three new processes for automatic verticsl and horizontal welding of thick Al alloy 5083 plate have been developed. They include the LD process /dual shield and double melt/ in which weld metal is remelted under an He-rich dual shielding, the NHA process narrow gap horizontal welding of Al/ and the DT process / Δ pattern/.

195. BAHRANI, A.S.; CROSSLAND, B.: Solid-phase welding processesa. III. - Friction welding. Chartered Mechanical Engineer, Vol.23. No.5. 1976. pp.61-63., 65-66.

The three principal modes of friction welding are continuous drive, inertia drive, and orbital drive. Friction welding is described in detail and micrographs are presented which show the effects of varying the speed of rotation on the location of the plasticized zone in Al alloys. Variations in axial pressure of the plasticized zone for Al alloys are also demonstrated. The advantages of this process and its applications are described.

196. CROSSLAND, B. et alii: The explosion welding of some difficult combinations.In: Advanced Welding Technology, 1975. pp. 669-675.

Flyer plates of mild steel, En 25 steel and maraging steel have been successfully welded to base plates of mild steel, Armour ateel,maraging steel and K355 steel by an explosive cladding process using ammonium nitrate/diesel oil as a low detonating velocity explosive.

197. DONATH, V.: Welding /of aluminium materials/ with the three-phase TIG arc. ZIS Mitteilungen, Vol.18. No.6. 1976. pp.590-599. /German/

The principles of three-phase twin electrode TIG welding are explained, and trials are reported of one-sided close butt welding without filler of 99.5 Al up to 10 mm thick and AlMg3, AlBz5 /aluminium bronze/ and Ms63 /brass/ of thickness 3-6 mm. Parameters and procedures are given. Advantages of the process include simple edge preparation, good joint formation in one-sided welding, arc stability and savings on fillers.

198. GERIDONMEZ, Ö.: Structural use of aluminium in building military vehicles. Metall, Vol.30. No.6. 1976. pp.535-540. /German/

Welding processes and fillers are reviewed generally. The economic design of welded Al structures is discussed. This is followed by a discussion of welding procedure and of the effect of heat on the quality of the welded joint. Several examples are given of the application of welded Al-Zn-Mg alloys in military engineering.

199. HARDY, R.R.: High cycle fatigue behavior of 5086-H116 aluminum alloy electron beam welds. Welding Journal, Vol.56. No.1. 1977. pp.8s-12s.

Static and dynamic mechanical property tests were conducted on 1 in. /25.4 mm/ thick 5086-H116 Al alloy electron beam welds. The results indicate the properties of the welds compare favourably with those of 5086-H116 plate. The mechanical properties of the 5086-H116 electron beam welds are significantly superior to those of 5086-H116 gas metal arc welds.

200. ICHIRO KAWAKATSU; SEIJI KITAYAMA: The diffusion bonding of metals. Journal of the Japan Institute of Metals, Vol.40. No.1. 1976. pp.96-103. /Japanese/

The effect of bonding temp. and time on bond strength was investigated for the diffusion bonding of metals of the solid-solution, two-phase, or intermetallic compound types. Diffusion bonding was carried out in H with bonding pairs such as Cu/Ni, Cu/Ag, Cu/Al, and Fe/Al prepared from cold-rolled sheet.

201. KIESCHE, M.: Modulated TIG welding of aluminium materials. ZIS Mitteilungen, Vol.19. No.6. 1976. pp.577-582. /German/

Trials are reported of the use of a.c., d.c. electrode negative, and d.c. electrode positive TIG welding of Al sheet and /which a.c. only/ occurred. With the electrode negative, oxide film removal was imperfect but some applications are possible.

202. KORNIENKO, Yu.A.; GURSKII, P.I.: Cold welding of aluminium cable sheaths. Automatičeskaja Svarka, No.6. Aug. 1975. pp.73-74. /Russian/

The ends of the Al cable sheath are roll formed and the support insert is then positioned beneath the sheath. The sheaths are joined using Al tube as coupling. The welding time, including preparation, is 5-8 min.

