

The Marquis de Chabannes, Pioneer of Central Heating and Inventor

by

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War both expedites and inhibits technical exchange. It feeds the demand for certain types of information, yet makes it harder for knowledge to cross borders. It creates a body of emigrés whose talents are stimulated by want and by their forcible contact with cultures that otherwise might scarcely have concerned them. But it also sets such people at a disadvantage which only the most resolute of them are able to overcome. In the Revolutionary and Napoleonic period, the example of the celebrated and ruthless Count Rumford (1753–1814) comes particularly to mind.

Similar reflections are prompted by the quixotic career of Rumford's slightly younger contemporary, the Marquis de Chabannes (1762–1836). With slight differences of temperament and circumstance, Chabannes might have been Rumford's equal in fame and achievement. In the event, he is remembered only as a footnote in the history of early central heating. That footnote, we argue, should be longer.

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Jean-Frédérique de Chabannes came from an ancient Limousin family related to the Bourbon dynasty, the aristocratic and military line of Chabannes.¹ He was the second son of Jacques-Charles de Chabannes, Marquis de Curton (d. 1780), and a first cousin through his mother of Talleyrand. After their father's death his older brother, Jacques-Gilbert-Marie (1760–89), inherited the title. Both brothers, following family tradition, became officers in the pre-revolutionary French army; they may have been close, and their early careers are certainly sometimes confused with one another. Jean-Frédérique became a lieutenant in the Dragoons, then in 1780 (aged 18) captain in the Royal Polish Cavalry Regiment, and went out to America as aide-de-camp to the Baron de Vioménil in the closing stages of the War of Independence. Jacques-Gilbert-Marie was already serving in the French Expeditionary Force under the command of the Maréchal de Rochambeau, having been present at the decisive engagement of Yorktown. Jean-Frédérique's outward journey was on board the *Aigle*, which skirmished with the British *Hector* in September 1782. That was all the action he saw.² But America offered him a first taste of English-speaking cultures.

Jean-Frédérique married twice while still young. His first wife died without surviving children. Anne van Lennep, his second bride, whom he married out in Smyrna in 1787, was a younger daughter of the director of the Dutch Factory there, the important Smyrna merchant David-Jacob van Lennep of Amsterdam. There were to be ten children, of whom three sons were all to follow military careers and marry English girls.³ At the time of the marriage, Chabannes was second in command of the Limousin Regiment. He had made his first visit to England in January of that year, during a period of peace, while returning from a voyage to inspect the extensive family plantations developed by his father in St. Domingo (Haiti). Writing later, he claimed to have been struck in London 'with the general manner of building houses, and the similitude between the habitations of the midling class, and even those of the poorest persons, with those of the great, in a multiplicity of the first conveniences of domestic

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comfort'.⁴ He also noticed the dampness and the cold of English houses; but his decision 'to direct my attention to this object'⁵ can have come only later, after the onset of political troubles.

In 1789 Jean-Frédérique's elder brother, Jacques-Gilbert-Marie, who had remained a bachelor, died suddenly while on a visit to the Haiti plantations. Jean-Frédérique thus unexpectedly became the Marquis de Chabannes-Curton. The eve of the French Revolution was hardly a propitious moment to become head of a family of such noble and ancient lineage, let alone one even remotely related to the Bourbons. Yet the impressionable young Chabannes had had first-hand experience of American Independence; and through his wide-ranging travels, including the trip to England at a time when 'anglomanie' was the height of fashion, he in common with others of his class and generation had acquired an enthusiasm for new ideas and become restlessly intolerant of the decrepit Ancien Régime. In 1787-8 he had joined with his peers in the *révolte nobiliaire*, actively assuming his duties in the assemblies of the nobility of Auvergne, his ancestral province, preparatory to the enforced recall of the Estates General that unleashed the Revolution. This did not prevent him from attending Court and advancing his military career, for in 1788 he was gazetted Colonel of the Chasseurs de Normandie, a smart cavalry regiment.⁶

In May 1789, the new Marquis took his seat as alternating deputy of the Auvergnat nobility for Moulins (the town closest to the family seat of La Palice) in the celebrated Estates General assembled at Versailles. At the end of the month however he left for La Palice, probably in accordance with the alteration of his co-deputy. During the momentous events of June and July 1789 he was doing local service in the provincial assemblies. At this critical juncture, Chabannes chose to take his wife and new-born daughter off on a grand tour of Switzerland and Italy. Was this Grand Tour-cum-'French leave' fortuitous or prudential? In view of his later covert activities, it begs the question as to whether there was not some other motive or mission. The Auvergnat nobility adopted a conciliatory stance to the initial phase of the Revolution, but was quick to protest against the policies of the Constituent Assembly as soon as they perceived the risks for Crown and Church. They established a defensive coalition in late 1790, which was formally endorsed by 551 signatures, including that of Chabannes, in April 1791.⁷

In any case, what may have begun as a genuine grand tour became, after the forcible removal of the Royal Family from Versailles to Paris in early October 1789, a serious affair for the Chabannes, leading to emigration. In the late autumn the Marquis and Marquise reached Naples, where they stayed with his mother and a Talleyrand-Périgord uncle who had apparently already decided to emigrate. January 1790 found them finally ensconced in Smyrna with the Van Lenneps.⁸

Whatever Chabannes' libertarian inclinations, the moment of choice had now come. When in 1790 Louis XVI's younger brother the Comte d'Artois, leader of the emigrés, established his headquarters at the Turin court of the King of Sardinia, Chabannes was prompt in offering his services. Writing retrospectively in 1816, he states that he undertook a mission for 'M. le Comte d'Artois à Constantinople' to negotiate a loan in 1790 and again in 1791, returning to report at Turin and then proceeding both to Paris and to London.⁹ In the following year he joined the Army of the Princes on the Rhine, serving through all the campaigns until 1793. In between active service Chabannes pursued semi-diplomatic or clandestine missions for the Princes: to London in 1792; to Holland and Vienna ('auprès de M. de Metternich') in 1793; to Holland again in 1794; and several times that same year to Ham, in occupied Flanders, and to London where Artois was now based.¹⁰

His wife meanwhile had remained safely with her parents in Smyrna, where a second child was born in 1791. Finally in April 1794, following the collapse of the counter-revolutionaries and the dispersal of their armies, the Chabannes were reunited in England, by now with a third child. The Marquis however had not quite yet abandoned soldiering. He took part in the abortive emigré landing in Brittany during October 1795, and was captured after Quiberon. He escaped by passing himself off as an English-speaking officer of Swiss origin, took an American ship from La Rochelle, and by January 1796 was back with his family.¹¹

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Safe in England once more, the military phase of Chabannes' career now ends, and the entrepreneurial phase begins. The place where the Chabannes had lived since 1794 was Barnes Terrace, a smart and pretty group of Thames-side houses on the fringes of Barnes village, some four miles west of London.¹² The terrace boasted other French exiles, and there was a larger colony at Richmond nearby. The Chabannes had not only the biggest house in the group (which the Marquis later claimed 'at little expence' to have made 'as comfortable as any in England'),¹³ but a farm as well, so initially at least there seems to have been no dearth of money. In an undated letter to his mother, the Marquis provides a vivid picture of their daily life at Barnes at this testing but apparently not too stringent time:

More often than not I help my poor wife in her numerous occupations. After that comes my garden; the season is so mild that one must get on and sow one's peas, one's carrots and onions, etc. . . . The farm also requires a vigilant eye. Within the house I also have the title of 'housekeeper' (*sic*) . . . I organize the *rosbif* and the potatoes. I go up and down the stairs more than twenty times a day, to see that the house is being cleaned upstairs and if things are not getting out of hand in the kitchen.¹⁴

It sounds almost as if he had not got enough to do.

In the aftermath of the Quiberon debacle, the family now had to face up to the harsh realities of an indefinite exile. Unlike so many of the emigrés, the Chabannes were nothing if not resourceful. The practical and business-like Marquise was already organizing classes in French at Barnes before her husband's spectacular escape. The Marquis, too, soon found a wider field of endeavour: that of applied technology. Twenty years later, this is how his first ventures were remembered in Barnes:

This marquis here pursued two speculations, by which, at the time, he attracted attention and applause. In the first he undertook to give useful body and consistency to the dust of coals, of which thousands of tons, before their application to gas-lights, were annually wasted in the shipping and coal-wharfs; and for this purpose he erected a manufactory; but, after much loss of labour and property, found it necessary to abandon the project. In the second speculation, he proposed to introduce various French improvements into English horticulture, and undertook to supply the fruiterers of the metropolis with tender and unseasonable fruits and vegetables, in greater perfection, and at a lower rate, than they had heretofore been supplied by the English gardeners. For this purpose he built large and high walls, and very extensive hot-houses and conservatories; but, being unable to contend against the fickleness of our climate, he found it necessary to abandon this scheme also; when the glasses, the frames, &c. were sold by auction; and no vestiges now remain of his labours, but his vines and the ruins of his flues and foundation-walls.¹⁵

The hothouse scheme is clearly connected with Barnes. It was natural that Chabannes' involvement with heating should have started in this way. Experiments with hothouses were a domain in which pre-revolutionary France had excelled, through the stimulus of Buffon and others. In the *Jardin des Plantes*, under Buffon's directorship, the skilful Bonnemain de Pecq had used hot-water heating to help incubate chickens' eggs and ripen fruit. This initiative is generally regarded as the origin of modern central heating by hot water.¹⁶ But Chabannes must have regarded himself as an authority not just on hothouses but on horticulture in general, for among his first publications in England was a tract—as yet untraced—entitled *Letters on the Pruning of Peach Trees and Vines*.¹⁷

