

Iron ore lies widely distributed all over England and Wales, and though at present mainly raised in the northern and western counties, and all the districts which contain coal, the union with which alone gives it industrial value, the geological strata containing it are equally to be found in the south and elsewhere. The earliest use of the iron ore in England, before the important discovery of the manufacture of pig iron by coal was known, was almost exclusively in the southern counties, more particularly in Sussex. "I have heard," says John Norden, the topographer, in his *Survey of Middlesex*, published in the latter part of the 17th century, "that there are, or recently were, in Sussex neere 140 hammers and furnaces for iron." William Camden, writing about the same time, adds that Sussex "is full of iron mines in sundry places, where, for the making and founding thereof, there be furnaces on every side, and a huge deal of wood is yearly burnt." Other writers refer to the burning of "cole," that is, charcoal, in the iron manufacture of the south of England.

Discovery of iron smelting by "pit coal."

The old iron manufacture came to an end towards the middle of the 18th century, with the destruction of the once plentiful woods and forests of England. However, the production of iron in the country was still estimated in 1740 at 17,350 tons, made in 59 "hammers and furnaces," being less than half the number mentioned by John Norden as existing in Sussex. Within the next few years the trade sank still lower, and was on the point of being extinguished, when at last the efforts of a number of enterprising men to make use of "pit coal" for making iron were crowned with success. Like most discoveries, this great one, destined to give a new course to the industrial and commercial history of England, was not the work of one man, but resulted from the labours of many; still an important share of it fell to the Darbys, father and son, the first of whom established, in 1709, with the help of skilled Dutch workmen, the celebrated Colebrookdale ironworks, in Shropshire. The father did not reap the benefits of his great enterprise, but the son was fully rewarded. He sat "watching the filling of his furnace for six days and nights uninterruptedly, and was falling into a deep sleep, when he saw the molten iron running forth." In December 1756, the Colebrookdale iron works were "at the top pinnacle of prosperity, making twenty or twenty-two tons per week, and sold off as fast as made, at profit enough."

Production of pig iron, 1756 to 1854.

At the date here given, the total production of pig iron in England was probably about 225,000 tons a year, but from that time it rose with extraordinary rapidity. It is estimated that 68,300 tons were produced in the United Kingdom in 1788, which amount had increased to 125,079 tons in 1796, and to 258,206 tons in 1806, a doubling in ten years. The production had again doubled in 1825, when it was 581,000 tons; and once more in 1839, in which year it had risen to 1,240,000 tons. In 1848, the total amount of pig iron produced was estimated to be over two millions of tons; and in 1854, the first year for which trustworthy statistics were gathered by the mining record office, the production surpassed three millions.

Production of pig iron, 1854 to 1876.

The following table exhibits the quantities and value of pig iron produced in the United Kingdom in every third year from 1855 to 1876:—

Years.	Quantities.	Value.
	Tons.	£
1855	3,213,154	8,045,385
1858	3,456,064	8,640,160
1861	3,712,390	9,280,975
1864	4,767,951	11,919,877
1867	4,761,023	11,902,557
1870	5,963,515	14,908,787
1873	6,566,451	18,057,739
1876	6,555,997	16,062,192

The pig iron produced in the United Kingdom in the year 1876 came from 17,813,818 tons of iron, of which amount 16,841,583 tons were raised at home, and the remainder, 972,235 tons, imported from foreign countries, principally from Italy, Spain, and Portugal.

The following statement shows the amount of pig iron produced, and the quantity of coal used in its manufacture, in each of the divisions of Great Britain in the year 1876:—

	Pig Iron.	Coal.
	Tons.	Tons.
England.....	4,664,153	10,871,706
Wales.....	788,844	1,676,675
Scotland.....	1,103,000	3,050,000
Total Great Britain ...	6,555,997	15,598,381

It will be seen that the quantity of coal used in the manufacture of pig iron represented nearly one-eighth of the total coal produce of the year 1876.

