

NITRATE TRAFFIC

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Like the dancing wooden table imagined by Karl Marx in *Capital*, all commodities are shape shifters.¹ They appear to metamorphose. But nitrate materially changes. Its power as a substance and value as commodity lie in its capacity to change from material to immaterial state, to transform and to be transformative. Chilean nitrate is a sodium nitrate that, once processed, can be used as a fertiliser and to make explosives. It is the element nitrogen, which comprises eighty per cent of the earth's atmosphere, in this compound form that can speed or shatter life.

Capital transformation

The ore that contains nitrate, known as *caliche*, lies all over the Atacama Desert, just beneath its surface. *Caliche* was widespread, but the extraction of its nitrate was not. The driest desert in the world supplied neither water nor firewood for the refining process that required saturation and heating. There are some records of nitrate refining in Peru, above Lima, from the Spanish colonial period. One eighteenth-century account describes how 'Indians' crushed *caliche* into small pieces, soaked them in water for a day, then boiled and cooled the water to allow nitrate to crystallise. Dissolved again and dried, they were used as an explosive in silver mines.² Early nitrate works expanded on the indigenous refining process. Large inverted cones called *fondos* were filled with *caliche* and water, which was boiled then poured into *bateas*, tanks where nitrate cooled to crystallise. Mud and salt, the *ripio*, or waste of the nitrate refining remained in the *fondo*.³ While nitrate processing began before Peruvian Independence in 1821, it only developed as an industry in the Atacama Desert, then the territory of Peru, when British traders captured South American markets vacated by Spain. The 'merchant houses were the basic commercial units of British expansion' writes Michael Monteón.⁴ The desert became capitalised. Antony Gibbs and Sons, exporters of Peruvian guano, was, by 1865, a partner in the Tarapacá Nitrate Company. They had the capital, which they loaned, to create the nineteenth-century nitrate *oficinas*

¹ Karl Marx, *Capital: A Critique of Political Economy* [1867]. Harmondsworth: Penguin, 1988, p. 164.

² M. B. Donald, 'History of the Chile Nitrate Industry', *Annals of Science*, vol. 1, no. 1, 1936, pp. 37–38.

³ *Ibid.*, pp. 39–40.

⁴ Michael Monteón, 'The British in the Atacama Desert: the Cultural Bases of Economic Imperialism', *The Journal of Economic History*, vol. 35, no. 1 (March 1975), p. 118.

of the *pampa*, factories in the fields. Railway lines were laid across the desert to take *caliche* to be refined and its nitrate to the ports; tools, machinery, jute sacks were imported. Water for processing nitrate and water for nitrate workers to drink were transported. In an empty land, with nothing but explosive minerals in abundance, everything had to be supplied. The Antofagasta Nitrate and Railway Company is a case in point.

In 1860, José Santos Ossa, a Chilean adventurer, discovered *caliche* in Cobija. He was granted a tax-free concession right to mine and export nitrate from the Bolivian government, whose territory then extended into the southern Atacama. He tried to establish his own *oficina*. Without a transport infrastructure, he was dependent upon pack mules and his works failed. Ossa was bought out and the Antofagasta Nitrate and Railway Company, whose English partner was Antony Gibbs and Sons, worked the concession.⁵ The take-over is of great significance in the history of nitrate trafficking. In 1878, the Bolivian National Assembly ruled to impose an export duty on the Company, to raise a tax on nitrate extracted by a British-dominated affair. They refused to pay. The Chilean government protested that the imposition of export duty broke an 1874 treaty allowing tax-free operations in contested border zones. Diplomatic threats failed. Antofagasta Nitrate and Railway Company's property and produce was confiscated. An auction was planned for 14 February 1879 then the Chilean Navy occupied the port of Antofagasta. The War of the Pacific had started; nitrate was its fuse.

