

TABLE 1. CARBIDE AND GASOLINE BURNING

FACTORYS OF TRICE MOTORS, ELECTRIC GENERATORS AND ELECTRIC MOTORS

Year	1911		1912		1913		1914		1915	
	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity
Electric generators	1,234,567	12,345	1,345,678	13,456	1,456,789	14,567	1,567,890	16,789	1,678,901	17,890
Electric motors	2,345,678	23,456	2,456,789	24,567	2,567,890	26,789	2,678,901	28,901	2,789,012	29,012
Trice motors	3,456,789	34,567	3,567,890	35,678	3,678,901	37,890	3,789,012	39,012	3,890,123	39,123
Total	7,036,834	70,368	7,369,357	73,693	7,703,480	77,036	8,036,813	83,803	8,368,036	86,036

THE NON-FERROUS METALS TRADES.

THE NON-FERROUS METALS TRADES.

GENERAL REPORT.

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Introductory.

The following general report deals with those trades concerned with the smelting, rolling and casting of copper, brass, lead, tin, zinc and other non-ferrous metals, the refining of gold, silver and other precious metals, the manufacture of finished brass goods, watches, clocks and jewellery of all kinds.

Measured by the numbers engaged in the various trades, the largest member of the present group is the Jewellery, etc., Trade, which accounted in 1924 for 34,313 persons employed, or 28 per cent. of the group total of 123,222 persons. The next largest is the Finished Brass Trade, with 33,436 persons employed, or 27 per cent. of the group total.

Each of the trades included in the group forms the subject of a separate report, in which the detailed results of the 1924 Census of Production are set out, and such comparisons as are possible with

the results of the Censuses for 1912 and 1907 are made. The object of the present general report is to bring together the principal results for the whole group of trades, and, in addition, to set out certain particulars (e.g. as to fuel consumption) which are more conveniently dealt with here than in the separate trade reports.

Principal results for 1924.

The number of separate returns received from firms engaged in the Non-Ferrous Metals Trades group in 1924 was 4,621. About 1,130 firms to which schedules were sent did not furnish returns, but the great majority of these firms had very small establishments, and they included a number which were no longer carrying on business at the end of the censal year. On the basis of the information available, it is estimated that they did not employ more than about 3,170 persons in all, and that their aggregate net output was probably not in excess of £480,000. These figures represent an omission of, at most, about 2·5 per cent. and 1·8 per cent. respectively of the total figures for the group; and the absence of returns from the firms in question does not materially affect the uses made of the figures in this general report.

The main particulars obtained for 1924 are set out in the following table:—

Non-Ferrous Metals Trades.

Output in 1924.*

Trade.	Gross output (selling value of goods made and value of work done). (1)	Cost of materials used and amount paid to other firms for work given out (2)	Net output (excess of col. (1) over col. (2)). (3)	Persons employed (except out-workers). (4)	Net output per person employed as shown in col. (4). (5)
	£'000	£'000	£'000	Number	£
Copper and Brass (Smelting, Rolling and Casting)	23,611	17,292	6,319	27,460	230
Lead, Tin, Zinc and other Metals	32,081	25,897	6,184	21,690	285
Gold and Silver Refining	15,956	14,942	1,014	1,931	523
Finished Brass	10,486	4,549	5,937	33,436	178
Jewellery, Gold, Silver and Electro-plate	12,391	6,190	6,201	34,313	181
Watch and Clock	1,064	368	696	4,391	159
TOTAL FOR UNITED KINGDOM	95,589	69,238	26,351	123,221	214
England and Wales	92,774	67,637	25,137	118,579	212
Scotland	2,697	1,526	1,171	4,340	270
Northern Ireland	118	75	43	302	144

* Not including the output of, nor the persons employed by, Railway Companies, Government Departments, etc.; particulars relating to these establishments are given in the report on Public Utility Services, which forms part of a separate volume. The value of the goods produced by such establishments is stated in the individual trade reports concerned (see pages 363 and 371 of this volume).

Comparability of results with those for 1912 and 1907.

The scope of the Census was not quite the same in the three censal years, and the comparability of the totals for 1924 is affected by the changes referred to in the following paragraphs:—

(1) The Censuses of 1907 and 1924 extended to all firms, however small, but in 1912 firms employing not more than five persons (excluding proprietors) were required to state only the average number of persons employed by them in the year. The exemption of the small firms in 1912 resulted in the exclusion of an important proportion of some of the Non-Ferrous Metals Trades and the information available for that year, for the group as a whole, is not sufficiently complete to warrant its use for comparisons. For this reason the 1907 figures only are, except in respect of power equipment, taken for comparison with those for 1924 in this general report.

(2) The Census of 1907 covered Great Britain and the whole of Ireland, but that of 1924 applied only to Great Britain and Northern Ireland. According to the Census of Production carried out by the Government of the Irish Free State in respect of the year 1926, the Metal Trades carried on in that country employed about 1,150 persons and had a gross output of about £441,000, that is to say about 0·9 per cent. of the total number of persons employed and about 0·5 per cent. of the gross output returned for the Non-Ferrous Metals Trades in the United Kingdom in 1924.

(3) In any comparison of figures representing money values, the changes in the level of prices which occurred in the period between the first and third Censuses should be kept in mind.

Production.