The scheme to give 'body and consistency to the dust of coals' is more surprising, and probably post-dates the hothouses. The stimulus of the dynamic Count Rumford unquestionably lies behind this broadening of Chabannes' interests. In 1798 Rumford returned from Munich to live in London, after his triumphs as War Minister and resident technical wizard at the Bavarian Court. He had already published several essays on applied technology, notably his Essay IV on ways of improving the efficiency of domestic fireplaces and of regulating fuel consumption so as to emit less smoke and soot—a notorious nuisance in London. He now set up the Royal Institution, the ideal of which was to make practical technology generally available, without the inhibition of patents.¹⁸ Rumford steam-heated the lecture room there, probably following the lead of Boulton and Watt, who had been experimenting with steam-heating for some years and installed a fairly complete scheme in Matthew Boulton's own Soho House, Birmingham, in 1798–9.¹⁹

Chabannes responded to Rumford's work with two related enterprises, of which we learn in the first of his multifarious pamphlets to survive. This is *A Short Essay on the Composition of Oeconomical Fuel*, which appeared under the authorship of 'Mr Frederic, coal dealer', in about 1801.²⁰ The lesser of these ventures was a pure piece of Rumfordism; and indeed Rumford's 'eminent talents' in respect of 'the warming of houses and management of fires' are liberally acknowledged in the pamphlet, suggesting the two men may have met in London. Rumford had a house in Brompton Row, where he was beginning to experiment with heating systems at about this time. Likewise, in 1799 Chabannes 'took a house in Welbeck Street, which, during three winters, was completely warmed by the kitchen alone'. This West End house he proceeded to open to the public, claiming that it 'may be of great use to builders and housekeepers, who may want to warm their rooms without adding to the number of their fires'.²¹ His method was not central heating proper, but the less advanced and effective one of 'making use of the flue of an under fire-place, to warm the room above; by employing for that purpose, the heat of the smoke and vapour of the lower fire'. There was probably also an earthenware stove at the bottom of the staircase, connected to the kitchen fire—a device common in Continental Europe but still rare in England at this date. Chabannes stressed the usefulness of such stoves at the bottom of stairs, and also repeated Rumford's maxims for the design of grates.

Welbeck Street, however, was only a sideline. In the same year, 1799, Chabannes went into business under the apposite pseudonym of John Frederic or Frederick, bought a coal business and Thames-side wharf on Millbank and proceeded to manufacture patent fuel. This was the scheme to give 'useful body and consistency to the dust of coals', and the chief aim of the *Short Essay on the Composition of Oeconomical Fuel* was to publicize the speculation. The idea was an old one. Coal, argued Chabannes, burnt more slowly and completely if combined with cheaper materials such as clay, tan and sawdust. He therefore proposed to sift out the smaller coals and combine them with other materials into cubes or 'cakes', and he claimed a saving of up to one-third on his method. He patented his method, yet described it fully in the *Short Essay*, arguing with an inventor's hopefulness:

The Author is induced to give up the privilege of his patent, and to publish his practice and methods, with the hope that they may soon come into general use, for the relief of the poor, and the convenience of the rich; and when the advantage which this country must receive from it, shall be ascertained, he begs he might be permitted to offer it to the nation, as a small tribute of gratitude, for the very generous hospitality himself, and all his unfortunate countrymen, have experienced.²²

Others who wanted to build similar factories would be fairly treated, he added.

All this was far from a pipe-dream. The Millbank manufactory existed, perfectly placed for the Thames coal trade; 'John Frederick' is rated for a factory, wharf and house there between 1799 (when rebuilding was going on) and 1801.²³ The pamphlet too is detailed, and goes into the different prices and sizes of coal and the methods of manufacture. Chabannes managed to attract investors, and assured his readers he had as many orders as he could cope with. Yet something went amiss. Either the idea or the management was wrong, and the business fizzled out. The obvious answer is that Chabannes lost interest when he found himself able to return to France.

This opportunity presented itself in 1801, under the amnesty for emigrés that preceded the Treaty of Amiens. Like most emigrés, the Chabannes seem to have been eager to return; and a personal inducement to ending their long exile was the fortunate circumstance that at this juncture the Marquis's first cousin Talleyrand held the key post of Foreign Minister in the Consulate. Anticipating the amnesty, the Marquise had already gone to Paris in December 1800 to lobby Talleyrand's powerful colleague, Minister of Police Fouché, for the removal of her husband's name from the list of proscribed emigrés.²⁴ This was essential if Chabannes was to recover those family estates which had not been sold off during his 'absence'; to support his plea, he argued that he had left the country in 1789, well before the implementation of the anti-emigré decrees of 1791–2. From Paris, Anne van Lennep wrote to Delageneste, the Chabannes' faithful steward and 'ami' in the Auvergne asking after their properties and giving news of the Marquis:

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I have left him in London with three of my children, he is in the wine and coal business there. It is through his industry and through a boarding establishment for young ladies whom I brought up that we have lived and been able to provide our children with the education we would have desired, whatever the circumstances we might have found ourselves in . . . we have not been dependent on anyone, neither have we lacked for anything.²⁵

To the Millbank venture, therefore, we now have to add some sort of interest in the wine trade. Things seem to have been sunny still in the spring of 1801, when in a further letter to Delageneste, the Marquise mentions a trip Chabannes had taken to his parents-in-law in Holland with the aim of buying back former landholdings for his children's benefit:

He continues his commerce . . . My husband's business is so extensive, that, unless there be an absolute necessity for him to come, he will dispense himself from doing so until the peace [of Amiens]. He is more convinced than ever that he must repair by his industry the loss of his fortune.²⁶

Chabannes finally joined his family in Paris in February 1802. His proscription, through Talleyrand's help, was promptly expunged, and Delageneste was authorised to act as his attorney to recover unsold properties. A family visit to La Palice and the Auvergne estates was scheduled and no doubt took place in the spring. Yet Chabannes was by no means reconciled to becoming a country gentleman in Napoleonic France, for shortly after his return he was telling his steward that he had 'major interests' in Haiti and 'substantial affairs' in London and counted now on establishing 'some useful branch of commerce in Paris' which he hoped would provide suitable employment for Delageneste and his son.²⁷ The stage was set for his next entrepreneurial venture.

Chabannes certainly lost no time in capitalizing on his first-hand experience of British innovations in applied technology. Barely a month after outlining his prospects to Delageneste, he wrote again in April 1802 with news of a major but as yet unspecified commercial enterprise:

Would you like an accounting post in Paris at the head of a very large establishment of which you would be the managing director with emoluments of not less than 6,000F and probably a lot more eventually?²⁸

Two months of suspense ensued while the Marquis disappeared to England 'on business'. Back in Paris once more, he could reveal to Delageneste on 27th July that his 'very large establishment' was to be a government-protected mail and passenger service covering the whole of France, conveyed in coaches of his own patent design and due to become operational in the autumn. A few weeks later he was informing his steward and associate that he now had 240,000F working capital, Paris headquarters, Post Office approval and Ministry of Interior co-operation.²⁹

What was Chabannes up to during his cross-channel trip between April and June 1802? No doubt he was managing the transfer of funds to France and sorting out or winding up his affairs. At Millbank, John Frederick's name falls out of the ratebooks in this year, to be succeeded by a Charles Theodore and then by a George Augustus. These were possibly managers put in by Chabannes to carry on the coal-dust speculation; this, we know from the sequel, was not wound up voluntarily but failed with heavy debts, leaving angry and gravely embarrassed creditors. By 1808 at the latest the business had folded and the Millbank premises were in the hands of another vagabond entrepreneur of talent and ebullience, Frederick Albert Winsor of the Westminster Gas Supply Company.³⁰

However a further reason for Chabannes' return to London in 1802 may have been to review the Royal Mail service initiated by John Palmer in 1784-6, with its perfected coach-building technology and maintenance standards, preparatory to launching his own French venture. Chabannes was the better placed to be aware of the latest developments in mail coach design and production, because nearby to his coal wharf in Millbank was located Besant and Vidler's mail coach factory and maintenance depot. John Besant's stage coach design—with lubricated axle box, lateral and transverse elliptical laminated springs and two-part perches for which he took out a patent for 'improvements in wheeled carriages' (no. 1574) in 1786—was awarded the Post Office supply and servicing contract the same year. Besant died in 1791 but his carriage works retained the contract under his partner as John Vidler and Company of Millbank until c. 1817. Moreover Chabannes, versed in the ways of the Patent Office, would have

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had no bother in consulting not only Besant's patent design but also the subsequent perfection of the 'mail axle' and the 'pipe-wheel box' patented by John Collinge of Lambeth in 1787 and 1792, or for that matter Francis Moore's patent two-wheeler rear entry coach of 1786.³¹ Given the scale of his proposals he may well have brought English wheelwrights and coachbuilders back with him to France—he certainly had an English engineer as partner on his subsequent housing project of 1803. We do know at least that the Marquis, diffuse in his technological interests, returned from England with a new piece of machinery: a hand-operated steel flour mill and cutter or separator of flour and bran, which was admired and espoused in 1802 by Molard for the Conservatoire des Arts et Métiers, of which he was director.³²

Bullish optimism notwithstanding, it took longer than Chabannes anticipated to set up the public conveyance of mails and passengers in his *vélificères*, or rapid diligences conceived to take advantage of the recent Napoleonic repair and improvement of Perronet and Trésuguet's great eighteenth-century road system. Delays were more than likely due to bureaucracy and the sheer complexity of establishing an effective nationwide network with a fully equipped carriage works to serve it. In England, Besant and Vidler had found that to maintain 120 Royal Mail coaches on the road in 1792 they needed to have nearly as many being simultaneously overhauled at Millbank.³³