Chile won out over an alliance of Bolivia and Peru, increasing its land-mass by a third to incorporate the Atacama Desert and Pacific ports. Then, the desert was sold. The Chilean government, under some pressure from London investors seeking compensation for their loss of Peruvian bonds in the nitrate fields that were now part of its territory, instead allowed capitalist speculators, who had bought up war-devalued certificates, the right to mine.⁶ John Thomas North, who became known as the Nitrate King, and his partner Robert Harvey, bought mines in this way. Nitrate's transformation, its extraction from a mineral to chemical, from *caliche* to commodity, altered the desert itself. Material transformation sparked historical change: realigning borders within South America and world economic relationships. The Atacama Desert was no longer a national landscape of Peru, Bolivia or Chile but incorporated into a geography of European capitalism; it was a 'satellite' of an economic system,⁷ a location of mines, a site of extraction of material wealth, the riches of the earth's crust assimilated to capital.

⁵ Thomas F. O'Brien, 'The Antofagasta Company: A Case Study of Peripheral Capitalism', *The Hispanic American Historical Review*, vol. 60, no. 1 (February 1980), pp. 3–7; See Monteón, 'The British in the Atacama Desert', p. 120.

⁶ Thomas F. O'Brien, 'Chilean Elites and Foreign Investors: Chilean Nitrate Policy, 1880–82', *Journal of Latin American Studies*, vol. 11, no. 1 (May 1979), pp. 107–08 and pp. 113–14.

⁷ André Gunder Frank, *Capitalism and Underdevelopment in Latin America* [1969]. Middlesex: Penguin Books, 1971, p. 41.

Industrial transformation

In 1885, Robert Harvey presented a paper at the Institute of Civil Engineers in London entitled 'Machinery for the Manufacture of Nitrate of Soda at the Ramirez Factory, Northern Chili'. Formerly a Cornish engineer, Harvey had been the Inspector of Mines in Peru before being appointed to the same position in Chile, allowing him privileged information that would be realised in John Thomas North's speculations in war-devalued mining rights. Ramírez is another case in point. 'Oficina Ramirez', announced Harvey to the Institute of Civil Engineers, 'is the largest establishment of its kind in the world'. He refers not to the area of the nitrate fields, although it was indeed expansive, but to the factory that he helped to assemble:

In September, 1882, the Author received instructions from the directors of the Liverpool Nitrate Company, Limited, who own 6 square miles of nitrate grounds in the district of Ramirez, in the province of Tarapacá, to prepare plans and estimates for the construction of an oficina capable of producing from 6,000 to 6,500 tons of nitrate of soda per month, this total being 1,000 tons more than was in the power of the largest oficina then extant. In January, 1883, the plans and specifications were laid before the directors and approved of, and the Author was instructed to order the necessary machinery. Six steel boilers, 30 feet long by 6 feet 6 inches, double flues, with six Galloway tubes, were constructed by Messrs. R. Daglish and Co., of St. Helen's. Twelve boiling-tanks with steel condensing tubes, ninety crystallizing-tanks, two feeding-tanks, a five-compartment washing-tank, as well as three circular tanks, 25 feet in diameter by 12 feet high, came from the works of Messrs. Preston, Fawcett, and Co. The locomotives and rolling-stock, with a length of 2 1/2 miles of portable railway, as well as two semi-portable engines for the wells, were made by Messrs. John Fowler and Co. of Leeds, and the engines, pumps, machine-tools, &c., by Messrs. Tangye Brothers. And three crushing-machines were made by Messrs. North, Humphery, and Dickinson, of the Tarapacá Foundry, Iquique.⁸

His are details of the industrialisation of the desert. With the exception of the crushing-machines, made in Iquique, all machinery was imported from Britain. Nitrate trafficking was entwined with trafficking capital in its most material form: the structures of industrial production. These structures constituted a system, a simultaneous import. The multitude of metal tanks at Ramírez, and across all the *oficinas* of Atacama, were arranged according to the Shanks system, named after English patent holder James Shanks. His deployment of the gravitational flows of different liquid densities to increase the industrial efficiency of soda manufacture was applied by mining engineer

⁸ Robert Harvey, 'Machinery for the Manufacture of Nitrate of Soda at the Ramirez Factory, Northern Chili', Paper no. 2086, *Proceedings of the Institute of Civil Engineers*, 1884–85, pp. 337–38.