It is difficult to find a satisfactory basis on which to compare production in the several trades in the same year, or in any trade or trades in different years. Obviously, no comparisons between trades could be based on the aggregate quantities of goods produced owing to their varied character, even if the necessary information were available for this purpose. The gross output values recorded in the Census of Production are affected in varying degrees by the duplication of goods or processes which they involve, and hence they do not form a practicable basis for comparisons. Some of the difficulties can be avoided by basing comparisons on net output, which, being arrived at by deducting, from the value of the gross output, the total cost of materials used and the amount paid to other firms for work given out to them, represents completely and without duplication the value added to the materials in the course of manufacture. The net output thus constitutes for any industry the fund from which wages, salaries, rent, royalties, rates, taxes, depreciation, advertisement and sales expenses, and all other similar charges have to be

provided, as well as profits; and if the net output for any trade is divided by the number of persons employed by firms in that trade, the resulting figure of net output per head furnishes a basis of comparison between the positions of different trades in the same year (or the same trade in different years) which takes account of differences in the numbers of persons employed and the continuity of their work. The use of net output per head as a basis of comparison was discussed at length in the Final Report on the first Census of Production (1907), where it was pointed out that "as the net output is the fund out of which all charges on industry, except the cost of materials as delivered at the works, are met, it will naturally vary with the amount of those charges" (page 12 of Cd. 6320). The conclusion reached was that "the average net output per head gives a somewhat fictitious representation of the condition of a trade" and that it constitutes only a rough measure on which to base comparisons (pages 14, 15). Hence, while it remains true that the net output for a trade represents a fact, i.e. the value added to materials by capital and labour, and constitutes the best available basis for the comparisons in view, the qualifications to which its use for this purpose is subject must be kept in mind.

Net output per head in 1924 and 1907.—The following table shows, for each of the trades included in the Non-Ferrous Metals group, the net output per head of persons employed in 1924 and 1907:—

*Net output per head of persons employed (excluding outworkers).**

Trade.	1924.	1907.
Copper and Brass (Smelting, Rolling and Casting)	230	137
Lead, Tin, Zinc and other Metals	285	133
Gold and Silver Refining	523	197
Finished Brass	178	89
Jewellery, Gold, Silver and Electro-plate	181	94
Watch and Clock	159	72
ALL TRADES	214	104

* It has been ascertained from the Census records that the exclusion of particulars relating to Southern Ireland from the 1907 figures would not materially affect the calculations.

The net output per head of persons employed increased by nearly 106 per cent. for the group as a whole, the greatest increase (over 165 per cent.) being recorded in the Gold and Silver Refining Trade, and the smallest (68 per cent.) in the Copper and Brass (Smelting, etc.) Trade. The net output per head in the Finished Brass Trade, the Jewellery, etc., Trade and the Watch and Clock Trade, was below the group average in each year.

Employment.

Employment in 1924.

Classification of persons employed in a specified week.—The following table classifies by sex, age and character of employment the numbers of persons (excluding outworkers) who were recorded

as employed in the various Non-Ferrous Metals Trades in the week ended 18th October, 1924:—

Number of persons (excluding outworkers) employed in the week ended 18th October, 1924.

Trade.	Operative staff.				Administrative, technical and clerical staff.			
	Males.		Females.		Males.		Females.	
	Under 18.	Total.	Under 18.	Total.	Under 18.	Total.	Under 18.	Total.
	In thousands.							
Copper and Brass (Smelting, Rolling and Casting)	2.2	23.0	0.4	1.8	206	2,283	99	741
Lead, Tin, Zinc and other Metals	1.5	16.7	0.7	2.7	139	2,001	70	544
Gold Refining	0.2	1.3	*	0.3	4	305	6	84
Finished Brass	4.1	20.6	2.7	9.3	227	2,807	309	1,371
Jewellery, Gold, Silver and Electro-plate	2.2	15.8	3.5	13.3	203	3,600	460	2,507
Watch and Clock	0.4	2.7	0.2	0.5	6	985	42	170
TOTAL	10.6	80.1	7.5	27.9	785	11,981	986	5,417

* Less than 50.

The proportion of female operatives was greatest in the Jewellery, etc., Trade and the Finished Brass Trade, these two trades accounting for over four-fifths of the total number of female operatives employed in the group.

Monthly fluctuations in employment.—In order to ascertain what fluctuations in employment there might be in the course of the censal year, firms were also required to state the average numbers of the operative staff employed in one week in each month. The figures for individual trades are shown in the respective reports, and the following table gives the monthly aggregates for all the trades together:—

Operative staff (excluding outworkers) in the Non-Ferrous Metals Trades in 1924.

Week ended.	Males.	Females.	Total.
12th January	76,843	25,872	102,715
16th February	77,500	26,046	103,546
15th March	78,101	26,102	104,203
12th April	78,468	26,353	104,821
17th May	78,379	26,716	105,095
21st June	78,362	26,884	105,246
19th July	78,524	26,898	105,422
16th August	78,283	26,702	104,985
13th September	79,886	27,262	107,148
18th October	80,083	27,869	107,952
15th November	80,799	28,430	109,229
13th December	81,239	28,272	109,511
AVERAGE FOR THE 12 MONTHS	78,872	26,951	105,823

With the exception of a slight set-back in August, employment as a whole improved throughout the year. Slight decreases were recorded, for males, in May, June and August, and for females, in August and December. The total number employed at the end of the year exceeded the number employed at the beginning by 6,796, or 6.6 per cent., the increase being composed of 4,396 males and 2,400 females or 5.7 and 8.9 per cent. respectively.

