

APPENDIX.

I. Lists of Electric Furnaces for Iron and Steel Production in Operation or under Construction in 1912.

II. List of English and Foreign Patents relating to Electric Furnaces for Iron and Steel Production granted from 1898 to 1911.

III. Abstracts and Reprints of the early Patents relating to Electric Furnaces for Iron and Steel Production.

IV. Abstracts of Papers and Notes on Electric Steel Refining, and on Electric Furnaces.

I. LIST OF ELECTRIC FURNACES FOR IRON AND STEEL PRODUCTION.

A. Iron Smelting Furnaces.¹

In September, 1912, the following furnaces of the Swedish type were in operation, and in course of erection, in Europe:—

Completed—

Trollhätten, Sweden, 1 furnace	2,500 h.p.
Domnarfvet, „ 1 „	3,500 „
Hagfors, „ 2 furnaces of 3,000 h.p.	6,000 „
Hardanger, Norway 1 furnace	3,500 „

Under Construction or Planned—

Hagfors, Sweden, 1 furnace	3,000 h.p.
Nykroppa, „ 3 furnaces of 3,000 h.p.	9,000 „
Hardanger, Norway 1 furnace	3,000 „
Arendal, „ 3 furnaces of 3,000 h.p.	9,000 „
Switzerland . . . 1 furnace	2,500 „

Total, furnaces for 42,000 h.p.

¹ From *Metallurgical and Chemical Engineering*.

B. List of Heroult Steel Refining Furnaces, under Construction or in Operation, January, 1912.

Country.	Firm.	Size of Furnace.	Method of Melting.
England	Edgar Allen & Co., Ltd., Sheffield.	Tons. 2½	Tilting basic open hearth.
	Skinningrove Iron Co., Yorkshire	15	Talbot.
	Vickers, Ltd., Sheffield.	3	Melting scrap in electric furnace.
	Vickers, Ltd., Sheffield.	8	Melting scrap in electric furnace.
	Thomas Firth & Sons, Ltd., Sheffield.	2½	Melting scrap in electric furnace.
Austria-Hungary	Lake & Elliot, Braintree.	2½	Melting scrap in electric furnace.
	Kaerthner Eisen & Stahlwerke.	5	Melting scrap in electric furnace.
	Gebr. Böhler & Cie, A. G., Kapfenberg.	2½	Melting scrap in electric furnace.
	Gehr. Böhler & Cie, A. G., Kapfenberg.	4	Melting scrap in electric furnace.
	Brüder Lapp, Rottenmann, Works Steiermark.	6	Melting scrap in electric furnace.
	Danner & Co., Judenberg.	2	Melting scrap in electric furnace.
	Royal Hungarian Arsenal.	2	Melting scrap in electric furnace.
Belgium	Société des Usines Métallurgiques du Hainaut, Couillet.	5	Basic open hearth.
	Société Anonyme Ougrée-Marihaye, near Liège.	5	Basic open hearth.
France	Société Electro-Metallurgique Française, La Praz, Savoie.	2½	Melting scrap in electric furnace.
	Acieries du Saut du Tarn, St. Juéry.	5	Basic open hearth.
	Usine Métallurgique de la Basse Loire, Trignac.	5	Basic open hearth.

B. List of Heroult Steel Refining Furnaces, under Construction or in Operation, January, 1912—continued.

Country.	Firm.	Size of Furnace.	Method of Melting.
Germany	Deutscher Kaiser Stahlwerke, Bruckhausen.	Tons. 6	Basic open hearth.
	Deutscher Kaiser Stahlwerke, Bruckhausen.	6	Basic open hearth.
	Deutscher Kaiser Stahlwerke, Bruckhausen.	25	Basic open hearth.
	Stahlwerke Thyssen Hagendingen (Lothr.).	7	Basic open hearth.
	Stahlwerke Thyssen Hagendingen (Lothr.).	7	Basic open hearth.
	Stahlwerke Richard Lindenberg, Remscheid-Hasten.	2	Tilting basic.
	Stahlwerke Richard Lindenberg, Remscheid-Hasten.	3	Open hearth.
	Bismarckhütte, Upper Silesia.	1	Melting scrap in electric furnace.
	Bismarckhütte, Upper Silesia.	3	Melting scrap in electric furnace.
	Mannesmann Röhren Werke, Saarbrücken, Burbach.	3	Melting scrap in electric furnace.
	Rombächer Hüttenwerke, Rombach.	22	Open hearth.
	Rombächer Hüttenwerke, Rombach.	3	Open hearth.
	Deutscher Luxemburgische, Dortmund.	7	Open hearth.
	Deutscher Luxemburgische, Dortmund.	7	Open hearth.
	Italy	Societa Tubi Mannesmann, Dalmine.	6
Societa Tubi Mannesmann, Dalmine.		6	Melting scrap in electric furnace.
Russia	Imperial Steel Works, Obuchow, St. Petersburg.	3½	Open hearth.