The following table exhibits the number of furnaces in blast, and the quantities of pig iron made, in the various counties of England and Wales, in the year 1876:—

Counties.	Furnaces in Blast.	Pig Iron made.
	Number.	Tons.
<b>ENGLAND.</b>		
Northumberland.....	1	823,172
Durham.....	50½	1,261,013
Yorkshire, North Riding.....	75	235,451
Do. West Riding.....	34	300,719
Derbyshire.....	35	552,984
Lancashire.....	30	436,887
Cumberland.....	27	106,711
Shropshire.....	16	213,569
North Staffordshire.....	25	465,946
South do.....	65	84,916
Northamptonshire.....	11	125,198
Lincolnshire.....	16	28,108
Gloucestershire.....	5	29,479
Wiltshire.....	2	
Hampshire.....	1	
Somersetshire.....	1	
Total for England.....	393½	4,664,153
<b>NORTH WALES.</b>		
Denbighshire.....	3	32,723
Flintshire.....	1	
<b>SOUTH WALES.</b>		
Anthracite furnaces.....	6	20,421
Glamorganshire.....	28	321,754
Monmouthshire.....	35	413,946
Total for Wales.....	73	788,844
England and Wales.....	466½	5,452,997

The iron manufacture was not in a prosperous condition in the year 1876. The total number of existing furnaces in England and Wales was 771, so that more than 200 were standing idle. The total number of existing furnaces in England was 626, and in Wales 145, showing that the depression of trade was greatest in Wales, exactly one-half of the furnaces standing idle. The total number of active ironworks amounted to 159 in England, and 24 in Wales, at the end of 1876.

Lead.—In comparison with coal and iron, all the other mineral products of the country are of small importance. Of these minor products, the highest on the list, as to value, is lead ore, raised in the United Kingdom to the value of £1,218,078 in 1876, and producing lead valued at £1,270,415. The quantities of lead ore raised in the year amounted to 79,096 tons, and the metallic produce to

Pig iron and coal consumed.

Iron furnaces in England and Wales.

State of iron manufacture.

Production of lead.

58,667 tons. Of this total, 73,361 tons of ore were raised in England and Wales, producing 54,363 tons of lead. More than one-half of the lead ore and lead produced in England came from the counties of Durham and Northumberland, while two-thirds of the produce of Wales came from Montgomeryshire and Cardiganshire. There were altogether 392 lead mines in the United Kingdom in 1876, and of this number 387 were in England and Wales. The mines were very unequal in extent and produce. Derbyshire contained 140 lead mines, producing 2441 tons of ore and 2149 tons of metal; while Durham and Northumberland produced 23,285 tons of ore and 16,730 tons of metal in 28 mines.

Decline of lead produce.

The produce of the lead mines, after remaining stationary for many years, declined considerably from 1870 to 1876. In the fifteen years from 1854 to 1868 the average annual produce in the United Kingdom amounted to about 68,000 tons, valued at £1,400,000. The culminating point of production was reached in the year 1870, with 73,420 tons, valued at £1,452,715, after which there was a steady falling off, down to the amount of 1876. The decrease in the home produce of lead was accompanied by an increase in the imports of the metal, which amounted to 61,987 tons, valued at £1,411,988, in 1874, and rose to 79,825 tons, valued at £1,801,962, in 1875, and to 80,649 tons, valued at £1,749,978, in 1876. It will be seen that the imports of lead are considerably larger than the home production.

Production of tin.

Tin.—Next to lead in value, among the minor ores and metals, stands tin. In 1876 there were raised 13,688 tons of tin ore, producing 8500 tons of metallic tin, valued at £675,750. Tin ore is found nowhere but in Cornwall and Devonshire, the famous mines of Cornwall, which attracted foreigners thousands of years ago, producing the greater part. At the end of 1876 there were returned as existing in England 135 tin mines, of which number 104 were in Cornwall and 16 in Devonshire, the remainder consisting not of "mines," in the ordinary sense, but, more strictly, of "finding places," situated on rivers and near the shore. The number and produce of tin mines have suffered a great decrease in recent years. In 1872 there were raised 14,266 tons of ore, producing 9560 tons of metal, valued at £1,459,990; in 1873, only 1,056,835 tons were raised, producing 9972 tons of metal, valued at £1,329,766, and in 1874 but 788,310 tons of ore, producing 9,942 tons of metal, valued at £1,077,712. The year 1875 showed a further falling off to 735,606 tons of ore, with 9614 tons of metal, valued at £866,266, upon which followed the first-mentioned still lower production of the year 1876. During the same period, the imports of tin, in blocks and ingots, from foreign countries gradually increased. They amounted to 166,840 cwt., valued at £1,154,578, in 1872, and rose to 304,551 cwt., valued at £1,148,542, in 1876. It will be seen that while the total quantity of tin imported within the quinquennial period underwent a considerable increase, the total value not only did not augment, but actually decreased. The decline in price was probably one of the main causes of the decline in production of tin.