The average numbers employed were divided between males and females roughly in the proportion of 745 to $\frac{223}{253}$.

Employment in 1924 and 1907.

The following table shows the average numbers of male and female operatives (wage earners), and administrative, technical and clerical staff (salaried persons), in each of the Non-Ferrous Metals Trades in the two censal years. The figures stated exclude outworkers. The average numbers shown in this table and the table on page 347 have been determined in the manner explained in Note (19) on page xi.

Average numbers (excluding outworkers) employed in 1924 and 1907 in the several Non-Ferrous Metals Trades.

Trade.	Operatives (wage earners).		Administrative, technical and clerical staff (salaried persons).		Total.	
	Males.	Females.	Males.	Females.		
Copper and Brass (Smelting, Rolling and Casting)	1924	22,699	1,737	2,283	741	27,460
	1907	19,309	647	1,339	153	21,448
Lead, Tin, Zinc and other Metals	1924	16,400	2,745	2,001	544	21,690
	1907	6,437	972	767	57	8,233
Gold and Silver Refining ..	1924	1,263	279	305	84	1,931
	1907	1,808	71	266	42	2,187
Finished Brass	1924	20,300	8,958	2,807	1,371	33,436
	1907	27,575	7,301	3,200	840	38,916
Jewellery, Gold, Silver and Electro-plate	1924	15,510	12,696	3,600	2,507	34,313
	1907	21,180	11,939	3,389	1,880	38,388
Watch and Clock	1924	2,700	536	985	170	4,391
	1907	3,289	1,159	752	101	5,301
ALL TRADES	1924	78,872	26,951	11,981	5,417	
	1907	79,598	22,089	9,713	3,073	
TOTAL	1924	105,823		17,398		123,221
	1907	101,687		12,786		114,473

The total numbers employed increased between 1907 and 1924 by 8,748, or 7.6 per cent. The separate trades showed widely different variations in the relative numbers employed at the two Censuses, from an increase of over 163 per cent. in the Lead, Tin, Zinc, etc., Trades, to a decrease of over 17 per cent. in the Watch and Clock Trade. The Lead, Tin, Zinc, etc., Trades, and the

Copper and Brass (Smelting, etc.) Trade were the only two trades in which the numbers employed in 1924 exceeded those employed in 1907, the marked growth of the former being no doubt largely due to the extended manufacture of aluminium and nickel. These two trades together accounted for nearly half the male operatives employed in the group in 1924, but in 1907 for less than one-third.

Classification of average numbers employed.—The following table shows the distribution, according to sex, age and character of employment, of the average number of persons (excluding outworkers) employed in the Non-Ferrous Metals group of trades in 1924 and 1907 :—

Average numbers (excluding outworkers) employed in all Non-Ferrous Metals Trades in the two censal years.

Sex and age.	1924.		1907.	
	Operative staff.	Total staff.	Wage earners.	Total staff.
<i>Males :—</i>				
Under 18	10,546	11,331	12,610	13,454
Over 18	68,326	79,522	66,988	75,857
TOTAL	78,872	90,853	79,598	89,311
<i>Females :—</i>				
Under 18	7,285	8,271	6,137	6,912
Over 18	19,666	24,097	15,952	18,250
TOTAL	26,951	32,368	22,089	25,162
<i>Males and females :—</i>				
Under 18	17,831	19,602	18,747	20,366
Over 18	87,992	103,619	82,940	94,107
TOTAL	105,823	123,221	101,687	114,473

Sex and age distribution of operatives.—Labour in the Non-Ferrous Metals Trades was predominantly male in both years. The increased employment of operatives recorded in 1924 for this group (nearly 4.1 per cent) affected all the classes shown in the above table, except that of males under 18, where a decrease of 2,064 took place, the total of both sexes under 18 being also decreased as a consequence.

The proportion of operatives under 18 differed little in the two Censuses, being a little over 18 per cent. in 1907 and a little under 17 per cent. in 1924.

Administrative, technical and clerical staff.—The increase in the administrative, technical and clerical staff in 1924 (described in 1907 as salaried persons) was 4,612, or 36 per cent. Of this increase males accounted for 2,268 and females for 2,344. The increase in males probably signified an increase in management and sales staff ;

the increase in females probably related largely to clerical staff, reflecting a widespread adoption of more detailed accounting methods, and to clerical labour associated with selling organisation.

The proportion of males in the administrative staff in 1907 was 76 per cent. and of females 24 per cent., as compared with 69 per cent. and 31 per cent. respectively in 1924.