B. List of Heroult Steel Refining Furnaces, under Construction or in Operation, January, 1912—continued.

Country.	Firm.	Size of Furnace.	Method of Melting.
Russia—cont.	Aktiengesellschaft der Hütten-&mechanischen Werke, Sormovo.	Tons. 3	Molten Martin steel.
	Société Générale des Hts. Fourneaux & Acieries en Russie, Makejewka.	3	Molten Martin steel.
Sweden	Aktiebolaget Hercults elektriska Stal, Kortfors.	6	Melting scrap in electric furnace.
Switzerland	Georg Fischer, Schaffhausen.	1½	Melting scrap in electric furnace.
Canada	Electro Metals, Welland, Ontario.	1½	Melting scrap in electric furnace.
	Electro Metals, Welland, Ontario.	5	Melting scrap in electric furnace.
United States	United States Steel Corporation, S. Chicago.	15	Bessemer.
	United States Steel Corporation, Worcester.	15	Basic open hearth.
	Firth-Stirling Co., Syracuse, New York.	2½	Melting scrap in electric furnace.
	Firth-Stirling Co., Syracuse, New York.	5	Melting scrap in electric furnace.
	Halcomb Steel Co., Syracuse, New York.	5	Tilting basic open hearth.
	Crucible Steel Co., of America, Pittsburg, Pa.	5	Basic open hearth.
	Crucible Steel Co., of America, Pittsburg, Pa.	5	Basic open hearth.
Mexico	Cie. Mexicano Aciero & Productos Quimicos.	4	Melting scrap in electric furnace.
	Cie. Mexicano Aciero & Productos Quimicos.	4	Melting scrap in electric furnace.

C. List of Girod Steel Refining Furnaces.

Country.	Firm.	Capacity of Furnaces.	
		Operating.	Erecting.
		Tons.	Tons.
France.	Cie. des Forges et Acieries Electriques Paul Girod, UGINE . . .	12	
		12	
		3	
		3	
		2	
		1	
		$\frac{1}{2}$	
England	Messrs. Rubery, Owen & Co., Darlaston	—	3
Germany	Stahlwerke Becker, Krefeld-Willich Gütehoffnungshütte, Oberhausen Fried, Krupp, A.G.; Essen-Ruhr Oberschlesische Eisen-Industrie, A. G., Gleiwitz	3	
		3	
		12	
		8	
Austria	Sterrische Gusstahlwerk Danner & Co., Judenburg (Styrie) Ternitzer Stahl u. Eisenwerke von Schoeller & Co., Ternitz, a.d. Sudbahn	2	
		$\frac{1}{2}$	
Hungary	Diosgyorer Eisen & Stahlwerke, Diosgyor	2	
Switzerland.	Oehler & Cie, Aarau	2	2
Italy	Gio. Ansaldo Armstrong & Cie, a Genes	—	4
Russia	Usines Poutiloff, a St. Petersburg	—	8
America	The Simonds Manufacturing Co., Chicago	$\frac{1}{2}$	3
	Totals	66 $\frac{1}{2}$ (16 Furnaces.)	20 (5 Furnaces.)