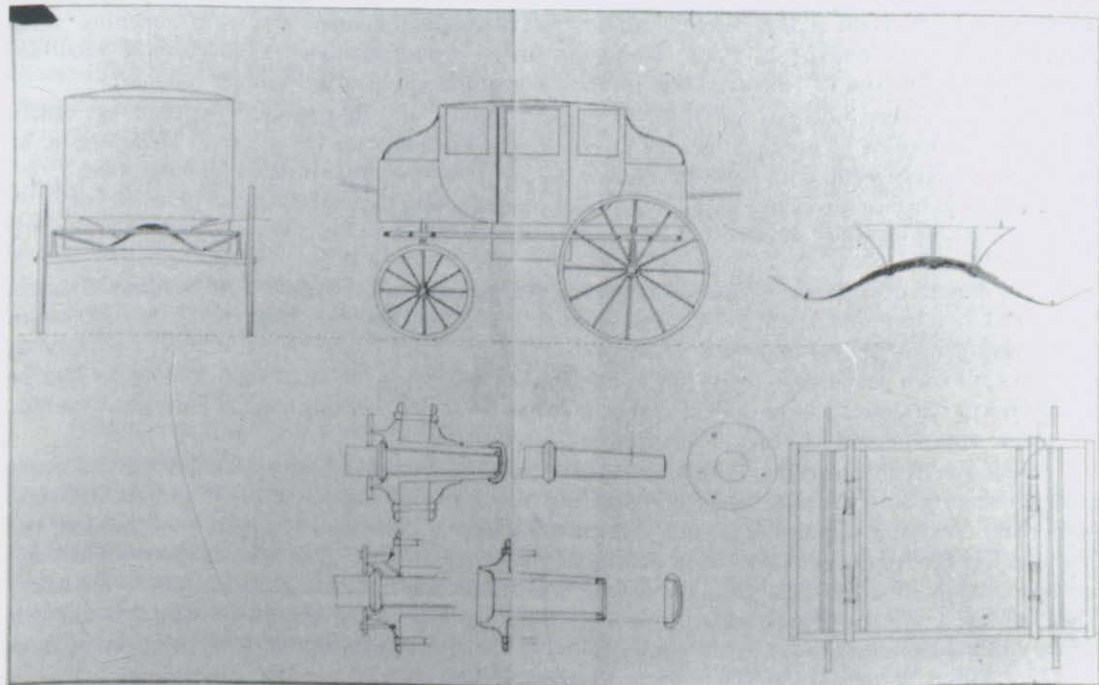


Fig. 1. Drawings for the undercarriage for one of Chabannes' *vélificères*, first patent, August 1803.

The key to Chabannes' 'Entreprise des Vélificères' was to be his design for a lighter and 'improved' version of the British mailcoach with a lower centre of gravity, for which he was granted a 'brevet d'invention de 15 ans' on 27 August 1803. The Marquis had evidently done his homework in the London Patent Office and indeed explicitly refers to the model of the 'malles aux lettres d'Angleterre' in his patent. The text, with schematic, incomplete drawings (fig. 1), indicates lubricated, collared axle-boxes of the John Collinge type and a low body (apparently with a laminated timber carcass and battened panels, lined and covered in painted canvas) with transverse springs fixed to it, slung on what is essentially a chassis framework with a dropped well for the passengers' feet.³⁴

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The Vélocifères office and carriageworks opened in February or March 1804 on the Rue Tiquetonne, Paris, but a regular service did not come into operation until the end of the year. Chabannes, claiming that his enterprise had been 'calumniated', had had to use all his influential connections. He had to wheel in the Minister of the Interior and get the Institut National des Sciences et des Arts (of which both Rumford and Napoleon were members) to request a report on his coach design from Molard, Montgolfier and Comte. In October these eminent members of the Institut gave their approbation. They were particularly impressed by the low-set, light bodywork and stability of the coach (it had born a test-load of 'twenty-six of His Majesty the Emperor's Guards'), noted its capacity for cabriolet or coupé seats fore and aft as well as a pair on top and, further, stated that 'the Entreprise des Vélocifères is the largest establishment of its kind to date and equipped with new and ingenious tools.'³⁵

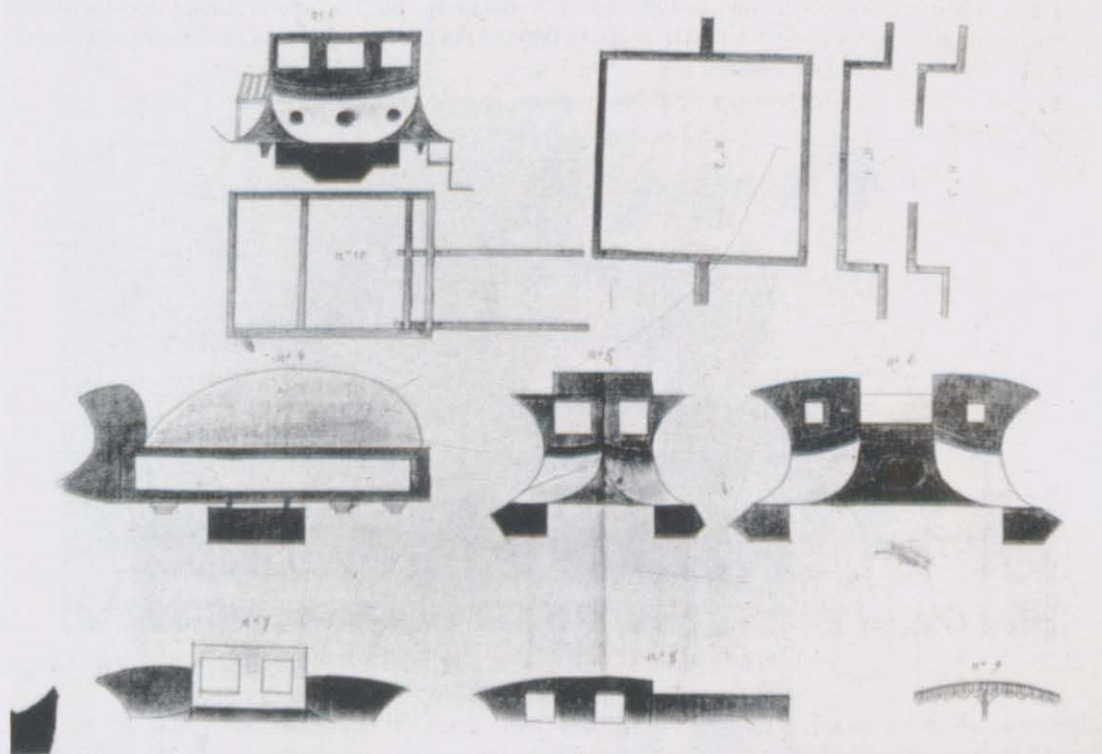


Fig. 2. Drawings for the body of the revised, smaller vélocifère, from the French patent of 1806.

News of the Institut's findings and its report to the Minister was gazetted in the *Moniteur*, which on 13 October 1804 informed the public that the vélocifères would 'shortly' go into service.³⁶ Not exactly a flying start, then; but if the Marquis had to battle with untoward encumbrances and assorted 'calumnies' in launching this particular project, his heady enthusiasm for invention and speculation meant that he was rarely without more than one iron in the fire.

In 1803 Chabannes had published the next of his pamphlets, the *Prospectus d'un Projet pour la construction de Nouvelles Maisons, dont tous les calculs de détails procurent une très-grande Économie et beaucoup de Jouissances*.³⁷ Like the *Oeconomical Fuel* treatise, it is a substantial document running to nearly fifty pages. Essentially it is a scheme for importing the latest British ideas about domestic construction, planning and technology into France. Cast-iron construction, a mixed system of hot-air and steam heating (like that of 'the famous Count Rumford at the Royal Institution')

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and ventilation supplemented by a gamut of innovative fireplaces and a battery of Rumfordian domestic devices, notably for the kitchen, are brought into play and elaborately described. There is to be a household high-pressure steam engine supplying steam on tap, heating the bath of the 'mistress of the house' and the dining room hot plate, raising cold water to the feeder tank (for 'lieux à l'anglaise' or lavatories, basins, fountains etc.), and serving to 'move all sorts of mechanisms'. The houses are to be arranged in a square around a common garden, with colonnaded street fronts, the cast-iron columns serving also as chimney flues; the garden elevations sport similarly functional pilasters or columns. As to the iron framework of the houses, this is not to be bolted but jointed and sealed with a 'ciment' concocted from 'equal portions of sulphur, powdered ammonium chloride and iron filings' mixed with five to ten more parts of filings and water. Within this ingenious but alarmingly cemented light frame, cross-braced floors with plank-on-edge joists are suspended and are further supported by means of ties from a bow-string truss roof, thus facilitating open planning. Similar space-saving considerations inspire the joggling of the party wall, to fit in the volume of the curve-ended well of the staircase—also, naturally, constructed of cast iron.³⁸