The following table shows the proportions of the administrative, technical and clerical staff in 1924, and of the salaried staff in 1907, to the total staff in those years:—

Trade.	Proportion of total staff represented by	
	Administrative, technical and clerical staff in 1924.	Salaried persons in 1907.
Copper and Brass (Smelting, Rolling and Casting) ..	11.0	7.0
Lead, Tin, Zinc and other Metals	11.7	10.0
Gold and Silver Refining	20.1	14.1
Finished Brass	12.5	10.4
Jewellery, Gold, Silver and Electro-plate ..	17.8	13.7
Watch and Clock	26.3	16.1
ALL TRADES	14.1	11.2

Outworkers.—The average number of outworkers employed in the Non-Ferrous Metals Trades group in 1924 was 1,294 as compared with 3,218 in 1907. They were employed in only two of the trades in the group in each year, viz.: the Jewellery, etc., Trade and the Watch and Clock Trade. In the former the average number employed in 1924 was 1,271 (1,001 males and 270 females) and 2,916 (2,507 males and 409 females) in 1907: in the latter the numbers were 23 (18 males and 5 females) in 1924 and 302 (286 males and 16 females) in 1907.

Wages in 1924.

The following table summarises the information contained in the reports on the separate trades as to the amount of wages paid by firms in those trades in 1924. The particulars of wages shown in column (5) of the table are those ascertained by the Ministry of Labour as a result of the voluntary enquiry undertaken by that Department into wages and hours of labour in the United Kingdom in 1924. The numbers of operatives shown in column (1) are those returned to the Census of Production as employed by the firms concerned in the week ended 18th October, 1924. The proportion of each trade represented by the firms that furnished particulars of their wage-bills is shown in columns (2) and (4) on the basis of numbers of operatives employed and of net output, respectively.

Trade.	Firms furnishing returns of wages.					
	Operatives employed.		Net output.		Wages paid.	
	Number. (1)	Proportion of trade total. (2)	Amount. (3)	Proportion of trade total. (4)	Amount. (5)	Proportion of net output. (6)
		Per cent.	£'000	Per cent.	£'000	Per cent.
Copper and Brass (Smelting, Rolling and Casting) ..	30,080	66	9,845	73	4,209	42.7
Lead, Tin, Zinc and other Metals ..						
Gold and Silver Refining						
Finished Brass						
Jewellery, Gold, Silver and Electro-plate ..	16,632	54	3,172	53	1,712	54.0
Watch and Clock	16,632	57	3,449	56	1,683	48.8
	849	26	198	28	126	63.6
TOTAL	63,733	59	16,664	63	7,730	46.4

The proportion of wages to net output was highest in the Watch and Clock Trade and lowest in the Non-Ferrous Metals (Smelting, etc.) Trades.

Mechanical Power.

The power equipment of factories consists in the first instance of the prime movers installed in the works, part being used to apply power mechanically and part to actuate generators for the production of electric energy. Only a portion of that electric energy is used for power, i.e. to drive electric motors, the remainder being used for lighting, heating and other purposes. In addition, many factories derive part or all of their power from electricity purchased and used for driving electric motors.

Power equipment of the various trades in 1924, 1912 and 1907.—The particulars furnished at the three Censuses regarding prime movers and electric generators in factories in the Non-Ferrous Metals group of trades are shown in the following table. Particulars of electric motors were not obtained in 1907, and particulars relating to 1924 and 1912 only can be given.

The summary figures of power equipment secured at the 1912 Census are included in this and the following paragraphs, though they are omitted from most of the individual trade reports. The exclusion in that year of firms employing not more than five persons and the incompleteness of many of the returns rendered the results secured for the most part ineffective for purposes of comparison. The figures relating to power equipment are, however, likely to have been affected in a less degree than other aggregates by the omission of the small enterprises. The main interest of the figures given for

1912 lies in the indication which they afford of the increase that has occurred since that year in the use of electricity, particularly purchased electricity, as a source of power. The omission of small firms in 1912 may have had a particular importance in reference to this feature.

In connexion with the omission of the Irish Free State from the 1924 Census (see page 343) it may be mentioned that, according to the Census of Production conducted by the Free State Government in respect of the year 1926, the total capacity of prime movers in the Metal Trades in that year was 287 horse-power, and the capacity of the electric motors driven by purchased electricity was 376 horse-power. The effect of the absence of the Irish Free State from the 1924 Census may, therefore, be considered as not affecting seriously the comparisons made in this report.

Power equipment of the several Non-Ferrous Metals Trades.

Trade.	Prime movers.			Electric generators.		
	1924.	1912.	1907.	1924.	1912.	1907.
	Thousand H.P.			Thousand Kw.		
Copper and Brass (Smelting, Rolling and Casting)	39.1	47.2	43.8	13.0	9.0	7.4
Lead, Tin, Zinc and other Metals	67.0	24.5	18.5	39.3	11.1	6.3
Gold and Silver Refining	0.3	1.7	1.6	—	0.1	†
Finished Brass	10.5	12.7	12.9	0.9	0.9	0.6
Jewellery, Gold, Silver and Electro-plate	6.1	7.7	6.6	0.5	1.0	0.6
Watch and Clock	0.2	0.2	0.6	0.1	*	0.1
TOTAL	123.2	94.0	84.0	53.8	22.1	15.0

* Less than 50 H.P.

† Less than 50 Kw.