D. Kjellin and Röchling-Rodenhauser Electric Steel Refining Furnaces, Working or under Construction, on April 1st, 1912.

Country and Firm.	Capacity in kgs.		Type.	Power.	Product.	Charges.
	Work-ing.	Under Con-struction.				
Germany and Luxem- burg—						
Bergische Stahl- industrie, Rem- scheid	5,000	—	Röchling Roden- hauser	1 Ph.	High- grade steels.	Hot Martin steel.
Eicher Hütten- verein	3,500	—	Do.	Do.	High- grade steels and steel	—
Le Gallais Metz & Cie.	3,500	—	Do.	Do.	castings.	—
Dommeldingen .	3,500	—	Do.	Do.	High- grade steels.	Cold scrap.
Eberle & Co., Augs- burg	—	3,500	Do.	3 Ph.	Acid steel castings.	Do.
Grohman & Co., Wesseling b/Koln	500	—	Do.	1 Ph.	Do.	Do.
Oberschlesische, Eisenindustrie A. G. Gleiwitz	1,500	—	Kjellin	Do.	Do.	Do.
Peiner Walzwerk, Peiner	—	4,500	Röchling Roden- hauser	2 Ph.	Molten Ferro- Man- ganese.	Do.
Röchling'sche, Eisen & Stahl- werke, Volk- lingen	12,000	—	Do.	1 Ph.	High- grade steels.	Hot Martin steel.
	1,500	—	Do.	3 Ph.	Molten Ferro- Man- ganese.	Cold scrap.
	1,000	4,000	Do.	1 Ph.	Do.	Do.
Austria—						
Braun's Sohne, Vocklabruck	400	—	Kjellin	Do.	File- steel.	Do.
Poldihutte, Kladno	4,500	—	Do.	Do.	High- grade steels.	Hot Martin steel.

D. *Kjellin and Röchling-Rodenhauser Electric Steel Refining Furnaces, Working or under Construction, on April 1st, 1912—continued.*

Country and Firm.	Capacity in kgs.		Type.	Power.	Product.	Charges.
	Work- ing.	Under Con- struction.				
Austria— <i>continued.</i> Acieries de la Ma- rine et d'Home- court, St. Cha- mond	3,000	—	Röchling Roden- hauser	1 Ph.	High- grade steels.	Hot Martin steel.
Altiforni Gregorini, Lovere	1,600	—	Kjellin	Do.	Do.	Hot scrap.
Russia— Kronwerke, Sla- toust	—	1,000	Röchling Roden- hauser	3 Ph.	Do.	Cold scrap.
Sweden— Eisenwerk, Dom- narfvet, Gysinge	1,500	—	Kjellin	1 Ph.	Do.	Do.
Norway— Stavanger Elektro- stalverk, A. S.	—	4,000	Röchling Roden- hauser	Do.	Do.	Hot scrap.
Spain— Urigoitia e Hija Araya	1,500	—	Kjellin	Do.	Do.	Cold scrap.
Japan— Kaiserl, Stahlwerk, Wakamatsu	—	3,000	Röchling Roden- hauser	2 Ph.	Do.	Hot Martin steel.
Mexico— Ricardo Honey, Mexico	—	2,500	Do.	3 Ph.	Do.	Do.
England— Jessop & Sons, Sheffield	1,800	—	Kjellin	1 Ph.	Do.	Cold scrap.

D. *Kjellin and Röchling-Rodenhauser Electric Steel Refining Furnaces, Working or under Construction, on April 1st, 1912—continued.*

Country and Firm.	Capacity in kgs.		Type.	Power.	Product.	Charges.
	Work- ing.	Under Con- struction.				
England— <i>continued.</i> The University, Sheffield	300	—	Kjellin	1 Ph.	Experi- mental furnace.	—
United States— Crucible Steel Cast- ing Co., Lans- downe, Pa.	—	2,000	Röchling Roden- hauser	Do.	Steel castings.	Cold scrap.
General Electric Co., Schenectady	—	200	Kjellin	Do.	Experi- mental furnace.	—
Canada— Electric Steel Co., Welland, Ontario	—	—	Do.	Do.	75 kgs. (At pre- sent not working).	—

E. *List of Keller Electric Steel Refining Furnaces, Working, or under Construction, in February, 1912.*

Firm.	Capacity in kgs.
Usines de la Société des Etablissements Keller Leleux, at Livet, Isere, France	3,500
Acieries Jacob Holtzer, at Unieux, Loire, France	1,500
Ateliers de Constructions Electriques du Nord et de l'Est, at Jumont, France	3,500
Technical Science Schools, Grenoble, France	3 × 500
Luxemburger Bergwerke & Saarbrücken Eisenhütten, at Saarbrücken, Germany	3,500
Gebrüder Stumm, at Neunkirchen, Germany	3,500
Societa Anonima Ferriere di Voltri, at Darfo, Italy	3,500