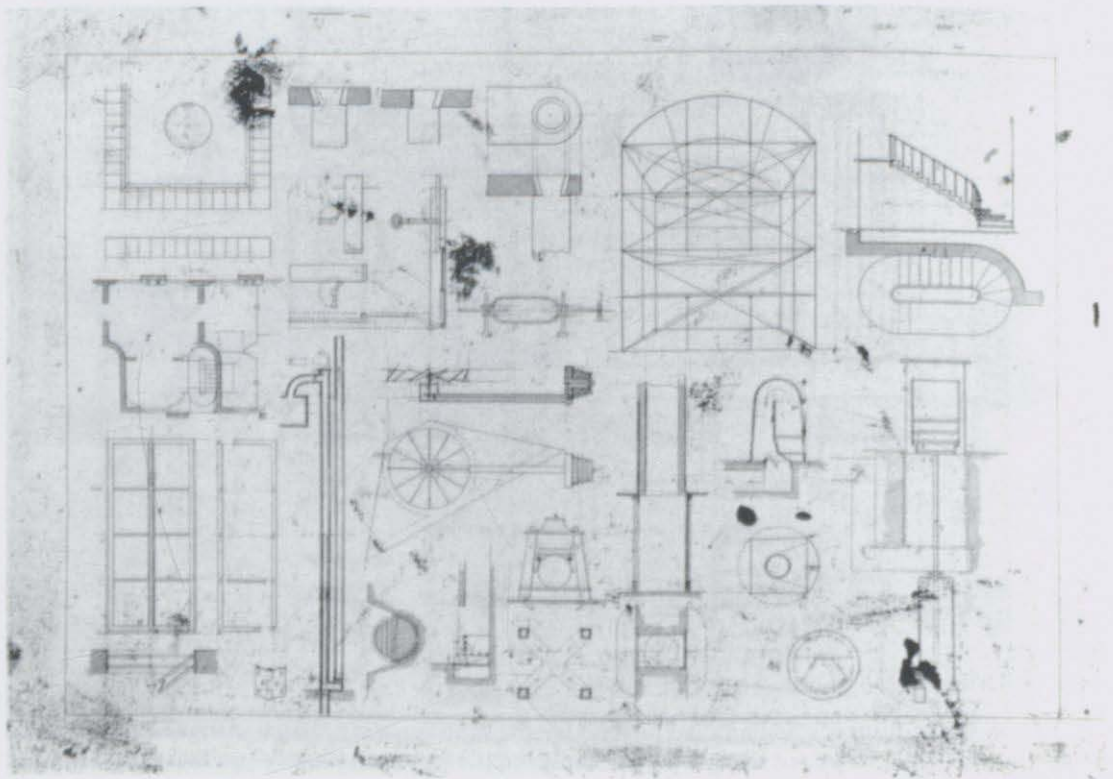


Fig. 3. Drawings by James Henderson of proposed structure and servicing of houses from the patent accompanying Chabannes' *Prospectus d'un Projet* . . . (1803).

The *Prospectus* is not all Chabannes' unaided work. He acknowledges the help of James Henderson, an engineer otherwise unknown who seems to have made and signed most of the drawings for the accompanying patent of 1803, without which Chabannes' unillustrated text would be incomprehensible. Gathered together into two crowded sheets, Henderson's patent drawings (figs. 3, 4) include designs for the geared and cogged drive wheel of a steam locomotive of advanced Trevithick derivation, to run on rack rails and (according to Chabannes) 'so perfected from those used today in

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England that one could say it is not the same thing at all'. There is also an appointed architect, M. Query, connected with Moulins, the town Chabannes had represented in 1789; and Chabannes invites interested persons to apply to them in Rue de la Pépinière, Paris. So, like Rumford, Chabannes enjoyed technical support which he never properly acknowledged. On the other hand Rumford hated patents, because they inhibited the diffusion of knowledge. The manifold 'inventions' of the *Prospectus* can only have been loosely covered by the omnium-gatherum patent. In any case, there is no evidence that anybody ever took them up.³⁹

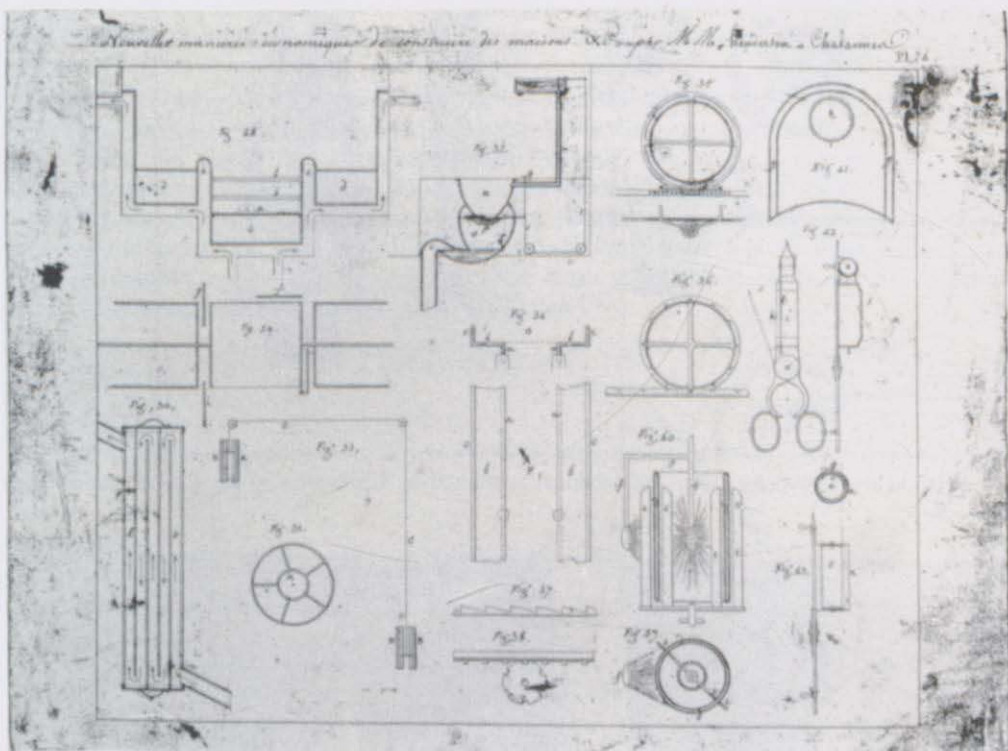


Fig. 4. Further drawings by Henderson for the patent accompanying Chabannes' *Prospectus*.

In the winter of 1807–8, Chabannes followed up his heating interests again by entering a competition for stoves sponsored by the Minister of the Interior and held at the Arts et Métiers, submitting three complete stoves and designs for three elaborate others. Never loth to pull rank or influence, in April 1807 he had already sent the Minister the description of his prototype and his own rough sketches for the set, including by way of an opening gambit a revealing declaration of faith and character:

As a lover of everything useful and concerned now for a number of years with all the perfections that can be made to the dwellings of men, whether in the building of houses or their internal arrangements, it seemed to me that the present system of fireplaces was in many points most susceptible to a general and extremely worthwhile reform . . . I began by studying the desires, the tastes and needs of mankind and concluded that the initial basis for the construction of any fireplace should have as its aim: (1) salubrity, (2) evenness of temperature, (3) the provision of a view of the fire, which custom has turned into a need, (4) economy: such are the principles to which I have directed all my efforts.⁴⁰

Developing his Welbeck Street experiments and the steam and warm air systems and fireplaces of the *Prospectus*, Chabannes proposes a combination of pressurised steam and water and pumped warm

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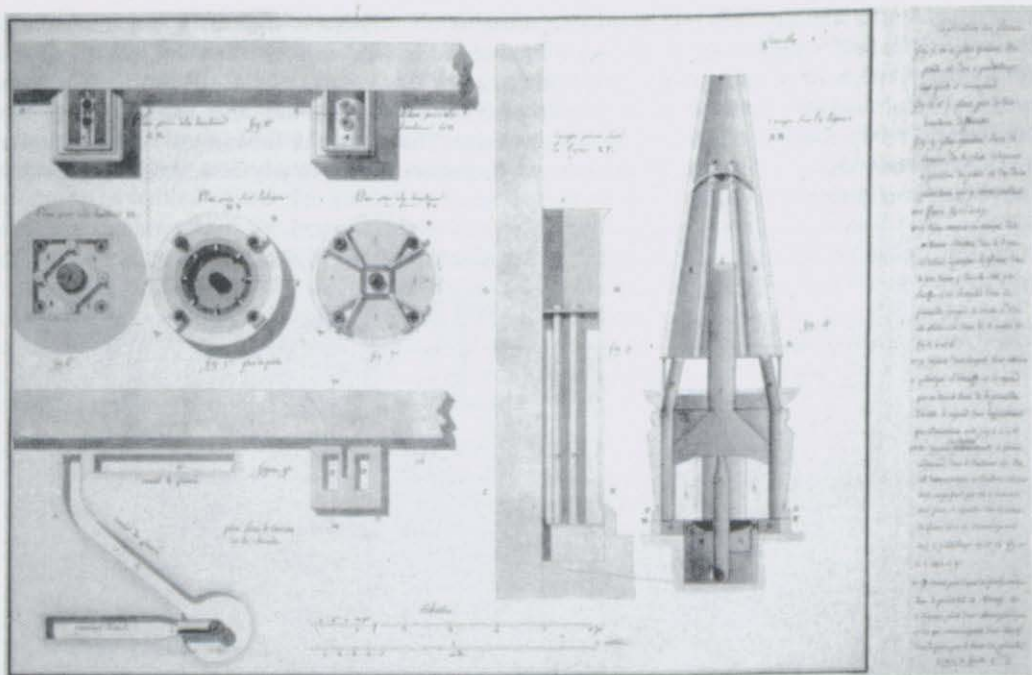


Fig. 5. Pyramid stove-fireplace (plan and sections) submitted by Chabannes to the Conservatoire des Arts et Métiers, 1807–8.