Trade.	Electric motors driven by electricity generated in same works.		Electric motors driven by purchased electricity.		All electric motors.	
	1924.	1912.	1924.	1912.	1924.	1912.
	Thousand H.P.					
Copper and Brass (Smelting, Rolling and Casting)	20.6	8.3	69.7	10.8	90.3	19.1
Lead, Tin, Zinc and other Metals	17.3	2.6	38.7	8.2	56.0	10.8
Gold and Silver Refining	—	0.3	5.0	2.7	5.0	3.0
Finished Brass	1.5	0.7	16.3	3.6	17.8	4.3
Jewellery, Gold, Silver and Electro-plate	0.3	0.2	15.2	3.2	15.5	3.4
Watch and Clock	0.1	*	0.8	0.4	0.9	0.4
TOTAL	39.8	12.1	145.7	28.9	185.5	41.0

* Less than 50 Kw.

The distribution of the power equipment recorded in 1924 between Scotland and the rest of the United Kingdom was as follows:—

Area.	Prime movers.	Electric generators.	Electric motors driven by	
			Electricity generated in same works.	Purchased electricity.
	Th. H.P.	Th. Kw.	Th. H.P.	Th. H.P.
England and Wales and Northern Ireland*	82.0	28.9	38.2	141.4
Scotland	41.2	24.9	1.6	4.3
TOTAL	123.2	53.8	39.8	145.7

* In order to avoid the possible disclosure of information relating to individual firms, the figures for Northern Ireland have been combined with those for England and Wales.

Classification of power equipment of the Non-Ferrous Metals group.

The next table, which relates to the power equipment of all the trades taken together, classifies the prime movers according to kinds, the electric generators according to the description of prime movers by which they were driven, and the electric motors according as they were actuated by purchased electricity or by electricity generated in the same factory or works.

Power equipment.	1924.	1912.	1907.
	Th. H.P.	Th. H.P.	Th. H.P.
PRIME MOVERS:—			
Reciprocating steam engines	45.1	56.2	55.7
Steam turbines	3.6	0.9	0.5
Gas and oil engines	26.5	22.8	20.1
Water power	48.0	14.1	7.7
TOTAL	123.2	94.0	84.0
ELECTRIC GENERATORS:—			
Driven by:—			
Reciprocating steam engines	15.7	9.4	7.9
Steam turbines	2.7	0.6	0.4
Gas and oil engines	4.4	12.1	6.7
Water power	31.0		
TOTAL	53.8	22.1	15.0
ELECTRIC MOTORS:—			
Driven by:—			
Electricity generated in same works	39.8	12.1	(not ascertained)*
Purchased electricity	145.7	28.9	
TOTAL	185.5	41.0	—

* The total amount of electric energy recorded as purchased for all purposes in 1907 was 3,877,000 Board of Trade units (kilowatt-hours) and it would appear that the quantity generated by the dynamos operated by the firms in this group of trades may have amounted to about 50,000,000 Board of Trade units.

There was an increase of nearly 47 per cent. between 1907 and 1924 in the total capacity of prime movers available in this group of trades, though there was a decline in the case of reciprocating steam engines. The most noteworthy feature was the development in the use of water power, mainly for driving electric generators. The capacity of electric generators installed also showed a substantial increase (nearly 259 per cent.) in the interval between the two years.

Power equipment in use and not in use in 1924.—The firms that made returns to the Census for 1924 were required to distinguish between the prime movers, electric generators, and electric motors ordinarily in use in the course of the year, and those that were in reserve or idle. The proportion not in use should not be taken as a direct measure of the inactivity of trade during the year. While some of the engines, generators, and motors were not in use on account of lack of orders for goods, some were idle because they were normally in reserve against a breakdown or sudden rush of trade, and others may have been in various stages of obsolescence, awaiting the time for being dismantled. The particulars recorded as to power ordinarily in use and not in use in 1924 are given in the following table:—

Power ordinarily in use and not in use in the Non-Ferrous Metals Trades in 1924.

Trade.	Prime movers.		Electric generators.		Electric motors.	
	(a) Ordinarily in use; (b) not in use.	Percentage not in use.†	(a) Ordinarily in use; (b) not in use.	Percentage not in use.†	(a) Ordinarily in use; (b) not in use.	Percentage not in use.†
	Th. H.P.		Th. Kw.		Th. H.P.	
Copper and Brass (Smelting, Rolling and Casting)	{ a 32.6 b 6.5	} 16.7	{ a 9.1 b 3.9	} 29.8	{ a 77.9 b 12.4	} 13.7
Lead, Tin, Zinc and other Metals	{ a 62.8 b 4.2	} 6.2	{ a 36.7 b 2.6	} 6.6	{ a 50.0 b 6.0	} 10.6
Gold and Silver Re- fining	{ a 0.3 b *	} 10.5	{ a — b —	} —	{ a 4.5 b 0.5	} 10.1
Finished Brass	{ a 9.5 b 1.0	} 9.7	{ a 0.8 b 0.1	} 14.6	{ a 15.7 b 2.1	} 11.8
Jewellery, Gold, Silver and Electro-plate..	{ a 5.3 b 0.8	} 13.2	{ a 0.4 b 0.1	} 18.8	{ a 13.5 b 2.0	} 13.2
Watch and Clock	{ a 0.2 b —	} —	{ a 0.1 b —	} —	{ a 0.8 b 0.1	} 6.5
TOTAL	{ a 110.7 b 12.5	} 10.2	{ a 47.1 b 6.7	} 12.5	{ a 162.4 b 23.1	} 12.4

* Less than 50 H.P.

† Based in each case upon the actual figures returned, not upon the round figures shown in this table.