James Humberstone to the separation, or lixiviation, of saturated nitrate from the salt and mud of *caliche* rock. Increased industrial capacity and efficiency, more machines in working order, increased the need for nitrate miners, for more labour. British nitrate companies, such as those run by John Thomas North or Antony Gibbs and Sons, planted the machinery and created industrial colonies.

William Howard Russell, who accompanied John Thomas North on a much-publicised journey to Tarapacá in 1889, said of Ramírez:

The works appear to be very extensive and complete. A great collection of boilers, tanks, engines, two chimneys rising in the midst, workman's huts and residences of the staff... On the branch railway a long train of wagons loaded up with nitrate bags for the port was awaiting haulage, and the explosions of the *tiros* near at hand indicated great activity and working power.⁹

Russell's travelogue was serialised in the *Illustrated London News*. Other periodicals, *The Economist* in particular, accused John Thomas North of manipulating a nitrate market prone to booms and slumps and offering only promises of profit based on illusions.¹⁰ Russell, celebrated reporter of the Crimean War, accepted an invitation to join North's tour but 'to judge for myself and report what I saw'.¹¹ He provided details of nitrate mining that confirmed it was a business of some substance. Russell described its processes of extraction for his London audience in an industrial taxonomy, a scientific ordering that serves as a truth: raw materials, machinery and workers were carefully classified. A *barretero* sinks a shaft; at the base of the shaft, a *destazador* digs a *taza*, or hole; a *particular* lights the charge that explodes the surface layers of the desert.¹² Another observer, Mabel Loomis Todd, who accompanied a North American astronomical exploration in 1907, uses the same taxonomic strategy of explanation. She notes that both explosion and extraction is called a *tiro*.¹³ Russell relates that *caliche* is separated from *costra*, the layer of desert rock just below the desert surface. The surface is the *chuca*. A *corrector* inspects and prices the *caliche* once it is ready in carts to be taken to the *maquina*.¹⁴ He was the overseer, as Loomis Todd had noticed, the 'handsome *corrector* on his fine horse, is omnipresent'.¹⁵ At the *maquina*, *caliche* is supplied to the

⁹ William Howard Russell, *A Visit to Chile and the Nitrate Fields of Tarapacá*. London: Virtue, 1890, p. 197.

¹⁰ Harold Blakemore, *British Nitrates and Chilean Politics, 1886–1896: Balmaceda and North*. London: University of London/Althone Press, 1974, p. 66.

¹¹ See Russell, *A Visit to Chile*, p. 2.

¹² *Ibid.*, p. 182. The spelling of *destazador* has been corrected from Russell's original, which reads *destazdor*.

¹³ Mabel Loomis Todd, 'The Nitrate Wealth of Tarapacá', unpublished manuscript, Mabel Loomis Todd Papers (MS 496C). Manuscripts and Archives, Yale University Library, p. 13. See pp. 105–08 in this volume.

¹⁴ See Russell, *A Visit to Chile*, pp. 181–85.

¹⁵ See Loomis Todd, 'The Nitrate Wealth of Tarapacá', p. 14.

crushers by *acendradores* and to boiling tanks, *cachuchos*, by *carreros*.¹⁶ A charge of salty water, *agua vieja*, is added to the crushed *caliche*, which when heated forms a dense liquid called *caldo* that is run off into *bateas* to leave only *ripio* removed by *desripiadores*.¹⁷ The refined nitrate in the *bateas* is worked by *arrolladores*; *canchadores* empty it to the *cancha* below to dry; it is then re-worked by *retiradores* in preparation for the *llenadores* to pack it into jute sacks for the *cargadores* to take onto railway trucks.¹⁸ As Russell observes, ‘all the arrangements for the working of an *oficina* are minute in the division of labour and responsibility’.¹⁹ The organisation of these desert field factories, the separation and specialisation, was characteristic of monopoly capitalism; division and deskilling of the industrial process was its mechanism of industrial control.²⁰ Indeed, the taxonomy of tasks barely obscured the essential similarity of industrial work: nitrate mining was a matter of hard labour.