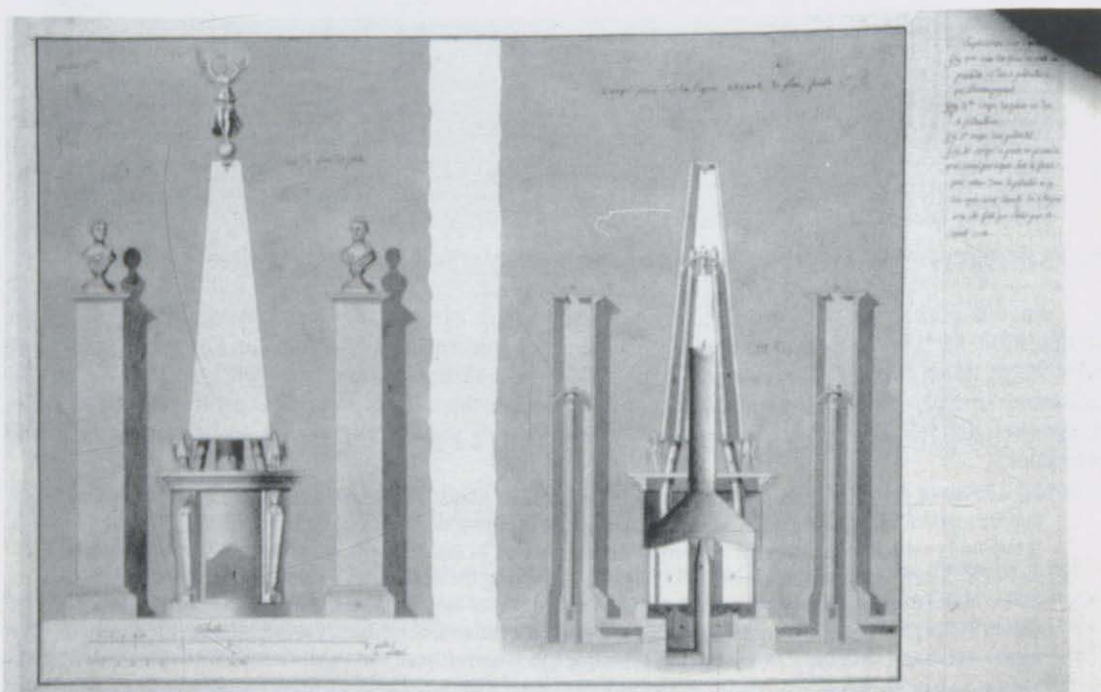


Fig. 6. Pyramid stove-fireplace (elevation and section) submitted by Chabannes to the Arts et Métiers, 1807–8.

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air central heating, his main aim being to avoid the 'noxious exhalations and temperature extremes' given off by overheated metalwork.⁴¹ A basement stove connected to hot air ducts is to be complemented in larger rooms by a concentric drum stove whose fuel-chamber is successively jacketted by water, air, water, smoke, steam, and air; this feeds two drum radiators pierced with air vents in the corners of the room, and warm air and smoke are then drawn back through eight cast-iron caryatids by a pump in the chimney flue. As for the desired open fireplaces, Chabannes devises a stove whose firebox is exposed on all four sides and advanced with an air-vent below inducing a strong horizontal flame over the coals, with a boiler-condenser chamber above; and he sketches out other domestic fireplaces on similar principles, with heat-exchange pipes in the flues to recuperate and diffuse warmed air.

For the tests carried out in the winter of 1807–8, Chabannes seems to have had at least two of his stoves built by Bertolini, one of the other competitors, and to have deemed it politic to pass off his prototype under his old Millbank pseudonym of Frédéric. The professional draughtsmen of the Vaucanson Portfolio at the Arts et Métiers meticulously recorded the entries. They show designs closely corresponding to Chabannes' description, including a concentric jacketted drum-stove (fig. 5), a pyramid stove-fireplace (fig. 6), a glazed firebox with condenser (fig. 7), and heat-exchange piped flue models. The competition proved inconclusive, but these stoves were evidently the origin of the Marquis's *calorifère fumivore*, later promoted in England.⁴²

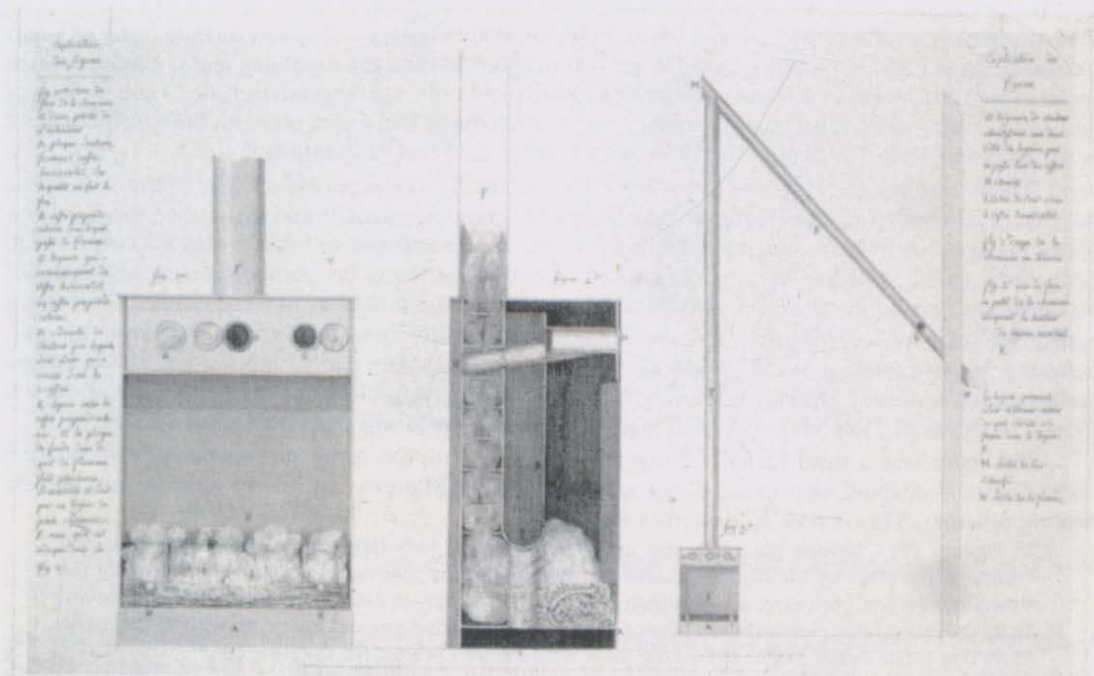


Fig. 7. Glazed firebox submitted to the Arts et Métiers, 1807–8.

By this time however Chabannes was in grave financial trouble, sufficiently so for him to decamp from Paris in order to escape his creditors. The premonitory difficulties encountered in launching his *Enterprise des Vélocifères* venture had finally caught up with him. Vested interests, technical hitches and an aggravated funding crisis combined to render his situation precarious. For reasons of economy as much as improved efficiency, he obtained a *brevet de perfectionnement* in October 1805 for a two-wheeled version of the *vélocifère*, achieving virtually the same capacity yet equally adaptable to mail-

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van, post-chaise or other configurations (fig. 2). This seems to have been inspired in part by Francis Moore's rear-entry two-wheeler patent no. 1546 of June 1786. Chabannes also secured a thirteen-year monopoly for his vehicles on the public roads. By 1806 the *vélocifères* had made over 1300 journeys between Paris and Bordeaux, he claimed. But on the Lyons route the venture was a fiasco. The project collapsed amid a welter of excuses and accusations from Chabannes, among them that the Pope's visit to Lyons had led to a crucial juncture to the requisitioning of all the horses he had needed to use for the *vélocifères*. He was perhaps showing the first signs of paranoia. The whole enterprise had to be sold up. On Chabannes' own admission there were lawsuits galore; his wife and his mother lost their inheritance, and he owed his father-in-law Van Lennep 80,000 francs.⁴³

From 1807 to 1813 Chabannes' whereabouts and activities remain vague. A letter from his wife in Paris to Delageneste at the beginning of 1808 refers to the Marquis as being 'still in Spain';⁴⁴ this perhaps was a convenient hop across the border when the going got too hot. The following year, Chabannes seems to have been able to return in reduced circumstances to Verrières, one of his country estates near La Palice and Moulins. He writes to his lawyer that summer with news that his eldest son, barely eighteen, has been wounded in the arm at the Battle of Wagram (he was subsequently awarded the *Légion d'Honneur*, promoted to captain and was with the *Grande Armée* in the 1812 Russian campaign).⁴⁵

Then, with Napoleon on the ropes in 1813, the Marquis bobbed up again as a royalist. During that autumn he slipped across to England, placing himself at the disposal of Louis XVIII, then at Hartwell, almost certainly as an emissary of his cousin Talleyrand. In February 1814, now aide de camp to Louis, Chabannes was back in Flanders, trying to get commanders to raise the royal flag and urging his king to make a rapid return. By so doing he incurred the enmity of Louis' cautious adviser the Comte de Blacas, and grew estranged from his compromising cousin. It seems he had fallen out with them sufficiently to come back to London in September 1814, shortly after the First Restoration.⁴⁶

There followed the Hundred Days, Waterloo and the Second Restoration. The Marquis followed the court to Ghent during the Hundred Days, where he served as a supernumerary among the Gardes du Corps under his eldest son, who held the rank of colonel. He returned to France with his corps in July 1815, but seems then to have gone back to London, whence he pamphleteered vigorously.⁴⁷ Nevertheless he was made a peer, and should logically have returned to live permanently in France. Instead, he spent most of the next six years in London, apparently living on his own, apart from his long-suffering, impoverished wife. Why was this? Politics was certainly part of the reason; he loathed the constitutional tendency abroad in France, as his venomous pamphlets against the *Charte* attest. His French creditors of 1806 may very well also have been at large and demanding satisfaction still.