II. LISTS OF ENGLISH AND FOREIGN PATENTS RELATING TO
ELECTRIC FURNACES FOR IRON AND STEEL PRODUCTION
GRANTED 1898—1911.

A. List of English Patents prepared by John E. Raworth, Chartered
Patent Agent, Queen Anne's Chambers, 28, Broadway,
London, S.W.¹

No. of Patent.	Date of Patent.	Patent Granted in Name or Names of	Subject-matter of Patent.
11604/98	23 May, 1898	Ernesto Stassano.	Improvements in and connected with the electro-metallurgic production of iron, steel, and their alloys with chromium tungsten, nickel, manganese, and the like.
16293/00	13 Sept., 1900	John Imray (La Société Electro-Métallurgique Française)	Improvements in electric furnaces.
22584/00	21 May, 1900	Charles Albert Keller	An electric furnace with two bed plates.
14486/01	16 July, 1901	John Imray (La Société Electro-Métallurgique Française)	Process and apparatus for the manufacture of wrought iron, steel, and cast iron by electric heating.
14643/01	18 July, 1901	John Imray (La Société Electro-Métallurgique Française)	Electric furnace arranged for being oscillated or tipped.
24234/01	6 July, 1901	Charles Albert Keller	Improvements in the obtainment of metals and alloys, and in furnaces to be employed therein.
24235/01	6 July, 1901	Charles Albert Keller	Improvements in the manufacture and treatment of alloys.
3912/02	15 Feb., 1902	Paul Louis Tousseint Heroult	Improvements in electric furnaces.
8288/02	9 April, 1902	Ernesto Stassano.	Improvements in and relating to the electrical smelting of ores and the refining of metals and to furnaces therefor.
15271/02	8 July, 1902	Charles Albert Keller	A new or improved process for the electric heating and refining of metals and other substances.
6950/03	25 March, 1902	La Société Electro-Métallurgique Française	Improved method of deoxidising and carburising molten iron or steel.

¹ (1) The dates given, in all cases, are the dates of the patents. (2) The list covers only the names of patentees and inventions dealt with in the present volume, and does not include furnaces that have never received practical trial.

A. List of English Patents prepared by John E. Raworth, Chartered
Patent Agent, Queen Anne's Chambers, 28, Broadway,
London, S.W.—continued.

No. of Patent.	Date of Patent.	Patent Granted in Name or Names of	Subject-matter of Patent.
7027/03	26 March, 1903	Arthur George Bloxam (La Société Electro-Métallurgique Française)	Improvements in the production of iron and steel.
3790/04	15 Feb., 1904	Charles Albert Keller	Improvements in and relating to electric furnaces.
4866/04	27 Feb., 1904	Otto Frick . . .	Improvements in electric furnaces.
25948/04	8 July, 1904	La Société Métallurgique Française	Improvements in the manufacture of steel.
6001/05	22 March, 1905	T. S. Anderson .	Improvements in the method of, and apparatus for, the smelting of ores, iron sand, and the like, and subsequent conversion into steel or other metals or alloys.
13690/05	4 July, 1904	P. Girod . . .	Improvements in electric furnaces.
14214/05	11 July, 1904	F. A. Kjellin . .	Improvements in electric furnaces.
14333/05	11 July, 1905	P. Girod . . .	Improvements in electric furnaces.
23402/05	24 Dec., 1904	P. Girod . . .	Improvements in electric furnaces.
25174/05	4 Jan., 1905	Société Anonyme Electro-Métallurgique (Procédés Paul Girod)	Improvements in electric furnaces.
25771/05	11 Dec., 1905	O. Frick . . .	Improvements in electric transformer furnaces.
3004/06	11 Feb., 1905	La Société Electro-Métallurgique Française.	Electric mixing furnace for mixing steel.
9799/06	8 May, 1905	E. A. A. Grönwall.	Improvements in processes for heating, smelting, or reducing materials, and means for carrying out the same.
10097/06	30 April, 1906	O. Frick . . .	Method of, and furnace plant for, reduction of arcs or the like by electric transformer furnaces.
12329/06	26 May, 1906	H. Röchling and W. Rodenhauser.	Improvements in and relating to electric furnaces.
13189/06	5 Aug., 1905	La Société Electro-Métallurgique Française.	Improved manufacture of de-carburised cast iron.
16269/06	18 July, 1906	The Gröndal Kjellin Company, Ltd., and J. Härden.	Improvements relating to electric induction furnaces.
17615/06	4 Aug., 1906	H. Röchling and W. Rodenhauser.	Improved means for obtaining thin liquid dross in electric furnaces for metallurgical purposes.