Power available for mechanical and electrical application in 1924.—
In order to ascertain the actual amount of power available in the

several trades, and the proportion of that power applied electrically, the capacity of the prime movers used to actuate electric generators must be replaced by the capacity of the electric motors driven by the electricity so produced. How far it may be legitimate to add together the capacity of engines applying, or intended to apply, power mechanically and the capacity of the electric motors, so as to obtain the power capacity of a factory using both forms of energy, will depend on the organisation of the factory. The information supplied furnishes no guidance as to the effective capacity of the power equipment, for, on the one hand, actual working capacity is not necessarily identical with the indicated horse-power, nor with that which an engine was originally built to develop, data which served largely as the basis of returns; and, on the other hand, it does not follow that an engine could run uniformly at its peak load, and some engine-power is generally provided as a reserve against breakdowns and not for regular use. In particular, a series of motors (whose aggregate capacity would be returned to the Census) may be installed to run on successive processes, some of which are carried on intermittently as the materials to be treated become available, so that the series always includes some units not actually in operation. In such cases the aggregate horse-power of the motors, being greater than the power called for at any moment, may be greater than the horse-power of the prime movers required to actuate the generators from which the series of motors is driven. Since, however, the mechanical power available per operative employed is regarded as significant of the efficiency of an organisation, an attempt has been made to provide such a measure, though the result can only be regarded as a rough indication claiming no high degree of precision.

In calculating this measure, the power allocated for driving electric generators has to be deducted from the total capacity of prime movers; for this purpose, 746 kilowatts of electrical energy are taken as the equivalent of 1,000 horse-power of mechanical energy, and an average loss of 10 per cent. is allowed in the conversion of mechanical into electrical energy, except in the case of steam turbines, which are usually bolted direct to the shafting of the generator. The power available to be applied mechanically is thus ascertained; and the electrical power available is the sum of the capacities of motors driven by purchased electricity and of those driven by electricity generated in the same works. Comparison with power available in 1907 is not possible, since the capacity of electric motors was not ascertained in that year.

The calculation relating to power available has been made on the basis of the power equipment installed and not on that recorded as being in use. For reasons already given, it must be recognised that the figures representing power available per operative employed are, to some extent which cannot be determined from the data available in the Census office, in excess of the average power utilisable.

The following table sets out the result of the calculation :—

Power available in the several Non-Ferrous Metals Trades in 1924.

Trade.	Power for mechanical application.	Power for electrical application.	Total power.	Per head of average number of operatives employed.
	Th. H.P.	Th. H.P.	Th. H.P.	H.P.
Copper and Brass (Smelting, Rolling and Casting)	20.1	90.2	110.3	4.5
Lead, Tin, Zinc and other Metals ..	8.4	56.0	64.4	3.4
Gold and Silver Refining	0.3	5.0	5.3	3.4
Finished Brass	9.3	17.9	27.2	0.9
Jewellery, Gold, Silver and Electro-plate	5.4	15.5	20.9	0.7
Watch and Clock	0.1	0.8	0.9	0.3
TOTAL	43.6	185.4	229.0	2.2

In the aggregate the power available for mechanical application and that available for electrical application were roughly in the proportion of 19 to 81.

Fuel and Electricity in 1924.

All firms that received schedules were asked to furnish voluntarily particulars of their consumption of fuel (of specified kinds) and electricity (distinguishing that purchased from that generated in the works) under two headings, namely (i) for power (driving engines), and (ii) for heating or lighting the premises, transport, etc. Firms whose aggregate net output was 61.0 per cent. of the net output of all firms in the Non-Ferrous Metals Trades in 1924 furnished information in response to this request, though, as will appear later, many of them were unable to divide their particulars into the two categories indicated. The information returned was fairly equally representative of fuel consumption, of production of electricity, and of consumption of purchased electricity, the data supplied under these three headings respectively covering 67.9 per cent. of the capacity of all the prime movers (not hydraulic) in use in the group of trades, 65.1 per cent. of the capacity of the electric generators, and 65.6 per cent. of that of the electric motors driven by purchased electricity. The proportion of the trade for which particulars were furnished varied considerably, however, between one trade and another, as will be seen from the tables given below.

Fuel consumption.

In 1907, when firms were only asked to state their consumption of coal and coke without specification of purpose, the firms that furnished particulars had 72.6 per cent. of the net output of the trades as a whole, and they recorded a consumption of 967,000 tons of coal and 172,000 tons of coke. The consumption recorded

in 1924 by firms representing 61.0 per cent. of the net output of the group, included 665,000 tons of coal and 150,000 tons of coke.

In 1924 the trades engaged in smelting, rolling, casting, etc., were by far the largest consumers of all kinds of fuel.

The following table summarises the information which was received from firms regarding the quantities of different kinds of fuel which they consumed in 1924. These quantities are divided into (a) the amounts used for power purposes, i.e., driving engines, and (b) the amounts used for the lighting or heating of premises, transport, etc., so far as the particulars furnished enable the classification to be made. It appears from the returns, however, that the basis of classification adopted by the various firms which furnished information was by no means uniform; and apart from this, considerable quantities were reported for which no particulars of purpose could be assigned. These quantities are shown under heading (c) in the table.

Consumption of fuel (so far as reported) in the several Non-Ferrous Metals Trades in 1924.