203. MECKELBURG, E.: The welding of aluminium alloys. - I. Rivista Meccanica, Vol.27. No.621. July 1976. pp.49-58. /Italian/

The relationship between composition and mechanical properties before and after welding for alloys in the Al-Zn-Mg system is considered and the effects of small additions of other elements noted. The response of the alloys to heat treatment is related to conditions in the weld region. The choice of specific alloys for weldability is discussed together with problems of embrittlement in the weld zone and methods of modifying the microstructure in the weld zone.

204. OHSUMI, M. et alii: Electron beam /EB/ welding of high strength aluminum alloy. In: Advanced Welding Technology, 1975. pp.105-110.

The application of the EB welding process, the penetration characteristics and the mechanical properties of 7075 Al welds are reported. Partial penetration of EB-welded Al is considerably affected by vaporizing alloying elements.

205. PLATONOV, V.M. et alii: Weldability of aluminium alloy 01205. Metallovedenie i Termičeskaja Obrabotka Metallov, No.7. 1976. pp.27-29. /Russian/

The welding characteristics of Al alloy 01205 /Cu 6.17-7.0, Mn 0.46-0.64, Ti 0.12-02%, traces of Zr, Cd, Fe, Si, and Mg/ were studied and correlated with its structure and mechanical properties. This alloy had excellent welding properties under both Ar-arc and contact conditions.

206. SCHEVERS, A.A.: Plasma-MIG welding of aluminium: increased welding speed and better weld-metal quality. Philips Welding Reporter, Vol.12. No.2. 1976. pp.8-12.

The advantages of plasma-MIG welding compared with MIG welding for Al are discussed. These factors are illustrated in a description of the welding of longitudinal seams inside Al tubes and the welding of Al tubes to flanges. Plasma-MIG welding results in a production increase of 700% over MIG welding in the latter example.

207. SCHULTZ, J.P.; CUNY, F.: Direct current plasma welding of light alloys. Soudage et Techniques Connexes, Vol.30. No.3/4. 1976. pp.91-99. /French/

Various techniques employed for plasma welding are discussed. A new method suitable for welding light alloys, which uses d.c., is described. The same range of thicknesses can be welded by this method as can be by the TIG process. The welding parameters are given in detail.

7.2 Brazing, soldering and adhesive-bonding of aluminium

208. Aluminum brazing. II. - Fillers and fluxes. Heat Treating, Vol.8. No.10. 1976. pp.22-24., 26,28.

Useful data are given in tables on composition and melting ranges for brazing filler alloys, brazing range of clad Al brazing sheet and filler alloys, cross references to fillers of various manufacturers, suggested combinations of braze alloy and flux for different parent metals, flux melting ranges and dip braze flux physical properties. Guidelines to selections for torch, furnace and dip braze are given, along with processing precautions.

209. ANTONEVICH, J.N.: Fundamentals of ultrasonic soldering. Welding Journal, Vol.55. No.7. 1976. pp.200s-207s.

In the development of fluxless ultrasonic soldering of Al, improvement of process reliability was achieved only after considerable study of the basic variables. Investigations made to determine the parameters that influence the quality of ultrasonically soldered joints and the reliability of ultrasonic soldering processes of 3003 Al alloy are described.

210. BOLGER, J.C.: Single component epoxy adhesives for sheet steel and aluminum bonding. In: Durability of Adhesive Bonded Structures, 1976. pp.537-559.

Five new epoxy adhesives and bonding processes recently developed for low-cost, high-volume, industrial metal assembly operations are discussed. Two of these applications, involving bonding Al street lighting poles and assembling engine block temp. sensors, represent adaptations of airframe design principles and adhesive compositions.

211. COSTELLO, B.: Practical considerations in infrared soldering. Dearborn, Mich. 1975. Society of Manufacturing Engineers, 11 p. /SME Techn. Paper No. AD75-367/

Visual accessibility of the area to be heated, and the size, thickness and material of the components to be heated, are two criteria regarded to be very important for evaluating radiant heating for soldering. Four examples of soldering applications are presented to illustrate good and poor cases.

212. DANFORTH, M.A.; SUNDERLAND, R.J.: Contamination of adhesive bonding surface treatment. In: Durability of Adhesive Bonded Structures, 1976. pp. 303-313.