A. List of English Patents prepared by John E. Raworth, Chartered Patent Agent, Queen Anne's Chambers, 28, Broadway, London, S.W.—continued.

No. of Patent.	Date of Patent.	Patent Granted in Name or Names of	Subject-matter of Patent.
21416/06	5 March, 1906	F. A. Kjellin	Improvements in and relating to electrical furnaces.
22519/06	18 Dec., 1905	O. Frick	Improvements in electric transformer furnaces.
28370/06	12 Dec., 1906	A. Hiorth	Improvements in electric furnaces.
28959/06	5 May, 1906	A. Hiorth	Improvements in the method of operating electrical smelting furnaces.
28960/06	2 June, 1906	A. Hiorth	Improved electrical induction furnace with electrodes.
28961/06	6 Nov., 1906	A. Hiorth	Improvements in the method of operating electrical smelting furnaces.
29019/06	19 Dec., 1906	The Gröndal Kjellin Company, Ltd., and J. Härden.	Improvements in or relating to electric induction furnaces.
29271/06	27 Dec., 1905	O. Frick	Improvements in electric transformer furnaces.
1658/07	26 Jan., 1906	E. A. A. Grönwall, A. R. Lindblad and O. Stalhane.	Improvements in electric smelting furnaces.
3276/07	9 Feb., 1907	Société Anonyme Electro-Métallurgique (Procédés Paul Girod)	Improvements in the crowns or covers of electric furnaces.
4927/07	25 Sept., 1906	F. M. Chaplet and Société la Neo Métallurgie	Improvements in or relating to electric furnaces.
6193/07	14 March, 1907	E. A. A. Grönwall, A. R. Lindblad and O. Stalhane	Improvements in electric transformer furnaces.
7791/07	3 April, 1907	E. A. A. Grönwall, A. R. Lindblad and O. Stalhane	Improvements in electric transformer furnaces.
8445/07	11 April, 1907	The Gröndal Kjellin Company, Ltd., and J. Härden.	Improvements relating to electric furnaces.
10750/07	8 May, 1907	J. H. Reid	An improved process and apparatus for treating ore or like material by the aid of heat.
11917/07	22 May, 1907	H. Röchling, J. Schoenawa and W. Rodenhauser	Improvements in electrodes for resistance furnaces.
24587/07	6 Nov., 1907	C. A. Keller	Improvements in or relating to flexible electrical connection devices. [Note.—For use with electric furnaces.]

A. List of English Patents prepared by John E. Raworth, Chartered Patent Agent, Queen Anne's Chambers, 28, Broadway, London, S.W.—continued.

No. of Patent.	Date of Patent.	Patent Granted in Name or Names of	Subject-matter of Patent.
27556/07	13 Dec., 1907	H. Röchling and J. Schoenawa	Improvements in the treatment of iron which is to be converted into steel.
28542/07	4 Jan., 1907	A. Hiorth	An improved electrical induction furnace.
3680/08	21 Feb., 1907	Karl Albert Fredrik Hiorth	An improved method of reducing ores, principally iron ores.
7188/08	1 April, 1908	Hans Nathusius and Westdeutsche Thomasphosphatwerke G.m.b.H.	Improvements in or relating to electric furnaces.
7923/08	9 April, 1908	Hans Nathusius and Westdeutsche Thomasphosphatwerke G.m.b.H.	Improvements in or relating to electric furnaces.
12634/08	12 June, 1908	Charles Albert Keller	Improvements in or relating to connections for the electrodes of electric furnaces.
18513/08	26 Feb., 1908	Röchling'sche Eisen- und Stahlwerke G.m.b.H. and Wilhelm Rodenhauser	Improvements relating to electric induction furnaces.
21741/08	14 Oct., 1908	Charles Albert Keller	Improvements in or relating to electric furnaces.
6820/09	22 Aug., 1908	James Henry Reid	Improvements in electric furnaces.
6821/09	22 March, 1909	James Henry Reid	Improved process for reducing iron or other ores and refining the metal obtained.
8194/09	5 April, 1909	The Gröndal Kjellin Company, Ltd., and Johannes Härden.	Improvements relating to electric induction furnaces.
9508/09	21 April, 1909	Albert Edwards Greene	Improved process of refining metals and alloys.
11480/09	16 May, 1908	Albert Hiorth and Carl Wilhelm Soderberg	Improvements in electric induction furnaces.
12337/09	23 Sept., 1908	James Henry Reid	Improvements in processes of separating and refining metals.
13295/09	7 June, 1909	Hans Nathusius and Westdeutsche Thomasphosphatwerke G.m.b.H.	Improvements in or relating to electric furnaces.