Rocks scattered by explosions were prised apart with crowbars or split with pickaxes to expose the *caliche*; it was then lifted and thrown or carried and hauled onto carts to be pulled to the factory. Then carts were heaved up to allow the *caliche* to fall into the crushers ready for saturation and boiling. The residue of the boiling tanks, the *ripio*, was shovelled away into more carts then tipped onto slag heaps while the dissolved, dried, crystallised nitrate on the drying floors was shattered with bars and picks into fine pieces. The fine crystals were shovelled into bags. The bags were heaved onto railway trucks, loaded up for the ports. A general description of all nineteenth-century mining applies here: ‘The raw material of industrialization was dug out of the earth by the muscles of men aided only by pick and shovel.’²¹ Nitrate mining was laborious; it was dependent upon manual labour in an inhospitable place where nobody lived. Chilean, Bolivian and Peruvian day labourers were brought in gangs to the nitrate fields. These *enganchados* had been rounded up by contractors working for the *Asociación Salitrera* or for themselves; either way, they were paid by the head. The *enganche* system began with carnival entertainment followed by the promise of payment three times the rural wage of one peso a day. But the three pesos daily wage served to bind nitrate workers to the nitrate *oficinas*; many became indebted to the contractor for their passage to the nitrate fields or to the company for whom they worked because their wages were not coins but *fichas*. A company scrip, the token carrying the company name, was the only means to buy the overpriced goods from the

¹⁶ See Russell, *A Visit to Chile*, p. 186. The spelling of *cachuchos* has been corrected from Russell’s original, which reads *cachuros*.

¹⁷ See Loomis Todd, ‘The Nitrate Wealth of Tarapacá’, pp. 15–16. The term *desripiadores* has been corrected from Loomis Todd’s original which reads *ripiadores*.

¹⁸ See Russell, *A Visit to Chile*, p. 191. The spellings of *llenadores* and *arrolladores* have been corrected from Russell’s original, which reads *llededores* and *arroloadores*.

¹⁹ *Ibid.*, p. 184.

²⁰ Harold Braverman, *Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century*. New York: Monthly Review Press, 1974.

²¹ John Burnett (ed.), *Useful Toil: Autobiographies of Working People from the 1820s to the 1920s*. Harmondsworth: Penguin, 1984, p. 25.

company stores, the tins of water or portions of food, required to sustain a working life in a desert.²²

Trafficking nothing

In the factory and the field, nitrate has substance; its weight was felt as it was scooped up in shovel or heaved up in a jute bag; the quantity shifted from desert floor to cart, cart to crusher, boiling tank to slag heap, drying floor to bag, bag to train, was measured by weariness of the nitrate workers' limbs used to shovel and heave, shovel and heave. Its agitating properties were known through their skin. Nitrate workers tied socks over their shoes and their trousers; they wound fabric around their waists to protect themselves from the scratchy substance. But it soon disappears. As the bags of nitrate begin their journey away from the *oficina*, the substance starts to assume its commodity form: a representation of material around which charges, taxes, payments, shares circulate; it becomes the subject of spiraling exchanges and is no longer a substantial, industrial object.

The railway lines that ran from the desert to sea and on which nitrate changed state from material to idea, substance to value, were one of the 'keys' to profits and profiteering.²³ Railway companies charged nitrate companies for transportation. They overcharged. High tariffs per quintal, per hundred weight, were demanded. A nitrate company would own several nitrate fields, nitrate *oficinas* and a warehouse in the port of Iquique but was dependent upon the railway. In 1887, John Thomas North bought 7,000 shares in the Nitrate Railways Company, owned by Peruvian Montero brothers but registered in London in 1882. The following year, he became company director. Henry Hucks Gibbs, head of the merchant house Antony Gibbs and Sons, complained to the Foreign Office that 'the monopoly of the Nitrate Railways was weighing unmercifully upon British capital invested in the Nitrate works'.²⁴