Materials that are normally used for handling metal details which have been surface treated for adhesive bonding were evaluated for their effect on the bond. A white cotton glove or neutral kraft paper was lightly rubbed over the treated surface of the metal. The rubbed panels were adhesively bonded to an untouched Al 7075 panel and the bond durability tested using the wedge-crack test.

213. GEMPLER, E.B.: Parameters evaluated in long cycle aluminum vacuum brazing. Welding Journal, Vol.55. No.10. 1976. pp.293s-301s.

An evaluation was made of the brazing capabilities of various Al alloy combinations to evaluate the newer alloys developed especially for vacuum brazing and to determine the optimum parameters for use of the alloy systems. The parameters considered were variations in brazing sheet thickness, Al alloy combinations, fin shape and height, side piece /nose-piece/ width and height, rate of temp. drive, brazing temp. and holding time, fixture pressure, Mg catalyst and vacuum requirements.

214. HUGHES, E.J.; RUTHERFORD, J.L.: Adhesives in a stress environment. In: Durability of Adhesive Bonded Structures, 1976. pp.515-535.

Studies have been made of the changes in properties of adhesives resulting from the application of tensile and shear stresses to metal/metal/7075 Al/ bonded joints.High sensitivity extensometers were used to determine values for the modulus, precision elastic limit, microyield stress and energy loss. It was found that stress decreased the modulus, raised the microyield stress and increased the energy loss in load-unload cycles.

215. LASHKO, S.V. et alii: Fluxless brazing of aluminium alloys in a non-oxidizing atmosphere. Avtomatičeskaja Svarka, No.8. 1975. pp.27-30. /Russian/

The presence of the oxide film, Al_2O_3, on Al-alloys causes problems during fluxless brazing in O-free atmospheres. The oxide layer is removed by treating the Al-alloy surface with a molten metal /e.g. Ag, Si, Cu/ which forms a eutectic with the Al having limited solubility in Al at the brazing temp. The fluxless brazing is carried out in a vacuum of 10^{-3}-10^{-4} torr.

216. LEVI, D.W.: Durability of adhesive bonds to aluminum. In: Durability of Adhesive Bonded Structures, 1976. pp.283-301.

Two approaches were taken in studying the durability of adhesive bonds to Al. A reaction rate method was used to estimate the useful life of bonds at various temp. and under different mechanical stresses. The effect of humidity on lifetime was also examined. In the second approach statistical methods were used to compare the effect of different processing parameters and the effect of different Al alloys /2024 and 6061/ and adhesives on the resulting bond strength. Weibull distribution statistics have been found to be quite useful in this regard.

217. MAYO, C.R.: Salt bath brazing of aluminium. Metal Construction and British Welding Journal. Vol.8. No.1. 1976. pp.10-11, 13.

Successful salt-bath brazing of Al alloys requires careful selection of the alloys due to the relativelv high brazing temp. and the need for good wetting. It also requires correct precleaning and joint design, preferably lap joints with clearances of 0.05-0.18 mm.Residual salts must be removed by washing in boiling water if subsequent corrosion is to be avoided.

218. METZGER, G.E.: Diffusion brazing of aluminum alloys. Ohio. Apr. 1976. Air Force Materials Lab., Wright-Patterson Air Force Base. /Technical Report AFML-TR-75-210/ /Pamphlet/

The diffusion brazing of butt joints in 6061 and 7075 Al alloys in a vacuum atmosphere with mechanical pressure perpendicular to the joint was investigated. Filler metals included Ag, Au, Cu, Mg, Zn, Al12Si and Ag28Cu in the form of foil, powder, electroplated deposits and vapour deposits. Joints were examined by metallography, bend tests, tensile tests and other mechanical tests.

219. PATTNAIK, A.; MOAKIN, J.D.: Characterization of aluminum adherend surfaces. In: Durability of Adhesive Bonded Structures, 1976.pp.211-229.

A fundamental understanding of the strength and durability of adhesive bonding requires a complete knowledge of the nature of treated adherend surfaces. The surface morphology of various surfaces has been established.

220. RIEL, F.J.; GREEN, G.S.: Design concepts for durable adhesive-bonded structures. In: Durability of Adhesive Bonded Structures, 1976. pp.175-193.