Production of copper.

Copper.—Next to tin in value, among the minor ores and metals, stands copper. The total product of copper ore raised in the United Kingdom in 1876 was 79,252 tons, of which 71,756 tons were the produce of England and Wales, while 680 tons came from Scotland, and 6816 tons from Ireland. The total amount of the metal produced from the ores was 4694 tons, valued at £392,300, of which 4222 tons were made in England and Wales, 33 in Scotland, and 449 in Ireland. There were at the end of 1876 copper mines to the number of 101 in the United Kingdom,—England and Wales possessing 93, Scotland 1, and Ireland 7. Only the copper mines of England, and more particularly those of Cornwall and Devonshire, are of any importance. At

the end of 1876 there was one copper mine in each of the counties of Cumberland, Cheshire, and Lancashire, 15 in Devonshire, and 65 in Cornwall, the latter producing 43,016 tons of ore and 3034 tons of metal. Even more than lead and tin, the production of copper has been greatly declining in recent years. In 1855 the total produce of copper was as high as 21,294 tons, valued at £3,042,877; which amount had fallen to 15,968 tons, valued at £1,706,261, in 1860. In 1865 the quantity had fallen to 11,888 tons, valued at £1,134,664; and in 1870 it had further declined to 7175 tons, valued at £551,309. Thus the decline continued, with slight fluctuations, till the production had reached the small amount of 1876. As with lead and tin, the copper imports grew largely while the production declined.

Zinc.—The remaining metallic ores—zinc, silver, and gold—are but of trifling value. Zinc is found in five counties of England and seven of Wales, which together possess 53 mines. There are 3 more mines in the Isle of Man, and 1 in Scotland. In 1876, the total of zinc ore raised was 23,613 tons, producing 6641 tons of zinc, valued £158,011. The production of zinc trebled in quantity and value in the sixteen years from 1852 to 1876. It amounted only to 2151 tons, valued at £50,548, in 1862, and in 1872 had risen to 5191 tons, valued at £118,076. The increase in production did not prevent a simultaneous increase in imports, which more than doubled in the decennial period from 1866 to 1876, amounting in the latter year to 29,327 tons, valued at £662,190, being more than four times the amount of the home produce.

Silver and Gold.—Silver and gold, the so-called "precious" metals—though iron is infinitely more valuable under every point of view—form but imperceptible additions to the mineral wealth of the country. Of silver, always found in combination with lead ores, 483,422 ounces, valued at £106,222, were raised in the year 1876 in the United Kingdom, and of gold, 293 ounces, valued at £1138. There were, according to the returns of the mining record office, two "gold mines" in the United Kingdom, the one in Merionethshire, and the other in the county of Wicklow, Ireland. The former, situated at Cloggan, produced 288 ounces, valued at £1119, in 1876. As for the Irish "gold mine," its yield was just 4 ounces, worth £18. The returns do not state the sum expended in raising the 4 ounces of Irish gold.

Salt and Clays.—The sum total of England's mineral riches is completed by a variety of miscellaneous substances raised from the earth, such as salt, clays—including porcelain, potter's clay, and fire clay—coprolites, oil shales, barytes, and gypsum. None of these are of much importance except salt and clays. The centre of the salt production is in Cheshire, at Northwich, Middlewich, Winsford, and other places; but there are also salt mines in Staffordshire and Worcestershire. In 1876 the total quantity of salt raised amounted to 2,273,256 tons, valued at £1,136,628, of which 854,538 tons, valued at £529,547, were exported to foreign countries, chiefly to the United States and British India. Of clays of all kinds, the total produce in 1876 was 3,971,123 tons, valued at £744,224. The finest of the clays, known as kaolin, or porcelain clay, is the produce of Cornwall and Devonshire, the former county raising 105,275 tons, and the latter 25,000 tons, in 1876. Of importance next to it, as potter's material, is the "Poole clay" of Dorsetshire, of which 72,105 tons were produced in 1876. Raised in much larger quantities than both the kaolin and the "Poole" are the fire-clays, the production of which in the year 1876 amounted to 1,514,902 tons. The fire-clays are found chiefly in the north and west of England and in South Wales. There were 171 fire-clay pits at the end of 1876, the largest number of them, 45, in Northumberland.