A. List of English Patents prepared by John E. Raworth, Chartered Patent Agent, Queen Anne's Chambers, 28, Broadway, London, S.W.—continued.

No. of Patent.	Date of Patent.	Patent Granted in Name or Names of	Subject-matter of Patent.
24839/09	3 Feb., 1909	James Henry Reid	Improved process for recovering precious metals from ores.
25244/09	2 Nov., 1909	Fredrik Adolp Kjellin	Improvements in or relating to the treatment of ores in blast furnaces.
26588/09	6 May, 1909	Société Anonyme Electro-Métallurgique (Procédés Paul Girod)	Improvements in the process of refining steel.
26251/09	12 Nov., 1909	Johannes Härden	Improvements in or relating to electric furnaces.
26266/09	12 Nov., 1909	Johannes Härden	Improvements relating to electric furnaces.
27003/09	20 Nov., 1909	Société Anonyme Electro-Métallurgique (Procédés Paul Girod)	Improvements in the process of refining steel.
3421/10	26 Aug., 1909	Société Anonyme Electro-Métallurgique (Procédés Paul Girod)	Method of supplying electric furnaces with tri-phase current.
3739/10	15 Feb., 1910	Johannes Härden	Improvements in or relating to metallurgical processes.
7303/10	23 March, 1910	Johannes Härden	Improvements relating to the reduction of metals from their oxides or other compounds.
9459/10	19 April, 1910	James Henry Reid	Electric induction furnaces.
9897/10	23 April, 1910	Johannes Härden	Improvements relating to electric furnaces.
12214/10	22 May, 1909	Albert Hiorth	Improvement in electric induction smelting furnace.
15139/10	6 July, 1909	Carl Hering	Improvements in or relating to electric furnaces.
19804/10	24 Aug., 1910	James Henry Reid	Electric furnaces.
19805/10	24 Aug., 1910	James Henry Reid	Means for regulating electrodes in electric furnaces.
21206/10	12 Sept., 1910	Johannes Härden and Electric Furnaces and Smelters, Ltd.	Improvements in and relating to the production of metals from their ores by reduction.
1609/11	21 Jan., 1911	James Henry Reid	Improvements in electric furnaces.
8901/11	10 April, 1911	Ernesto Stassano	Electric furnace.

A. List of English Patents prepared by John E. Raworth, Chartered Patent Agent, Queen Anne's Chambers, 28, Broadway, London, S.W.—continued.

No. of Patent.	Date of Patent.	Patent Granted in Name or Names of	Subject-matter of Patent.
10231/11	13 Dec., 1910	Röchling'sche Eisen- und Stahlwerke G.m.b.H. and Wilhelm Rodenhauser	Improvements relating to electric furnaces.
13731/11	9 June, 1910	Société Anonyme Electro-Métallurgique (Procédés Paul Girod)	Method of supplying electric furnaces with tri-phase currents.
14239/11	15 June, 1910	Société Anonyme Electro-Métallurgique (Procédés Paul Girod)	Improvements in the process of refining steel.
15824/11	7 July, 1911	Johannes Härden and Electric Furnaces and Smelters, Ltd.	Improvements in or relating to the production of metals from their ores.

B. List of more important Heroult Patents, relating to Electric Steel, prepared by La Société Electro-Métallurgique Française, June, 1912.