Theory, experiments and results and service history of adhesively bonded Al honeycomb sandwich aircraft structure are presented. The theory relates to the characterization of corrosion and the control of corrosion of bonded Al /2024/.

221. WANGSNESS, D.A.: Sustained load durability of structural adhesives. In: Durability of Adhesive Bonded Structures, 1976. pp.425-443. /English/

A review of structural adhesives revealed that heat curing systems possess greater durability than RT cure systems. Surface preparation is an important factor and systems must be evaluated on the same surface preparation to obtain valid comparisons. The chemistry of adhesive systems has an effect on durability.

7.3 Machinability of aluminium

222. AKIYASU YUKI: The profile of the built-up edge in drilling aluminium alloys. Journal of the Japan Institute of Metals, Vol.39. No.12. 1975. pp.1249-1253. /Japanese/

The built-up edge on the profile along the lip and perpendicular to the rake surface was investigated in the drilling of Al alloys. The geometry and size of the profile of the built-up edge vary depending on the material, the cutting conditions and the drill shape.

223. LESKOVAR, P.: An analysis of material properties and their influence on the forces in the cutting process. Strojniski Vestnik, Vol.21. No.3/4. 1975. pp.49-54. /Slovenian/

Microhardness, its fluctuations and distribution were measured in Al contg. Fe 0.22 and Si 0.09% and in three Al alloys: D_3 contg. Fe 0.28, Si 0.57, Mg 0.68, Mn 0.67 and Cu 4.3%; D_4contg. Fe 0.25, Si 0.43, Mg 1.30, Mn 0.53, and Cu 4.32%; D_{58} contg. Fe 0.23, Si 0.11, Cu 5.45, Pb 0.35, and Bi 0.26%. Mechanical properties are tabulated. The relation between the microhardness, tensile strength, and cutting forces was studied and plotted for the D_3, D_4, and D_{58} alloys.

224. MASAMICHI HIRONO et alii: Deposits on the flank-wear region during the turning of a hypereutectic aluminium-silicon alloy. Journal of the Japan Institute of Light Metals, Vol.26. No.1. 1976. pp.1-7. /Japanese/

During the machining of a hypereutectic Al-Si alloy, severe flank wear and a considerable deposit on the flank-wear region of the tool are observed. The deposit produced under several cutting conditions was studied in order to determine the relation between the flank wear and the deposit.

225. NEILSON, R. et alii: Machinability of polymer-impregnated porous aluminium compacts. Materials Science and Engineering, Vol.24. No.2. Aug. 1976. pp.283-285.

Unimpregnated and polymer-impregnated porous Al compacts were machined into tensile specimens by milling. The roughness of machined surfaces is reduced by polymer impregnation. For unimpregnated specimens sintering gives a less rough surface, whereas the surface is uniformly smooth for impregnated specimens which have been sintered under various conditions.

226. PHILIPPE, J.M.: Diamond grinding of light metals. Werkstatt und Betrieb, Vol.109. No.5. 1976. pp.267-273. /German/

The use of diamond grinding on an Al-9% Si-3% Cu /AS9U3/ cylinder block is described. The machines employed, operating parameters, and the results obtained are discussed in detail.

227. REER, W.J.: Surfaces machined to millionths - in seconds. Machine and Tool Blue Book, Vol.71. No.5. 1976. pp.50-54.

A precision machining concept combines hydrostatic air bearing accuracy and repeatability, diamond cutting capability and vibrationless machine construction to produce optical quality surfaces. A specially designed chip evacuator, mounted on the tool post, extracts chips from the cutting area so they will not scratch the surface of the workpiece.

7.4 Forming of aluminium

228. BARIL, J.: The deep drawing of aluminium and its alloys. Revue de l'Aluminium, No.454. Aug.-Sept. 1976. pp.401-412. /French/

A general theoretical discussion is given of plastic deformation, with consideration of the principal elementary deformations involved. Attempts to characterize the deep-drawing of Al are reviewed. The Erichsen, Swift, and K.W.I. tests and Maslennikov's method are described.