land and Durham, and the next largest, 33, in South Wales.

**Miners.**—In the census returns of 1871 there were 376,783 persons distinguished as "miners," the number comprising 371,105 males and 5678 females. At the preceding census of 1861 there were 330,446 persons enumerated as "miners," of whom 330,352 were males and only 94 females. Thus there was a total increase of 46,337 persons so designated, comprising 40,753 males and 5584 females, in the ten years from 1861 to 1871. There were besides enumerated as "workers in stone and clay," 152,673 at the census of 1871, comprising 149,567 males and 3106 females. At the census of 1861 the total number of persons so classified was 144,773, so that there was an increase of 7900 persons in the decennial period.

V. Textile Manufactures.—Fisheries.

Origin of the cotton manufacture.

There were two agencies, one moral and the other material, that gained for England its comparatively modern superiority in manufactures. Long after textile and other industries had been flourishing in the leading states of the Continent,—the Netherlands, Flanders, and France,—England remained a purely agricultural and pastoral country, content to export her riches in wool, and to import them again, greatly enhanced in value, as clothing. Thus it remained till religious persecution drove the flower of the industrial population of the West of Europe away from the homes of their birth; and, happy to find an asylum here, they liberally repaid English hospitality by establishing their own arts in the country, and teaching them to the inhabitants. Thus religious liberty formed the noble foundation of England's industrial greatness. Then came the material agent, machinery propelled by steam. The invention of the steam engine, following quickly upon that of the carding machine, the spinning jenny, and other ingenious machinery employed in textile manufactures, gave an extraordinary impulse to their development, and, with them, that of kindred branches of industry. At the basis of all of them was England's wealth in coal.

Faventions for spinning cotton.

**Cotton Manufacture.**—That England, not possessing the raw material, became the seat of the cotton manufacture, was owing, in the first instance, to the ingenuity of her inventors of machinery. Established as early as the beginning of the 17th century at Manchester, the cotton manufacture made no progress for a long time, and generation after generation clothed themselves in cotton goods spun by Dutch and German weavers. It was not till the latter part of the 18th century, when a series of inventions, unparalleled in the annals of industry, followed each other in quick succession, that the cotton manufacture took real root in the country, gradually eclipsing that of other European nations. But though the superior excellence of their machinery enabled Englishmen to start in the race of competition, it was the discovery of the new motive power, drawn from coal, which made them win the race. In 1815 the total quantity of raw cotton imported into the United Kingdom was not more than 99 millions of pounds, which amount had increased to 152 millions of pounds in 1820, and rose further to 229 millions in 1825, so that there was considerably more than a doubling of the imports in ten years. In 1830 the imports of raw cotton had further risen to 264 millions of pounds, in 1835 to 364 millions, and in 1840 to 592 millions of pounds.

The following table shows the progress, with fluctuations, of the cotton trade, in the annual imports, the exports, and the excess of imports of raw cotton during each, for every fifth year from 1841 to 1876 :—

Years.	Total imports of raw Cotton.	Total exports of raw Cotton.	Excess of imports.
1841	487,992,355	37,673,585	450,318,770
1846	467,856,274	65,930,732	401,925,542
1851	757,379,749	111,980,394	645,399,355
1856	1,023,886,304	146,660,864	877,225,440
1861	1,256,984,736	298,287,920	958,696,816
1866	1,377,514,096	388,981,936	988,532,160
1871	1,778,139,776	362,075,616	1,416,064,160
1876	1,487,858,848	203,305,872	1,284,552,976