At the point of export, as the bags of nitrate were loaded onto small vessels called lighters to be hauled up onto sailing ships at anchor at the Pacific ports of Iquique or Pisagua, the Chilean government imposed their tax per quintal. High production of nitrate delivering high volumes of export was in the Chilean national interest: more nitrate accrued more revenue. But nitrate exported in large amounts lowered prices in world markets. It was in the interest of nitrate companies to restrict production, reduce exports and raise prices. Monopolies reigned. Successive *combinations* of competing companies, that is, a series of nitrate mining monopolies, were established to regulate production. Over-production was a problem for nitrate capitalists but the source of income for Chile. Nation and market were fatally opposed. Indeed,

²² Michael Monteón, 'The Enganche in the Chilean Nitrate Sector, 1880-1930', *Latin American Perspectives*, vol. 6, no. 3 (Summer 1979), p. 67.

²³ See Blakemore, *British Nitrates and Chilean Politics*, pp. 45-60.

²⁴ Quoted in Blakemore, *British Nitrates and Chilean Politics*, p. 132.

in the second of three successive combinations, market divided the nation and set Congress against Presidency in the Civil War of 1891. Economic interests of British capital, the nitrate mine owners, nitrate merchants and their bankers, were served by Congressional opponents to President José Manuel Balmaceda. He had attempted to intervene in the nitrate industry to stop the transformation of the Atacama into 'simply a foreign factory'.²⁵ Nitrate fields were taken by Congressional forces against Balmaceda's army; nitrate companies paid export tax to them and John Thomas North was accused of their direct financial support through the Bank of Tarapacá and London.²⁶ *The Times* reported on 1 April 1891:

Without quoting names, some of which are as well-known upon the London Stock Exchange as the cardinal points on the compass, the fact remains, beyond possibility of contradiction, that the instigators, the wire-pullers, the financial supporters of the so-called revolution were, and are, the English or Anglo-Chilean owners of the vast nitrate deposits in Tarapaca.²⁷

Nitrate is a share price, a figure in a market, and it is in this most immaterial of forms that it dominates over the desert. It becomes invisible. Once nitrate has been extracted from the Atacama Desert, once it has been exploded, scattered, lifted, carried, shattered, shovelled, tipped and loaded for export, it is only seen again by the dock workers who haul the bags from quay to boat or boat to quay or the rural labourers who dig it back into the ground; they mix it into fields of Western Europe to speed the growing of crops to feed the growing cities. That its dynamic properties have been put to work is of no matter; it remains unseen. Nitrate is an arbitrary value; it rises and falls.

Liverpool Nitrate Company owned Ramírez. The company paid its shareholders a dividend of 26 percent in 1885 rising to 40 percent in 1888. £5 shares traded at £35 in that peak year but their values were unstable.²⁸ 'Gullible English investors', writes Michael Monteón, 'provided North with much of his profit'.²⁹ North sold the idea of nitrate shares as profitable; he engineered an arbitrary value to new heights; he inflated prices. *The Economist*, always critical of North's gambling business practices, exposed upwards manipulation of nitrate share prices in 1894 as a 'well-organised and systematic attempt to entice buyers to come in at greatly enhanced prices before the bubble has had time to burst'.³⁰ The invisibility of nitrate, the trade in value detached from materiality, developed into deceitful illusions. North and his partners

²⁵ Quoted in J. R. Brown, 'Nitrate Crises, Combinations, and the Chilean Government in the Nitrate Age', *The Hispanic American Historical Review*, vol. 43, no. 2 (May 1963), p. 235.

²⁶ William Edmundson, *The Nitrate King: A Biography of "Colonel" John Thomas North*. New York: Palgrave Macmillan, 2011, p. 118.

²⁷ Quoted in Edmundson, *The Nitrate King*, p. 119.

²⁸ *Ibid.*, p. 43.

²⁹ See Monteón, 'The British in the Atacama Desert', p. 128.