229. DIRKS, F.J.; HEGAZY, A.A.: Deep drawing cold-worked and partially annealed round aluminium blanks. Blech, Rohre, Profile, Vol.22. No.6. pp.255-258, 279. /German/

An account is given of the effects of short heat treatments in a salt bath on the deep drawing behaviour of Al. Soft, half hard, and fully hard blanks in 99.5% Al, and AlMgMn and AlMg3 alloys were included.

230. KELLOCK, B.C.: Superplastic forming: aluminium. Machinery and Production Engineering, Vol.128. No.3316, June 1976. pp.621-624.

Development of the Supral 100 and 150 Al alloys, and of pressure-vessel and press-type machines to form them, is described. Th. alloys both contain Cu 6%, with a cladding of 99.8% Al on both faces of the 150 type, and can be elongated by fully 1000%. The requisite fine-grain structure is obtained by $ZrSiO_4$ additions, giving boundary precipitation inhibiting grain-growth. Typical operations and products are illustrated.

231. MATSUO MIYAGAWA: The bulge formed at the bottom of aluminium drawn cups by upsetting. Journal of the Japan Institute of Metals, Vol.26. No.2. 1976. pp.82-87. /Japanese/

The bulge formed at the bottom of Al drawn cups by axial compression in secondary forming operations such as nosing, tapering, closing, and flaring at the open ends of cups sometimes effects the dimensional accuracy of the final products.

232. MURRAY, R.G.: Punch it flat, spin it around. Tooling Production, Vol.42. No.7. Oct. 1976. pp.70-71.

For spin-forming parts which require fabricating or machining operations such as punching /perforating/ cost reduction can be achieved by punching the flat metal, Tig welding the metal into a cone and then spin-forming the part.

233. NEUMANN, W.D.: Surface contact problems in the working of aluminium. Bänder-Bleche-Rohre, Vol.17. No.5. 1976. pp.184-187. /German/

Literature on the lubrication of Al in deep drawing is reviewed and the choice of tool material and of lubricants both liquid and solid film types are discussed.

234. TAYLOR, B. et alii: Warm forming of aluminium. In: Second International Conference on Mechanical Behavior of Materials, 1976. pp.2004-2008.

Uniaxial tensile tests were performed on 2036-T4, 5020-T4, 5058-H111, 5090-H34, 5182-0 and 6151-T4 Al alloys to determine their potential for automotive body sheet applications.

235. WYLIE, A.: Sheathing supertension power cables with aluminium. Wire Industry, Vol. 43. No.507. Mar. 1976. pp.177-180.

The use of Al as a sheathing material for cables is discussed. Details are given of mechanical properties required for processing and for service, types of sheath, methods of manufacture and principal requirements. Extension techniques are considered, including Al flow, tool design, prevention of defects and protection of cores. Cable manufacturing methods are also described.

7.5 Powder metallurgy and composites of aluminium

236. CEBULAR, W.S. et alii: High-strength aluminum P/M products. Metal and Engineering, Vol.16. No.4. Nov. 1976. pp.37-44.

Wrought Al powder metallurgy /P/M/ mill products in Al-Zn-Mg-Cu-Co alloys develop combinations of engineering properties that offer unique advantages over existing wrought ingot metallurgy /I/M/ Al alloys. The P/M products have stress corrosion cracking resistance superior to commercial I/M alloy products.

237. JANGG, G. et alii: Powder metallurgy of aluminium. In: 6. Internationale Leichtmetalltagung, Leoben/Wien 1975, 1975. pp.61-63. /German/

The properties obtainable by sintering Al compacts and the optimum sintering conditions were studied, and new alloy compositions tested. Al-Sn and Al-Si compacts were produced and mechanically resistant materials also successfully sintered-in. Powder classification by extrusion, forging or rolling gave good results with Al.

238. LILHOLT, H.: Metal matrix composites./Proceedings of the 4th Nordic Symposium/ High Temperature Materials Phenomena, Helsinki, June 1975. 1975. Vol.2. pp.1-53. /English/

A review is presented of composites made with ductile matrices and brittle fibres, and their use at high temp. is described. The different types of composites /Al/B, Ti/B, directionally solidified eutectics, eto./ are considered and their creep behaviour is discussed in detail. A geometrical analysis of possible dislocation behaviour at fibre/matrix interfaces is presented.