NOTES.—(1) The figures in italics below the name of the trade represent respectively (1) the percentage of the total net output of the trade represented by the firms giving information, and (2) the percentage of the total capacity of prime movers (not hydraulic) in use in the trade represented by the firms giving information.

(2) The fuel consumed is, in each case, classified according to the purpose for which it was used, as follows:—(a) For power (driving engines); (b) for heating and lighting premises and for transport, etc.; (c) for purposes not separately distinguished.

Trade.	Coal and slack.	Coke and breeze.	Heavy oils.	Light oils.	Gas.†
	Th. tons.	Th. tons.	Th. galls.	Th. galls.	Th. therms.
Copper and Brass (Smelting and Rolling and Casting) ..	120.1	0.2	9.6	*	401.9
Lead, Tin, Zinc and other Metals ..	438.5	116.0	1,495.8	3,955.0	2,534.4
Gold and Silver Refining ..	85.1	8.5	14.8	1.3	388.4
(1) 66.3 (2) 71.9					
Finished Brass ..	4.8	0.1	17.0	0.6	665.9
(1) 58.5 (2) 61.8	5.4	22.2	2.2	37.8	937.8
Jewellery, Gold, Silver and Electro-plate ..	0.8	0.4	2.0	2.0	190.1
(1) 53.6 (2) 42.4	3.0	†	3.0	—	308.6
Watch and Clock ..	6.3	2.3	22.6	15.8	1,275.5
(1) 45.7 (2) 75.6	0.1	—	—	0.3	87.5
	0.6	—	—	—	4.5
	0.2	0.3	0.2	1.0	35.6
	—	—	—	—	17.7
ALL TRADES ..	128.5	0.3	29.6	0.6	1,380.9
(1) 61.0 (2) 67.9	450.4	140.8	1,520.8	4,009.6	4,783.3
	86.0	8.9	16.8	3.6	683.7
GRAND TOTAL (ALL PURPOSES)	664.9	150.0	1,567.2	4,013.8	6,396.9

* Less than 50 galls.

† Less than 50 tons.

‡ The amount of gas purchased was, in some cases, returned in terms of cubic feet; in such cases 200 cubic feet have been taken as equivalent to 1 therm.

In certain Non-Ferrous Metal Trades fuel is used for manufacturing purposes other than the production of power. Quantities of fuel so consumed were intended as a general rule to be included under heading (b), i.e., for lighting or heating premises, transport, etc., and have been included under that heading in the preceding table. In the following trades where such special consumption of fuel is of particular importance, information was invited as to the quantities used for special trade purposes. The particulars recorded were as follows:—

Special consumption of fuel (so far as reported).

Trade.	Coal.	Coke.	Heavy oils.	Light oils.	Gas.*
	Th. tons.	Th. tons.	Th. galls.	Th. galls.	Th. therms.
Copper and Brass (Smelting, Rolling and Casting) ..	428·0	113·3	1,494·9	27·4	2,013·3
Lead, Tin, Zinc and other Metals ..					
Gold and Silver Refining ..					
Finished Brass ..	2·9	20·0	1·4	3·7	322·6
(at foundries or forges).					
TOTAL	430·9	133·3	1,496·3	31·1	2,335·9

* See footnote (†) to table on page 355.

The difficulty of drawing conclusions and making generalisations on the basis of the figures shown in the table on page 355 is due primarily to the appreciable quantities of fuel consumed for which no particulars of purpose could be specified by the firms that furnished information. The following table shows these quantities as percentages of the total of each class of fuel consumed in each of the trades in the Non-Ferrous Metals group:—

Proportion of fuel consumption for purposes not defined.

Trade.	Coal and slack.	Coke and breeze.	Heavy oils.	Light oils.	Gas.*
	Percent.	Percent.	Percent.	Percent.	Percent.
Copper and Brass (Smelting, Rolling and Casting) ..	13·2	6·8	1·0	—	11·7
Lead, Tin, Zinc and other Metals ..					
Gold and Silver Refining ..					
Finished Brass ..	7·0	1·7	9·7	5·1	10·6
Jewellery, Gold, Silver and Electro-plate ..	1·0	—	—	1·9	5·2
Watch and Clock ..	—	—	—	—	30·6
ALL TRADES	13·0	5·9	1·1	0·1	10·0

* See footnote (†) to table on page 355.

Where the quantities of fuel consumed for purposes not distinguished form only small percentages of the total quantities reported, it may involve no great error to distribute them, e.g., in the proportions recorded for the purposes for which consumption was specified; but where the undistributed portion is important in proportion to the total consumption such a process might lead to erroneous conclusions.

In these circumstances it is not practicable to estimate with any degree of confidence the quantities of the different kinds of fuel used for power, and for other purposes, by the firms who replied to the question in the Census schedules on the subject. Any attempt to extend the particulars furnished so as to estimate the quantities of different kinds of fuel used by all the firms in each of the Non-Ferrous Metals Trades would encounter other difficulties, even if distinction of purpose be ignored and attention be confined to the fuel used for all purposes combined. The table on page 355 shows that the firms which furnished information represented varying proportions of the several trades, and in no case was the proportion, as measured by net output, as high as 70 per cent. Any assumption that the firms which did not furnish information distributed their consumption among the different kinds of fuel in the proportions represented by the practice of those firms which supplied particulars would be extremely hazardous in the absence of information regarding the general practice of the several trades.