³⁰ Quoted in Edmundson, *The Nitrate King*, p. 49.

traded to themselves. Assets of North's bankrupt Lagunas Syndicate Limited were profitably sold in a falling market to the Lagunas Nitrate Company, another of his concerns.³¹ North amassed and spent a fortune; he bought a ruin, Kirkstall Abbey in Leeds, only in order to give it away; he purchased the mansion he had rented in the Kent borders of London, Avery Hill, for £17,500 and spent at least three times as much turning it into an Italianate palace. When he died in 1896, he left a personal fortune of £700,000.³² For Antony Gibbs and Sons, the late nineteenth century saw profits fall as low as £15,000 a year but their fortunes changed. The company had £2 million in capital by the early 1920s.³³ In 1917, Herbert Gibbs, son of Henry Hucks, and now head of his father's business, had been appointed Director of the Nitrate and Soda Executive, which purchased nitrates for Allied forces in the First World War.

Explosions of air

Three months after the outbreak of the First World War, nitrate traffic halted. In early November 1914, German warships, which had sunk two British naval vessels with the loss of 1,600 lives, patrolled the coast of Chile. They remained for a month before sailing for the Falkland Islands to attack, refuel then fire Port Stanley. A British fleet of six battle cruisers intercepted the seven German ships, destroyed six; the seventh was captured months later. The Battle of the Falklands cost 2,000 lives but, explains Stephen R. Bown, 'enabled the Allied naval blockade of Germany'.³⁴ The purpose of the blockade was akin to a modern siege: to isolate Germany from world markets thereby denying supplies essential for a war effort, such as nitrate. In 1913, on the eve of the war, almost two and a half million tons of nitrate were exported of which three quarters of a million went to Germany, the largest single market.³⁵ Nitrate was the German farmer's fertiliser of choice for its quickening effect upon cultivation of beets for cattle feed. The Allied blockade not only affected food production but armaments, guns as well as grain.³⁶ Lack of natural nitrate directed the German war economy towards dependency upon its synthetic forms. Fritz Haber had developed, by 1909, a laboratory process of ammonia synthesis: nitrogen and hydrogen were combined at high pressures and high temperatures. Four years later, Carl Bosch engineered the industrial structures for the commercial production of Haber's process; in 1913 BASF

³¹ Ibid., p. 48.

³² David Shorney, *A Brief History of the Mansion at Avery Hill* [1984]. London: Thames Polytechnic Printing Services, 1990, pp. 3 and 6.

³³ Inés Roldán, 'Gibbs, Herbert Cokayne', *Oxford Dictionary of National Biography*, vol. 22. Oxford: Oxford University Press, 2004, pp. 44–45.

³⁴ Stephen R. Bown, *A Most Damnable Invention: Dynamite, Nitrates and the Making of the Modern World*. New York: Thomas Dunne Books, 2005, p. 197.

³⁵ Nitrogen Products Committee, *Final Report*. Ministry of Munitions, May 1919, pp. 9–10.

³⁶ L. F. Haber, *The Chemical Industry 1900–1930: International Growth and Technological Change*. Oxford: Clarendon Press, 1971, p. 198. Also quoted in Bown, *A Most Damnable Invention*, p. 219.

opened an ammonia synthesis plant in Oppau. Initially, it produced 8,700 tons of ammonia for the fertiliser market, but output increased seven times by 1915 to 60,000 tons to meet the demands of industrial warfare;³⁷ the Haber-Bosch process sustained the German war effort.³⁸ Known as 'nitrogen fixation', it created explosions from the air.