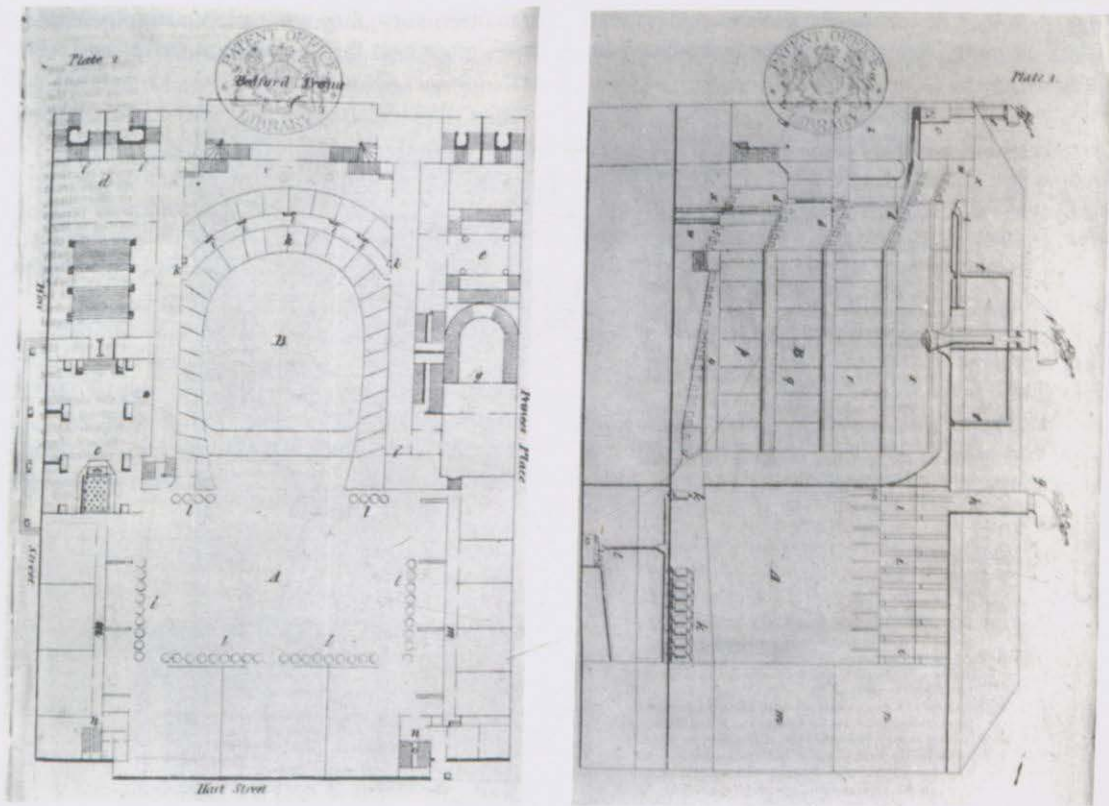
But there was a third factor. Chabannes was at last on the brink of success as a speculating technologist. Somehow, during the chaos of 1814-15, the Marquis had found time to resurrect his heating schemes. This is how he describes it:

In January 1814, writing the whole day in London before a very large fire, burnt on one side, and frozen on the other by the current of cold air rushing into the room at every aperture to supply the draught of the fire, I felt more sensibly than ever the great defects in the present construction of stoves. In this situation I first conceived the plan of the calorifere and had a model executed, with the intention of having some stoves made, and taking them with me into France for my own use.⁴⁸

After the events of the First Restoration, he continues,

I then had a calorifere made . . . with the sole design of guarding myself from cold, but the importance of the Invention appeared to me so great from the equal and agreeable warmth I immediately experienced in every part of my apartment, that I resolved to take out a Patent and to make public my long meditated plan for regulating the temperature and conducting and purifying the air in our dwellings. My chief aim in this was the ambition to abandon my patent to persons in trade, reserving to myself only a small acknowledgement from those licensed.⁴⁹

There followed two patents, of 1815 for a calorifère fumivore stove and of 1816 for a ventilator.⁵⁰ Chabannes opened a showroom near the house he was occupying close to Fitzroy Square, to be



Figs. 8 and 9. Plan and section of Covent Garden Theatre, from Chabannes, *On Conducting Air by Forced Ventilation* (1818).

followed by the grandly titled Patent Calorifere Fumivore Foundry at 121 Drury Lane.⁵¹ And he issued three pamphlets in 1815–19, describing his innovations in detail and illustrating the most prestigious heating schemes he executed.⁵² The most substantial of these pamphlets is called *On Conducting Air by Forced Ventilation* (1818).

If Chabannes' fugitive commercial career before this point suggests something of the crackpot or charlatan, the evidence of his successes in 1815–19 goes some way to disproving the charge. During these years he fulfilled contracts for heating and ventilating the Covent Garden and Olympic Theatres, the House of Commons, a hospital attached to Fort Clarence at Chatham, Nash's new Ophthalmic Hospital near Regent's Park, Lloyds, a shop and office in the Burlington Arcade, and a variety of lesser undertakings. Many of these jobs were large. The Covent Garden commission, for instance, involved

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replacing and supplementing the inadequate steam-heating which Boulton and Watt had installed when London's premier theatre was rebuilt by Smirke in 1809, with a hot-air system for the auditorium and steam-heating round the stage.⁵³ Chabannes placed three huge moving cowls on the roof, one of which took off the fumes of the new gas-lighting (not installed by him) in the centre of the auditorium; he set a variety of large and small iron stoves at points in the circulation space, mainly at the base of staircases; and he arranged large-bore pipes all round the edges of the stage, connected to an immense steam boiler in the basement. The installation is discussed and illustrated in some detail in *On Conducting Air . . .* (figs. 8 & 9). The independent stoves had no real claim to originality; they were simple supplementary devices which, Chabannes claimed, produced 'three times more heat than a common stove' and were

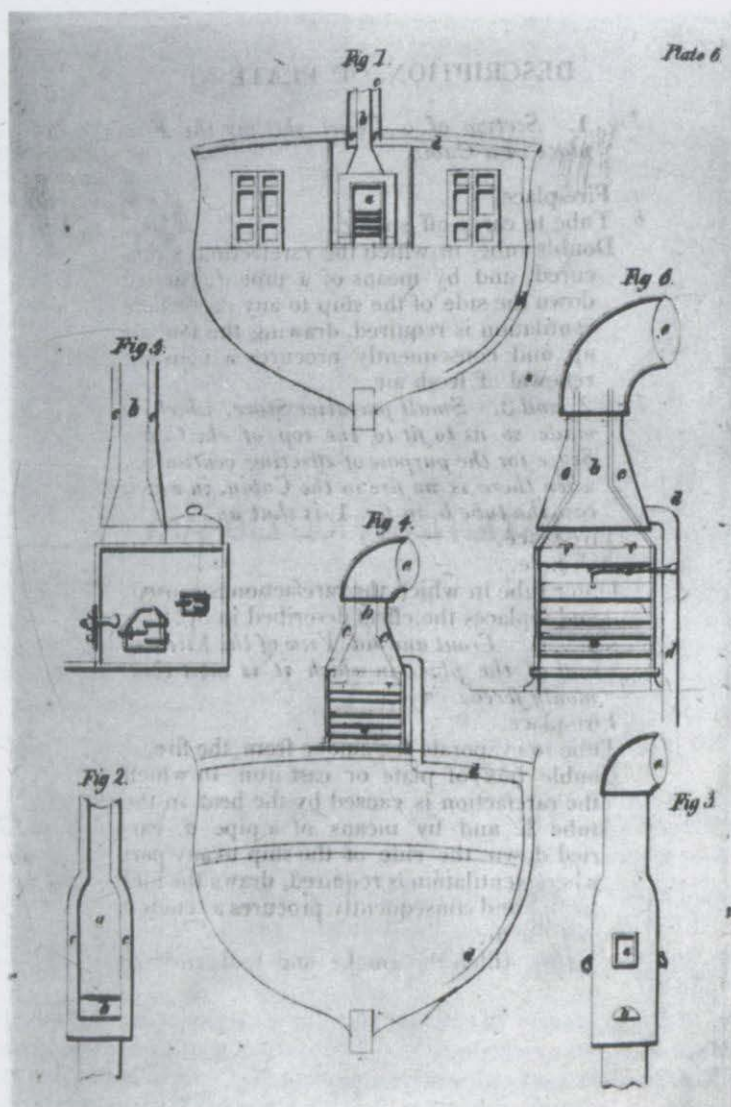


Fig. 10. A stove for heating and ventilating a ship, from Chabannes, *On Conducting Air by Forced Ventilation* (1818).

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used flexibly to keep the circulation spaces up to a temperature of 60°F. One of the larger stoves shown in section is connected by means of a battery of pipes with the private boxes, so that the action of the stove draws off the impure air from the boxes and helps ventilate the theatre. The steam boiler, though not dimensioned, appears to have been a thing of monstrous size but no special sophistication; Chabannes acknowledged that steam had been used for 'the last twenty years' to heat factories and houses, but claimed his Covent Garden boiler as an improvement. The fire acted directly upon a series of five separate 'pipe boilers' with twelve pipes each and communicated with 44 'patent steam cylinders', essentially large-bore steam radiators, immediately under the stage.⁵⁴

At the House of Commons, long subject to stuffiness, Chabannes in 1819 spent £1678 on a similar mixed steam-heating and ventilating system. There was trunking connected to existing apertures in the ceiling, which were once again crowned with his ugly cowls.⁵⁵

How original and effective were Chabannes' methods? For want of fuller information about rival systems of heating at this date, it is hard to be definite. At the time, most heating that went beyond simple fireplaces or free-standing close-stoves was still primitive and cumbersome; the Marquis's installations were far from trouble-free, but they seem to have been of at least equal standing with others, and tolerably effective. His virtue was to publish his work, which rivals did not do.