For the foregoing reasons, therefore, the information given in the table referred to should not be used as being of more than face value without extreme caution.

Production and consumption of electricity.

For 1907 the Census returns showed that about 48,000,000 units of electricity were generated in establishments with dynamos of 14,000 kilowatt capacity, equivalent to 93 per cent. of the total capacity of 15,000 kilowatts in the Non-Ferrous Metals Trades as a whole. In 1924, firms with generators of 30,700 kilowatt capacity (65·1 per cent. of the group total) recorded an aggregate of 173,700,000 units of electricity generated and consumed in their works. As regards purchased electricity, a return was obtained from all firms at the 1907 Census, and this showed a total of nearly 3,900,000 units purchased for all purposes. In 1924 the information received showed that about 67,800,000 units were purchased by firms owning 65·6 per cent. of the electric motors driven by purchased electricity. While the figures form only a slender basis for generalisation, the indications which they yield harmonise with the information available from other sources as to the increase in the use of electricity in the Non-Ferrous Metals Trades between 1907 and 1924, and possibly also with the conclusion indicated on page 350

as to the tendency to rely more largely on electricity purchased from public supply undertakings than on the installation of generating plant in the works themselves.

The table on page 359 summarises the detailed information received from firms in the Non-Ferrous Metals group of trades as to the generation and consumption of electricity in 1924. The figures must, however, be regarded as subject to qualifications similar to those which apply to the particulars given on pages 354 to 357 respecting consumption of fuel; and, for the same reason, they cannot be appropriately used as the basis of generalised deductions. The percentages of the reported consumption of electricity for which no particulars of purpose could be given were as follows:—

Proportion of consumption of electricity for purposes not defined.

Trade.	Electricity.	
	Purchased.	Generated in own works.
	Per cent.	Per cent.
Copper and Brass (Smelting, Rolling and Casting) ..	28·2	1·1
Lead, Tin, Zinc and other Metals		
Gold and Silver Refining		
Finished Brass		
Jewellery, Gold, Silver and Electro-plate	4·4	15·6
Watch and Clock	9·9	—
.. .. .	39·2	—
ALL TRADES	20·9	1·1

Reference to the table on page 359 will show that the percentage of the electric generators in use in the trade that was represented by the information furnished regarding electricity generated, was, in the aggregate, smaller than the percentage of the electric motors driven by purchased electricity that was represented by the information furnished regarding electricity purchased. This may be due in part to the predominance, among the firms replying to the voluntary question, of firms drawing the bulk of their electric power from public supply authorities and not from generators installed in their own works; but at the same time it may reflect the fact that, while all firms necessarily know the quantity of electricity they purchase, many do not record the quantity generated in their own works.

The particulars representing the average amount of electricity generated per kilowatt capacity (column (3) of the table) show considerable variations. These variations doubtless correspond to some extent with differences in the continuity with which the electric generators were operated in the works of the firms which furnished information. The difficulty of basing general conclusions regarding the several trades as a whole on the data shown in the table applies not less to this particular aspect of the matter than to the others.

Consumption of electricity (so far as reported) in the several Non-Ferrous Metal Trades.

NOTES.—(1) The figures in italics below the name of the trade represent respectively (1) the percentage of the total capacity of electric generators in use in the trade represented by the firms which stated the quantity of electricity generated in their works; and (2) the percentage of the total capacity of electric motors, driven by purchased electricity in use in the trade represented by the firms which stated the quantity of electricity purchased by them.

(2) The electricity generated and the electricity purchased are, in each case, classified according to the purpose for which they were used, as follows:—(a) For power (driving engines); (b) for heating and lighting premises and for transport, etc.; (c) for purposes not separately distinguished.

Trade.	Electricity generated in works of firms giving information.			Electricity purchased by firms giving information.		
	Capacity of electric generators (in use).	Quantity of electricity generated.	Average per kilowatt capacity of generators.	Capacity of electric motors (in use) driven thereby.	Quantity of electricity purchased.	Capacity of electric motors (in use) driven thereby.
	(1)	(2)	(3)	(4)	(5)	(6)
	Th. Kw.	Million B.T. units.	B.T. units.	Th. H.P.	Million B.T. units.	Th. H.P.
Copper and Brass (Smelting, Rolling and Casting) ..	30·2	a 23·0 b 148·2 c 1·9	5,737	25·2	a 28·4 b 3·8 c 12·6	67·5
Lead, Tin, Zinc and other Metals ..						
Gold and Silver Refining						
(1) 65·8; (2) 69·3						
Finished Brass	0·3	a 0·4 b * c 0·1	1,379	1·2	a 15·3 b 0·5 c 0·7	7·4
(1) 45·4; (2) 51·1						
Jewellery, Gold, Silver and Electro-plate						
(1) 14·5; (2) 54·9						
Watch and Clock	0·1	a * b * c —	639	0·1	a 0·2 b 0·1 c 0·2	0·5
(1) 96·2; (2) 60·5						
TOTAL						
(1) 65·1; (2) 65·6	30·7	a 23·5 b 148·2 c 2·0	5,669	26·6	a 48·8 b 4·9 c 14·1	82·7

* Less than 50,000 Board of Trade units.