239. MAYER, R.: The metallurgy of aluminium powders. Matériaux et Techniques, Vol.64. No.5. 1976. pp.163-174. /French/

Some properties of Al, Fe, and Cu are compared. The production and properties of Al powder are outlined. The historical development of Al powder metallurgy is traced, and the alloys and product forms manufactured are considered. The compositions, fabrication, heat treatment, mechanical properties, and applications of sintered Al alloy parts are described.

240. MISRA, P.S.; UPADHYAYA, G.S.: Activated sintering of aluminium under thermal cycling. Powder Metallurgy International, Vol.8. No.4. Nov.1976. pp.165-167.

Singering of Al base powder made products has been considered to be very difficult because of swelling problems. The present investigation aims at the development of a suitable sintering technique by which this problem is overcome. It was observed that cyclic sintering under vacuum of the order of 3.5×10^{-3} torr and under thermal cyclic conditions between 600 and 660°C, with a cycle period of 3 min leads to almost complete densification within one hour of treatment.

241. MORLEY, J.G.: Fibre reinforcement of metals and alloys. International Metallurgical Reviews, Vol.21. Sept. 1976. pp.153-170.

The general development of the science and technology of fibre-reinforced metals is outlined. The advantages and disadvantages of existing fibre-reinforced metals are discussed and the properties of a few selected systems are given in order to illustrate the basic similarities and differences between various types of reinforced metal composites.

7.6 Coatings on aluminium

242. CHARLES, J.P.: Phosphating of aluminum before powder coating. Galvano-Organo, Vol.45. No.466. 1976. pp.609-611. /French/

A plant for the phosphate treatment, in a trichloroethylene medium, of Al light fittings before powder coating is described. The system is rapid, and has the advantages of eliminating water consumption, effluent treatment, and saving energy by avoiding the need for drying.

243. KETCHAM, S.J.; BROWN, S.R.: Chromating high-strength aluminum alloys. Metal Finishing, Vol.74. No.11. Nov. 1976. pp.37-41.

Results of investigations show that all steps in the chromating process - cleaning, deoxidizing, chromate application and rinsing - affect the quality and corrosion performance of the final product. The following processing cycle is recommended for use in chromating Al alloy components for optimum corrosion resistance: clean in non-etching alkaline cleaner, rinse at least 1 min, deoxidize using chromate-sulphate deoxidizer, rinse at least 1 min, apply a MIL-C-81706, Class 1A chromate film, rinse film at least 1 min and air dry at temp. $<140^{\circ}F$ $/60^{\circ}C/$.

244. MUSCHAWECK, J.: Defects in coatings on aluminium. Metall, Vol.30. No.6. June 1976. pp.540-542. /German/

Examples are given which stress the importance of careful surface preparation before lacquering metal surfaces. The correct handling of polyurethane, polyester, or epoxide systems results in corrosion-resistant coatings on Al and Al alloys.

7.7 Heat-treating of aluminium

245. CENTRY, C.B.: Ceramic heat wheel in the aluminium industry. In: Aluminum Industry Energy Conservation Workshop, 1976. p.19.

The geometric stability of the ceramic wheel at high temp. provides the answer to critical high-temp. sealing. Very low expansion at temp. allows the use of 'close gap' ceramic seals. These seals are also low expansion material, and the wheel literally rotates in air, with no seal wear and very low leakage.

246. HEADLEY, T.J.; HREN, J.J.: Influence of heat-treatment and solute content on repeated precipitation at dislocations in aluminium-copper alloys. Journal of Materials Science, Vol.11. No.10. 1976. pp.1867-1876.

The influence of heat-treating parameters and Cu content on repeated precipitation of the O'-phase which occurs at climbing dislocations during quenching dilute Al-Cu alloys has been studied by transmission electron microscopy. In Al-3.85 wt.-% Cu the process occurs during quenching from all temp. within the solid solution range to all temp. in the range from room temp. to > 300°C.