British.		United States.		Canada.	
No.	Date.	No.	Date.	No.	Date.
16293	1900	707776	1902	78160	1902
14486	1901	721703	1903	79716	1903
14643	1901	807026	1905	96379	1905
6950	1903	807027	1905	96380	1905
7027	1903			99756	1906
25948	1904			106295	1907
3004	1906				
13189	1906				

C. List of English Patents relating to the Girod Electric Steel Refining Furnace.

No.	Date.	Name of Specification.
13690	4 July, 1904 . . .	Improvements in electric furnaces.
14333	11 July, 1905 . . .	Improvements in electric furnaces.
23402	24 December, 1904 . . .	Improvements in electric furnaces.
25174	5 January, 1905 . . .	Improvements in electric furnaces.
3276	7 February, 1907 . . .	Improvements in the crowns and covers of electric furnaces.
26588	6 May, 1909 . . .	Improvements in the process of refining steel.
3421	26 August, 1909 . . .	Method of supplying electric furnaces with tri-phase currents.
27003	20 November, 1909 . . .	Addition to No. 26588 of May 16th, 1909.
13731	9 June, 1910 . . .	Method of supplying electric furnaces with tri-phase currents.

D. List of Patents relating to the Kjellin type of Induction Furnace and its later modifications, prepared by the Gröndal Kjellin Company, of London, September, 1912.

Patentee.	British Nos., with date of application.	United States Nos., with date of grant.	Canadian Nos., with date of grant.	Subject-matter of Patent.
Benedicks	18921	682088	73701	Coil inside melting chamber.
Kjellin.	Oct. 23, 1900	Sept. 3, 1901	Nov. 12, 1901	
Kjellin . . .	14214	800857	None	Jacketed coils for cooling.
" . . .	July 11, 1904	Oct. 3, 1905		
" . . .	None	None	100269	Conductors arranged to oppose leakfield.
" . . .	None	None	July 21, 1906	
" . . .	None	None	102575	Channels for resistance heating.
" . . .	None	None	Dec. 11, 1906	
" . . .	None	None	104207	Resistance heating furnace.
" . . .	None	None	Mar. 19, 1907	
Colby . . .	None	428378	None	Annular conducting crucible.
" . . .	None	May 20, 1890	None	Annular conducting crucible.
" . . .	None	428379	None	Crucible lining.
" . . .	None	May 20, 1890	None	
" . . .	None	830208	None	
" . . .	None	Sept. 4, 1906	None	
" . . .	None	840825	None	Crucible with recess in underside.
" . . .	None	Jan. 8, 1907		

D. List of Patents relating to the Kjellin type of Induction Furnace and its later modifications, prepared by the Gröndal Kjellin Company, of London, September, 1912—continued.

Patentee.	British Nos., with date of application.	United States Nos., with date of grant.	Canadian Nos., with date of grant.	Subject-matter of Patent.
Colby . . .	None	840826	None	Arc shaped crucible.
" . . .	None	Jan. 8, 1907		
" . . .	None	859641	109540	Coils round crucible.
" . . .	None	July 9, 1907	Jan. 7, 1908	
Hay . . .	27972	932469	125527	Heat radiating device for induction furnace.
" . . .	June 19, 1909	Aug. 31, 1909	May 10, 1910	
Röchling-Rodenhauser.	None	877739	103614	Liquid slag obtained by concentration of current by means of hearth projections.
" . . .	None	Jan. 28, 1908	Feb. 12, 1907	
Röchling-Rodenhauser.	12329	939095	103615	Heating by means of induced currents and currents introduced through terminal plates.
" . . .	May 26, 1906	Nov. 2, 1909	Feb. 12, 1907	
Röchling-Rodenhauser.	18513	987404	116021	Wide central hearth obtained by cores with section long in proportion to width.
" . . .	Feb. 26, 1908	Mar. 21, 1911	Jan. 12, 1909	
Röchling-Schmelzer.	18523	984970	None	Lower portions of charge in any furnace heated by means of an auxiliary source of heat consisting in the passage of current through electrodes in hearth.
" . . .	Nov. 4, 1907	Feb. 21, 1911		
Röchling-Shonawa	27556	411945	126698	Process for the preliminary refining of pig-iron in a mixer provided with electric heating device.
" . . .	Dec. 13, 1907	(Appl.) Jan. 28, 1909 (recorded)	July 5, 1910	
Röchling-Shonawa-Rodenhauser	11917	—	126855	Electrodes of metal plate coated with such material as dolomite or magnesite, etc.
" . . .	May 22, 1907		July 12, 1910	