Chabannes' diagrams show that he employed all three main techniques of warming and ventilating—hot air, hot water and steam, often in some kind of mixed system. In the tentative fumbling towards full central heating that took place in the last quarter of the eighteenth century, notably in the 1790s, Britain broadly took precedence in the development of hot air and steam systems, while France had the edge in hot-water systems following the hothouse experiments of Bonnemain in the 1770s. Chabannes asserts that his hot-water heating is 'entirely novel in England',⁵⁶ while steam has 'long since been used here'.⁵⁷ In relation to both steam and hot air, he claims originality for his manner of

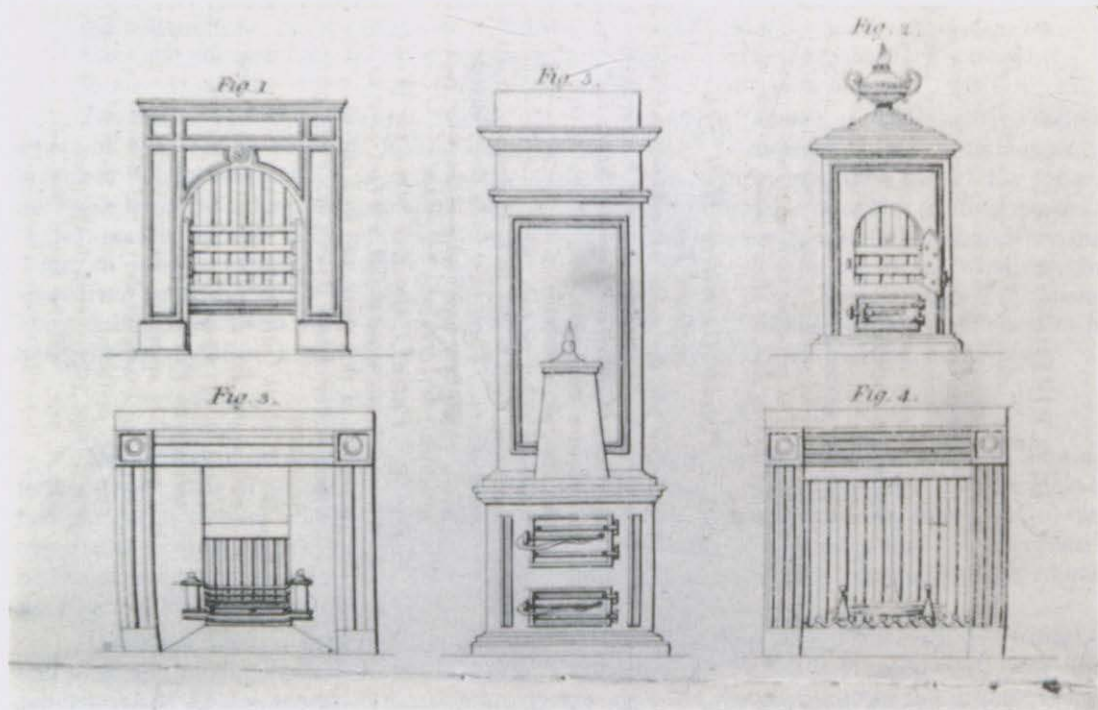


Fig. 11. Simple stoves (calorifères), from the *Appendix . . .*, 1819.

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application, not the principle. His greatest innovation, though he does not stress it in his pamphlets, seems to have been to extend complete circulating hot water systems of heating from hothouses to multi-storey domestic buildings, in which the more difficult vertical circulation had to be achieved without pumping machinery. From today's viewpoint, the most striking of his illustrations is a section through the shop and house in Burlington Arcade (fig. 11). Here every element of central heating as later practised in English town houses is present: the basement boiler attached to the kitchen range, the water tank in the roof, pipes for water to ascend and descend, and radiators in each room, shown on one floor in the form of pretty French lyre-shaped stoves. If anything so advanced had been done by others by 1818, we do not know of it.

Chabannes, however, took greatest pride in his stoves (fig. 11). Essentially they are all enclosed iron boxes on the model he had developed in France in 1807–8 and perhaps earlier, with a large central furnace for the fire, through which pass a multitude of large-bore pipes, sometimes carrying water or steam, sometimes just air. In the English context, where open fires and smoky rooms were the norm, he laid great weight upon the absence of smoke, which was carried off by a separate flue; hence the pretentious title *Calorifere Fumivore*, retained in French to give his inventions a touch of *chic* for the British market. The three pamphlets show many different shapes and sizes of caloriferes, and many different applications, including one on a boat (fig. 10). No two models were exactly alike. They may have been made by an ironmonger called James Lewis, who supplied the apparatus for the House of Commons in 1819.⁵⁸

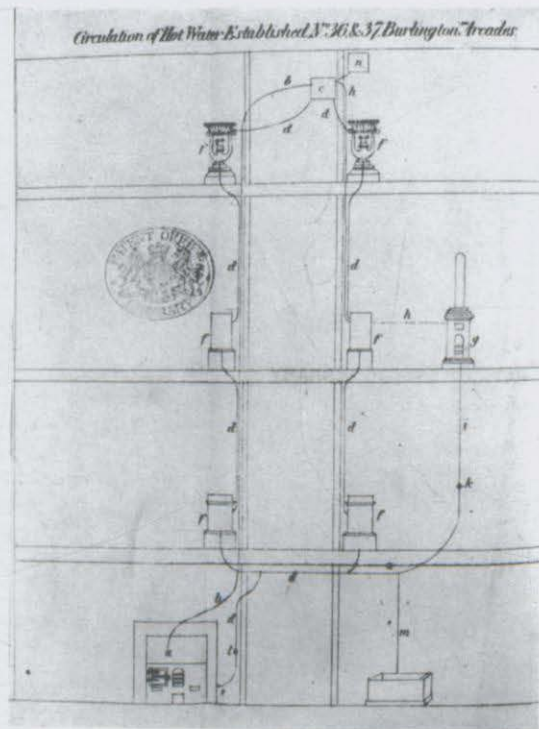


Fig. 12. Section through house and shop in Burlington Arcade, showing complete hot water circulation, from Chabannes' *Appendix* . . . of 1819.

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But his success could not last. Chabannes had never quelled his propensity for risk-taking. At Covent Garden he promised 'to withdraw whatever I might fix if it did not receive the sanction and approbation of the public'.⁵⁹ In the case of the House of Commons, he promised not to seek payment until his scheme had been pronounced successful. Two months later his bill was sent in, early and well over estimate. His excuse: 'the heavy responsibilities I am under through the unfortunate failure of Mr. Gilpin'.⁶⁰ Debts were also catching up with him again; in particular, the long-buried coal-dust fiasco raised its shadow, as creditors who had been misled by Chabannes in the past saw him riding high once more. We now learn that a certain Saint Quentin, a fellow legitimist and schoolmaster, and Dr. George Mitford of Reading, had been involved in 'some marvellous invention for lighting and heating houses' promoted by Chabannes years before—surely the Millbank coal dust business;⁶¹ Mitford, improvident father of the once-fashionable belle-lettriste Mary Russell Mitford, seems to have invested the huge sum of £5000 in the enterprise. How far these past debts contributed to the new failure we do not know, but the heating business suddenly collapsed. 'Chabannes' fate does not at all astonish me,' wrote Saint Quentin from Paris to Mitford in April 1820. 'His whole life has been a series of impositions; by his alluring prospects held out of great profits he has taken in the longest heads and the deepest calculators. I can only deplore and regret that he has so shamefully succeeded with me, who have neither a long head nor deep foresight.' Mitford was left vainly trying to get his money back through the French courts.⁶²

Still, Chabannes was not quite ready to go home to France. He was still in London in 1822, when a rambling pamphlet suggests that the balance of his mind was now conclusively disturbed. *Le Phare Trompeur ou la Chartomanie* is partly in prose, partly in verse. It abuses French and British governments with equal zeal, condemns the growing constitutionalism in France, and stakes his all on a last invention—a new method for catching fish. There is a final British patent for this, with the following explanation:

1st, the sinking of a lamp or light under the surface of the water to any depth that may be useful, with one or more communications from it open to the atmosphere above, by which the smoke may arise and feed the flame; 2nd, the using mirrors under the water connected with traps or nets, to allure the fishes into situations from which they cannot again escape; 3rd, the placing living fishes, surrounded by glass or other protection, in or about my nets or traps as a further allure or bait.⁶³

The rest, or what is known of it, is soon told. The Marquis had some sort of bolt hole in Scotland, where he went for his eccentric fishing and other purposes.⁶⁴ In about 1824, now notorious as 'un inventeur infatigable doublé d'un emprunteur insatiable',⁶⁵ he slunk across the Channel. For some of the 1820s he seems to have lived quietly in Brussels, no doubt for financial as well as political reasons.⁶⁶ He was back in Paris by 1829, where the instability of the next three years spurred Chabannes to a final frenzy of political pamphleteering. Violently opposed to the July Revolution, he put his all into two short-lived broadsheets, the *Régénérateur* and the *Foudre de la Vérité*. Some seventy-five separate items dating from these years in the printed catalogue of the Bibliothèque Nationale attest to his unregenerate royalism. It was his last gasp. In 1836 he died, aged 73, at Canteleu, near Rouen.

* * * * *

The authors of the *Dictionnaire Technologique*, writing in the 1820s during Chabannes' lifetime, took a savage view of his contribution to heating.⁶⁷ They listed a string of Frenchmen whose ideas he had plundered without acknowledgement, principally Bonnemain de Pecq (who turned out, to their surprise, to be alive), but they grudgingly acknowledged the value of his publications. We can afford to be less censorious, if only because of the swashbuckling nature of a career which might have adorned the pages of Balzac.

There is a substantive interest to Chabannes as well. Rumford, and to some degree Chabannes, still took an Enlightenment view of technology. Both were implicated with reactionary rather than progressive or liberal causes in the politics of their day. Yet they believed in the widest possible diffusion of technological principles for the general good of mankind, and instinctively disliked the

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secrecy of patents. In Chabannes, this attitude was modified by his contact with the commercial culture of the English industrial revolution, and by the growing desperation of his circumstances. But the very existence of his publications shows that he was never reconciled to such an attitude. In 1801 he was patenting his coal-dust process, yet at the same time explaining it in detail. In 1815 he offered licences for his heating inventions on the grounds of 'not having been brought up to commerce, and it being repugnant to him to injure any person who lives by his industry, by a monopoly'.⁶⁸ Likewise, he found it as ethical to crib from previous inventors as to raise money for his schemes wherever he could. This was not the kind of approach that found favour with Boulton and Watt.

Nor was there anything remotely nationalistic about Chabannes' view of technical exchange. More competitive attitudes between nations towards the applied sciences were fostered in large part by the conflicts of 1790–1815, but hardly appeared before their end. The concerted programme of a bureaucrat like Charles Dupin, who came to England after 1815 to discover systematically what France needed to learn, would have been alien to the Marquis de Chabannes. He was a patriot, soldier and technologist of the Old Régime: an impulsive mini-Rumford who was equally at home yet equally marginalized in France and in England, inventing, patenting, publishing, politicking, intriguing, borrowing—and, in the end, inevitably failing.