247. HISASHI SUZUKI et alii: Ageing phenomena in aluminium-3.8% copper-beryllium alloys. Journal of the Japan Institute of Light Metals, Vol.26. No. 10. 1976. pp.519-525. /Japanese/

Ageing phenomena in Al-3.8% Cu-Be alloys contg. Be ⋟ 0.093% and in an Al-3.8% Cu-0.09%Be-0.05%Cd alloy were investigated as a function of ageing temp. and Be content by means of electrical-resistivity and hardness measurements and transmission electron microscopy. Specimens were solution-treated at 520°C for 2 h, quenched, and subsequently aged at temp. in the range 0-200°C.

248. MOTOHIRO KANNO et alii: Structural changes of G.-P. zones due to reversion heat-treatment in aluminium-4% copper and aluminium-4% copper-0.065% tin alloys. Journal of the Japan Institute of Light Metals, Vol.26. No.10. 1976. pp.526-530. /Japanese/

High-resolution transmission electron microscopy was used to investigate structural changes in Al-4%Cu and Al-4%Cu-0.065%Sn alloys which were subjected to preageing at 100°C for 1000 min or 130°C for 4000 min in order to develop G.-P./1/ and G.-P./1/ plus G.-P./2/ structures /in relation to the binary alloy/, resp., and subsequently reversion heat-treated at 200 or 250°C for various times.

249. New furnace installation designed to heat treat 7046 aluminum alloy bumper reinforcements. Industrial Heating, Vol.43. No.10. 1976. pp.24-25.

A recirculating air furnace operates at 750°F /400°C/ and is capable of processing 276 pieces/h. Parts are horizontally conveyed through the furnace by means of two roller chains and into an air quench chamber via a quick discharge conveyor mechanism. Two zones of temp. control are provided, each heated by a dual fuel combustion system for a total input of 4.6 million Btu/h. Two ageing ovens are each heated by dual fuel package burner systems and operate at 250 and 350°F /121 and 177 °C/.

250. RACK, H.J.; KRENZER, R.W.: Thermomechanical treatment of high purity 6061 aluminum. Metallurgical Transactions, Vol. 8A No.2. Feb.1977. pp. 335-346.

The effects of combined deformation and ageing on the subsequent mechanical response of high-purity 6061 Al have been examined. It has been shown that the yield strength of this material can be increased by an appropriate choice of thermomechanical treatment.

251. TAKAYUKI TAKASUGI; OSAMI IZUMI: Effect of diffusion annealing on the deformation of aluminium coated with condensed films. Journal of the Japan Institute of Light Metals, Vol.25. No.12. Dec. 1975. pp.439-443. /Japanese/

The effect of diffusion annealing on mechanical properties was studied by tensile tests on Al polycrystals coated with 1.5 μm thick Ag and Cu condensed films. As-coated specimens only show a slight increase in strength, while marked increases in both YS and flow stress are achieved by diffusion annealing at 450-550 °C for 1-48 h.

7.8 Aluminium deposits

252. MORRIS, A.W.: The ion vapour deposited aluminum coating. Plat. Surf. Finish., Vol.63. No.10. 1976. pp.42-46.

The ion vapour method of depositing an Al coating illustrates the ability of the coating to withstand the effects of exposure to corrosive environments. Test data demonstrate the sacrificial protection mechanism by which the coating prevents corrosion of bare steel and Al surfaces adjacent to IVD Al coated surfaces.

253. SINGER, A.R.E.; KISAKUREK, S.E.: Centrifugal spray deposition of aluminium strip. Metals Technology, Vol.3. No.12. 1976. pp.565-570.

Molten Al has been centrifugally atomized and the spray of liq. particles directed on to a cold substrate on which it is deposited to form a porous Al strip. The deposited strip was subsequently rolled to consolidate it and to improve its mechanical properties. The effects of varying the conditions of atomizing and deposition on the density and strength of the porous and hot-rolled strip were examined.

254. SMITH, H.R.: Vacuum deposition techniques - methods of aluminum evaporation. Metal Finishing, Vol.74. No.9. 1976. pp.42-47.