There were 2655 cotton factories in the United Kingdom at the end of 1874. They had 41,881,789 spindles and 463,118 power-looms, and gave employment to 479,515 persons, of whom 187,620 were males and 291,895 females. The following statement gives the number of cotton factories in England—there are none in Wales—distinguishing those devoted to spinning and to weaving, and the total—including those both spinning and weaving, and all others—at various periods, from 1850 to 1874 :—

Years.	Number of Factories.		Total number of Cotton Factories.
	Spinning.	Weaving.	
1850	762	229	1,753
1856	910	419	2,046
1861	1,079	722	2,715
1868	1,041	632	2,405
1870	1,085	649	2,371
1874	1,172	600	2,542

The following table shows the number of spindles used in the cotton factories of England, distinguishing those for spinning and for doubling—the total including all others—at various annual periods from 1850 to 1874 :—

Years.	Number of Spindles.		Total Number of Spindles.
	Spinning.	Doubling.	
1850	8,685,392	10,055,410	19,173,969
1856	15,260,777	10,557,799	25,818,576
1861	15,077,299	13,274,346	28,351,925
1868	14,827,226	15,651,002	30,478,228
1870	17,302,982	15,309,505	32,613,631
1874	21,449,102	14,585,130	36,034,232

The subjoined table exhibits the number of power-looms used in the cotton factories of England, both weaving and of power spinning and weaving, at various annual periods from 1850 to 1874 :—

Years.	Weaving.	Spinning and Weaving.	Total Number of Power Looms.
1856	65,880	209,609	275,590
1861	131,554	235,268	366,125
1868	137,892	206,827	344,719
1870	175,432	235,904	411,336
1874	170,665	260,724	431,389

The following table gives the number of persons, male and female, employed in the cotton factories of England at various periods from 1850 to 1874 :—

Year.	Males.	Females.	Total.
1850	131,610	160,052	291,662
1856	148,354	192,816	341,170
1861	173,704	233,894	407,598
1868	152,656	204,396	357,052
1870	171,793	243,177	414,970
1874	180,607	259,729	440,336

Of the males employed in 1874 there were 33,342 under thirteen years of age, and 37,016 from thirteen to eighteen

See also the separate articles on the different textile manufactures.

years of age,—the rest, 110,249, being above eighteen years. Of the 259,729 females employed in cotton factories in 1874 there were 32,637 under thirteen years of age.

The cotton factories were distributed as follows over England at the end of 1874 :—

Counties.	Number of Factories.	Number of Power Looms.	Number of Persons Employed.
Middlesex, Surrey, and Kent	18	18	397
Gloucester, Hereford, Salop, Stafford, Worcester, and Warwick	19	3,000	5,278
Leicester, Rutland, Lincoln, and Notts	43	41	4,632
Cheshire	184	29,948	36,485
Lancashire	1,911	373,061	352,003
Derbyshire	72	7,608	10,091
Yorkshire	278	15,147	28,669
Durham, Northumberland, Cumberland, and Westmoreland	14	2,382	2,478
Essex, Suffolk, and Norfolk	3	184	303
Total	2,542	431,389	440,336

It will be seen that Lancashire absorbs more than three-fourths of the manufacture of cotton fabrics in England.

**Woolen and Worsted.**—Second only to the cotton trade as a national industry is the manufacture of woolen and worsted textile fabrics. There were in 1874 in the United Kingdom 1800 woolen and 692 worsted factories. In the woolen factories there were in use 3,323,881 spindles and 57,090 power-looms, and they employed 134,605 persons; while in the worsted factories there were in use 2,382,450 spindles and 81,747 power-looms, and they employed 142,097 persons. Unlike cotton, the raw material for woolen fabrics is mainly produced at home; still for many years past the native supply has been insufficient, which necessitated imports from foreign countries and British colonies, ever increasing in amount. During 1840–1876 the imports of wool rose from 49 to 390 millions of pounds.