The scale of warfare meant that even the exclusive supply of nitrate from Chile to the Allied forces was not enough. After less than a year of war, by May 1915, they were facing a shell shortage. The newly formed British coalition government created a Ministry of Munitions, which, within a few months, had established 250 national shell factories and controlled the armaments industry. Nitrate became an ingredient of the industrialisation of war, the mass production of high explosives. The Atacama was more intensively mined: more *caliche* was levered from its surface, carried to the carts, hauled to the crushers; more *ripio* was shovelled onto slag heaps; more nitrate was crystallised, dried, shattered, shovelled into bags and hauled onto trains; more was exported. As the Ministry of Munitions reported: 'Notwithstanding the loss of the large trade with Germany, there has been an increase in the output of Chile nitrate during the war period.'³⁹ The transformative properties of nitrate that accelerated cultivation did the same for destruction. But its state was altered once again. When bags of nitrate left Chile's Pacific ports or arrived in the English Channel, it was in a form ready for use as a fertiliser; its white crystals could be simply dug back into soils, but releasing its most explosive furore required another transformation. Nitrate was mixed with equal amounts of sulphuric acid and distilled through the age-old retort process,⁴⁰ an apparatus of vessels and looping pipes that collected nitric acid required for the production of dynamite, nitroglycerine, and nitro-toluol necessary for TNT (trinitrotoluene).

The wartime drive for increased production resulted in labour shortages that become more acute after conscription to the front in 1916. Women workers, as is well documented, entered engineering industries in large numbers.⁴¹ Women manufactured and filled the shells. A 1918 record of the female contribution to munitions work, *The Woman's Part* by L. K. Yates, noted 'women now undertake every process'. She described all, including packing a shell:

It may signify but little to man to give up his small personal possessions whilst at work in the danger areas but to many a woman worker it means much, that she may not wear a brooch, or a flower, while on duty, and that her wedding-ring, the only allowable trinket, must be bound with thread while she works. Her tresses, which she normally loves to braid, or twist into varying fashions, must also be left

³⁷ See Haber, *The Chemical Industry 1900–1930*, pp. 93–95.

³⁸ See Bown, *A Most Damnable Invention*, pp. 219–20.

³⁹ See Nitrogen Products Committee, *Final Report*, p. 83.

⁴⁰ *Ibid.*, p. 224.

⁴¹ Gail Braybon, *Women Workers in the First World War*. London: Routledge, 1981; Clare Wightman, *More than Munitions: Women, Work and the Engineering Industries, 1900–1950*. London: Longman, 1999.

hairpinless beneath her cap. She must relinquish her personal belongings before going to her allotted task; no crochet-hook or knitting-pin may accompany her into the zone where the friction of steel, or hard metal, might spell death to a multitude of employees.⁴²

Nitrate is terrible stuff. The need to protect the human body from its effects had not been properly noticed. Yet, the clothing of nitrate workers, their fabric bindings against its agitating properties, warned of its capacity for confrontation with other bodies: women workers and infantry at the front. Walter Benjamin reflected upon contradictions of the 'bodily experience' caused by 'mechanical warfare'. And, the chemicals packed within this weaponry played their part. 'A generation', he wrote in *The Storyteller*, 'now stood under the open sky in a countryside in which nothing remained unchanged but the clouds, and beneath these clouds, in a field of force of destructive torrents and explosions, was the tiny, fragile human body.'⁴³

The dynamic effect of nitrate fertilisers upon soils was compacted in the shell to turn plentiful harvests into a barren waste. Nitrate transformed another landscape, created another desert. Most of the nitrate traffic ended here, in the craters of the Western Front. In a lengthy report on nitrogen products compiled at the end of the First World War, the Ministry of Munitions concluded that 'national interests demand' synthetic nitrate processing.⁴⁴ Without any of the 'war to end all wars' rhetoric, the Ministry was eager to secure the supply of explosives for further conflicts:

Considerations of national safety, of finance, and of utility, would force a country to resort to the policy of adopting synthetic methods as an insurance against future emergencies, instead of placing reliance upon the importation of Chile nitrate.⁴⁵

It was predicted that the price of nitrate from Chile would fall and the industry would decline.

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⁴² L. K. Yates, *The Woman's Part: A Record of Munitions Work*. London: Hodder and Stoughton, 1918, p. 23.

⁴³ Walter Benjamin, 'The Storyteller', in Hannah Arendt, *Illuminations: Essays and Reflections*. London: Fontana, 1992, p. 84.

⁴⁴ See Nitrogen Products Committee, *Final Report*, p. 106.

⁴⁵ *Ibid.*, p. 80.