Aluminum is one of the most troublesome materials to evaporate at continuous high rates because of its extremely high reactivity at temp. where its vaporization rate is significant. No entirely satisfactory solution has been found and the success of various techniques is a relative matter. Concessions must be made between the desired length of life of the vapour source and the vaporization rate which must be achieved. Methods reviewed include resistance heating, radiant heating, electron beam vaporization, ion plating, sputtering and high resistance heating.

7.9 Corrosion of aluminium

255. BOMBARA, G.; BERNABAI, U.: Corrosion of aluminium in multimetal water systems. British Corrosion Journal, Vol.11. No.1. 1976. pp.25-30.

The thermodynamic conditiona of chemical stability for the three-metal, Al-Cu-steel/closed water systems are outlined, together with an eccount of the corrosion behaviour of Al ae affected by the pH of the water and the presence of inhibitore. A practical case is described of incorrect chemical treatment of the recirculating water in an air-conditioning multimetal system.

256. MEISSNER, H.: Corroeion protection of aluminium. 6. Internationale Leichtmetalltagung, Leoben/Wien, 1975, pp.111-114. /German/

The various possible methods of increasing the resistance of Al to drinking and industrial waters are reviewed. Anodizing, cathodic protection and organic coatinge are considered. The type of paint is lese important than the pre-treatment and method of epplication.

257. METZGER, M.: Intergranular corrosion of single-phase aluminium aa a pitting phenomenon. Journal de Physique, Vol.36. Oct. 1975. /10.Suppl./ pp.C4.387-C4.392. /French/

International Colloquium on Grain Boundaries in Metale. Electrochemical and micrographic observations ere presented of the pitting of Al contg. Cu 21, 140, or 600 ppm in eolid eolution /with Fe 10, Si 30, Mg 5 ppm/ when expoeed to H_2SO_4 with varying small amounts of NaCl. Intergranular fiesuring was reproduced.

258. MISRA, M.S.; OSWALT, K.J.: Corrosion behaviour of Al-Cu-Ag /201/ alloy. Metallurgical Eng.Q., Vol.16. No.2. May 1976. pp.39-44.

Alloy 201 ie a high-strength Al casting alloy containing Cu and Ag as major alloying elements. Castinge of it are eusceptible to strees corroeion cracking in the age hardened condition. Intergranular corrosion and etreee corroeion cracking susceptibility were atudied as a function of microstructural condition and related to the kinetice of precipitation during the age hardening proceee.

259. SAMPAT, S.S.; VORA, J.C.: Influence of colloids on the corrosion of 3S aluminium /alloy/ in low flow velocity water. Indian Journal of Technology, Vol.13. No.10. Oct. 1975. p.476.

The inhibitive powers of some colloids /gelatin, tannin, casein, dextrin, gum tragacanth, pulvie acacia and agar-agar/, ageinst the corrosion of an Al alloy in low flow potable water were studied. Tannin and casein were excellent inhibitors, conferring 99% inhibition for the experimental period of 90 days.

260. SHUHEI OSAKI et alii: Stress-corrosion cracking and intergranular corrosion of 5083 aluminium alloy. Journal of the Japan Institute of Light Metals, Vol.25. No.5. May 1975. pp.173-178. /Japanese/

The effect of heat treatment, microstructure, corrosion rate, and electrode potential on the stress-corrosion cracking of 5083 Al alloy /contg. Mg 4.72, Mn 0.97, Cr 0.12, Fe 0.18, Si 0.14, Cu 0.04, Zn 0.02, and Ti 0.01 wt.-%/ was studied in various NaCl solutions. There is a close correlation between stress-corrosion cracking and intergranular corrosion. The mean crack propagation rate varies exponentially with the corrosion rate.

261. TADAKAZU OHNISHI; YOSHIZO NAKATANI: Effects of some factors on the stress-corrosion susceptibility of aluminium-magnesium alloys. Journal of the Japan Institute of Light Metals, Vol.26. No.1. Jan. 1976. pp. 18-26. /Japanese/

The effects on stress-corrosion cracking in Al-Mg alloys of the anodic current, the temp. of solid-solution treatment, anodizing, and the addition of alloying elements were investigated. A linear relation between the log. of the anodic c.d. and the log. of the time to failure was observed, but this was altered by the applied stress.