The following table exhibits the imports of wool into the United Kingdom from foreign countries and British colonies, the amount of re-exports, and the net balance of imports, for every fifth year from 1841 to 1876 :—

Years.	Total Imports of Wool.	Total Exports (Foreign and Colonial).	Net Imports.
1841	56,170,974	2,553,671	53,617,303
1846	65,255,462	3,011,930	62,243,482
1851	83,311,975	13,729,937	69,581,988
1856	116,211,392	26,679,793	89,531,599
1861	147,172,841	54,377,104	92,795,737
1866	239,358,689	66,573,488	172,785,201
1871	323,036,299	134,866,304	188,169,995
1876	390,055,759	173,020,372	217,035,387

Of the 1800 woolen factories in existence in the United Kingdom at the end of 1874, England and Wales had 480; and of the 692 worsted factories, England and Wales had 239. The following table shows the number of woolen factories in England and Wales, the number of spindles and of power-looms in use, and the number of persons employed, at various annual periods from 1850 to 1874 :—

Years.	Number of Woolen Factories.	Number of Spindles.	Number of Power Looms.	Number of Persons Employed.
1850	1,306	1,356,691	9,170	64,423
1856	1,410	1,499,949	13,726	69,130
1861	1,456	1,846,350	20,344	76,309
1868	1,420	4,222,916	42,571	101,938
1870	1,550	2,681,931	37,356	100,640
1874	1,483	2,604,610	45,025	105,371

Number of woolen factories.

Imports of wool.

Woolen factories in England and Wales.

The subjoined table gives similar details regarding the worsted factories in England and Wales :—

Years.	Number of Worsteds Factories.	Number of Spindles.	Number of Power Looms.	Number of Persons Employed.
1850	493	864,874	32,617	78,915
1856	508	1,298,326	38,809	86,690
1861	512	1,245,526	42,968	82,972
1868	687	2,149,024	71,556	128,410
1870	599	1,766,636	63,443	103,514
1874	648	2,128,890	75,591	131,830

The number of persons employed in the woolen factories of England and Wales in 1874 comprised 54,119 males and 51,252 females. Of the males, 4391 were under thirteen years of age, 10,726 from thirteen to eighteen years of age, and 93,002 above eighteen. Of the females, 2841 were under thirteen, and 48,411 over thirteen years of age. In the worsted factories, the persons employed in 1874 comprised 53,995 males and 77,835 females. Of the males, 14,074 were under thirteen, 10,694 were from thirteen to eighteen, and 29,227 above eighteen years of age. Of the females, 15,394 were under thirteen, and 62,441 over thirteen years of age. It will be seen that the number of children, of both sexes, is far greater comparatively in the worsted than in the woolen factories.

The following table exhibits the distribution of the woolen factories over England and Wales, giving the number in different counties, with power-looms and persons employed, at the end of 1874 :—

Counties	Number of Factories.	Number of Power Looms.	Number of Persons Employed.
Herts, Bucks, Oxford, Northampton, Hants, Bedford, and Cambridge	10	231	984
Wilts, Dorset, Devon, Cornwall, and Somerset	69	2,586	7,695
Gloucester, Hereford, Salop, Stafford, Worcester, and Warwick	36	1,226	4,978
Leicester, Rutland, Lincoln, and Notts	8	...	315
Cheshire	11	130	538
Lancashire	98	9,023	11,822
Derbyshire	3	2	21
Yorkshire	936	30,684	75,354
Durham, Northumberland, Cumberland, and Westmoreland	36	559	1,555
Middlesex, Surrey, and Kent	6	...	116
Wales and Monmouth	269	584	1,190
Total	1,483	45,025	105,371

The worsted factories were thus distributed over England—there are none in Wales—at the end of 1874 :—

Counties.	Number of Factories.	Number of Power Looms.	Number of Persons Employed.
Middlesex, Surrey, and Kent	6	31	129
Essex, Suffolk, and Norfolk	11	563	1,042
Wilts, Dorset, Devon, Cornwall, and Somerset	4	...	564
Gloucester, Hereford, Salop, Stafford, Worcester, and Warwick	40	1,731	7,089
Leicester, Rutland, Lincoln, and Notts	13	...	1,825
Lancashire	46	6,758	5,317
Yorkshire	520	65,789	114,388
Durham, Northumberland, Cumberland, and Westmoreland	7	635	1,351
Derbyshire	1	84	125
Total	648	75,591	131,830

Distribution of woolen factories.

Distribution of worsted factories.