NOTES AND REFERENCES

This is a greatly expanded version of a paper given by the authors at a conference on 'L'Europe des Echanges', held at Clisson, France under the auspices of the Centre National de la Recherche Scientifique in June 1992. They are grateful to Werner Szamben for inviting them to give that paper, and to Mike Chrimes, Brent Elliott and Charlotte Ellis for help and forbearance during its long gestation.

1. Biographical information, unless otherwise indicated, is from Comte Henri de Chabannes, *Histoire de la Maison de Chabannes*, privately printed, Moulins, 1896, in three volumes: I, *L'Histoire*; II, *Preuves de l'Histoire*; III, *Supplément aux Preuves et Planches* (cited hereafter as 'Choulot', with volume numbers). A copy is in Bibliothèque Nationale LM³ 2167 (réserve). Further information is from the *Dictionnaire de Biographie Française*. The account of the life of Chabannes given in the *Biographie universelle*, 1834 and 1844 edns., deriving from *Biographie nouvelle des contemporains*, 1821, is untrustworthy.
2. Chabannes I, pp. 305–10; Asa Bird Gardiner, *The Order of the Cincinnati in France*, 1905, pp. 106–7, 206. Ludovic de Contenson, *La Société des Cincinnati en France et la Guerre d'Amérique*, 1934, p. 153, conflates the American military careers of the Chabannes brothers.
3. Chabannes I, pp. 334–7, 342, 354; II, pp. 369–72; III, pp. 256–60.
4. Chabannes, *On Conducting Air by Forced Ventilation*, 1818, p. iii.
5. *Ibid.*, p. iv.
6. Chabannes I, pp. 310–11; III, pp. 253–4.
7. Chabannes I, pp. 311–3.
8. Chabannes I, p. 312; II, pp. 350–1.
9. Chabannes I, p. 311; II, pp. 352–3.
10. Chabannes II, pp. 352–3.
11. Chabannes I, p. 316; II, pp. 354–60.
12. 1793 is the date given in *On Conducting Air . . .*, pp. iv–v, but 1794 is given on the evidence of letters. The dates given in Chabannes' pamphlets seem usually to be accurate. The Barnes house is rated to Chabannes from 1795 to 1802 (Surrey Record Office, church rate book for Barnes).
13. *On Conducting Air . . .*, pp. iv–v.
14. Chabannes I, pp. 316–19; II, pp. 360–5.
15. Sir Richard Phillips, *A Morning's Walk from London to Kew*, 1817, pp. 222–3.
16. See particularly *Dictionnaire Technologique*, vol. 2, 1822, pp. 288–91, and 4, 1823, pp. 375–8. J. C. Loudon's *Encyclopaedia of Gardening*, 1822, p. 370, claims that Gould, Prince Potemkin's gardener, also used hot-water at about the same time as Bonnemain. Advanced hot-house heating in 1790s England was generally by steam.

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17. This publication is announced as available on the title pages of Chabannes' *Short Essay on the Composition of Oeconomical Fuel* of c. 1801, but the authors have been unable to trace it, despite the assistance of Brent Elliott of the Royal Horticultural Society's Library.
18. The best account of Rumford's career is that of Sanborn C. Brown, *Benjamin Thompson, Count Rumford*, (MIT Press, Cambridge, Mass, 1979).
19. *Architectural Magazine*, 1, 1834, pp. 172–3; *Transactions of the Newcomen Society*, 21, 1940–1, pp. 101–3.
20. The full title is *A Short Essay on the Composition of Oeconomical Fuel and of Various Mixtures that may be used with Coal, to produce a clear saving of one-third part of the Expence of keeping up Fires in General, by the Patentee of the Coal Manufactory, Millbank-Street, Westminster*. A note on the copy in the Goldsmiths Library, Senate House, University of London (catalogue no. 18203) identifies the author as Chabannes, 'a French Nobleman of high Rank who carried on this trade under the name of Frederic'. The name Frederic occurs in the text. The attributed date of 1801 is convincing. The printer was S. Tibson of the Surrey Printing Office, Westminster Bridge Road, Lambeth.
21. *On Conducting Air . . .*, pp. iv–v. The house was No. 69 Welbeck Street (now demolished), for which Chabannes was rated under his own name between 1799 and 1801 (St. Marylebone ratebooks, Westminster City Archives).
22. *Short Essay on the Composition of Oeconomical Fuel . . .*, p. iv.
23. Westminster City Archives, ratebooks of St. John's district, St. Margaret's parish.
24. Chabannes I, pp. 328–9; II, pp. 368–9.
25. Chabannes II, pp. 369–70.
26. Chabannes II, p. 370.
27. Chabannes III, p. 267.
28. Chabannes III, pp. 267–8.
29. Chabannes I, pp. 331–2; II, p. 372.
30. Westminster City Archives, ratebooks (see n. 23).
31. *Patents for Invention; Abridgements of Specifications for Carriages and Other vehicles on Common Roads, 1625–1866*, Patents Office, London, 1880. John Besant, patent no. 1574, 29 Nov. 1786; Francis Moore, patent no. 1546, 13 June 1786; John Collinge, patents nos 1626, 2 Nov. 1787 and 1899, 17 July 1792.
32. Conservatoire des Arts et Métiers, Paris, Archives Q–70 (Correspondence between Molard, Director of the Conservatoire, and Becquoy, Director-General of Agriculture, Commerce, Arts and Manufactures, 16 Aug. 1802 and 22 Aug. 1804).
33. H. C. B. Rogers, *Turnpike to Open Road*, 1961, pp. 31–3.
34. Institut National de la Propriété Industrielle, Paris, *Collection des Brevets Français, 1^{er} juillet 1791–8 octobre 1844*. Brevet: Chabannes, 'Voitures dites Vélocifères', 5 fructidor An XI (27 Aug. 1803); and Christian, *Description des Machines et Procédés Spécifiés dans les Brevets d'Invention, 1^{er} juillet 1791 au 1^{er} juillet 1824*, 1824, vol. 7, p. 258.
35. Conservatoire des Arts et Métiers, Paris, Archives S–54 (Dossier Chabannes, 'Vélocifères', 17 Aug. to 3 Oct. 1804: report from Molard, Joseph Montgolfier and Comte de Jean Portalis, Minister of the Interior). The *Procès Verbaux de l'Académie des Sciences*, vol. III, p. 117, also refers to Gaspard Monge the mathematician and Gaspard-Marie-Riche, Baron de Prony, the engineer, reporting at the same time on the vélocifères to the Institut.
36. *Moniteur Universel*, 30 fructidor An XII (15 Sep. 1804); 20, 25 and 26 vendémiaire An XIII (8, 12 and 13 Oct. 1804).
37. The *Prospectus* was published in Paris at the same time as the application by Chabannes and his British engineer-partner Henderson for a patent granted 16 Nov. 1804 (see infra, n. 38). Copies of the *Prospectus* in Britain are in the British Library (523 d.15) and in the library of the University of Essex. The latter copy first drew the Marquis de Chabannes to the attention of one of the authors in about 1975.
38. See fig. 3, taken from the composite plate prepared for publication in Chabannes-Henderson, *Brevet d'Invention de 5 Ans*, 25 brumaire An XIII (16 Nov. 1804), in Institut National de la Propriété Industrielle, Paris, *Collections des Brevets Français, 1^{er} juillet 1791–8 octobre 1844*; and Christian, *Description des Machines et Procédés Spécifiés dans les Brevets d'Invention, 1^{er} juillet 1791 au 1^{er} juillet 1824*, 1824, vol. III, p. 69.

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39. The steam engine is referred to in the introduction to the *Prospectus* and in the Brevet. Query, the architect is presumably identifiable with the architect of the same name who proposed a design for a 'colonne départementale' at Moulins in the context of the national competition for this purpose launched by Lucien Bonaparte in 1801: see *Les Architectes de la Liberté*, Ecole Nationale Spéciale des Beaux Arts, Paris, 1989, pp. 319–20.
40. Conservatoire des Arts et Métiers, Paris, Archives N–45, 11 Feb. 1807–Nov. 1808. Letter from Chabannes of 8 April 1807 to the Minister of the Interior.
41. *Ibid.*
42. Conservatoire des Arts et Métiers, Paris, Archives, Portefeuilles Vaucanson 13571–327/4, 11, 14, 15.
43. Institut National de la Propriété Industrielle, Paris, *Collections des Brevets Français, 1er juillet 1791–8 octobre 1844*: Chabannes, 'Vélocifères, Brevet de Perfectionnement', 3 brumaire An XIV (25 October 1805). Chabannes again received a laudatory report from the Institut for this improved two-wheel vélocifère on 2 Oct. 1806: *Procès Verbaux de l'Académie des Sciences*, vol. III. For the fate of the vélocifères, see *Mémoire sur les voitures publiques et sur le moyen de soutenir les postes, par J. F. de Chabannes, propriétaire de l'entreprise de vélocifères*, Paris, 1806 (copy in British Library, 5403 c.6 (74)).
44. Chabannes I, pp. 375–7; II, pp. 379–84.
45. Chabannes I, pp. 380–1; II, pp. 384–6.
46. Chabannes I, pp. 379–80; II, pp. 384–5. See also Chabannes, *Aperçu historique et politique des fautes qui ont été commises depuis la bataille de Leipsic jusqu'à la nouvelle révolution qui vient de s'opérer*, London, 1815; and *On Conducting Air* . . . , p. v. In August 1814 however Chabannes had found time to demonstrate a threshing machine of his invention to the Institut and the Arts et Métiers. Conservatoire des Arts et Métiers, Paris, Archives Q–70, letters of 14 and 16 Aug. 1814; *Procès Verbaux de l'Académie des Sciences*, vol. V, 8 Aug., 1814.
47. Chabannes I, pp. 382–3. As well as the *Aperçu* . . . (above, n. 46), there are three further London pamphlets of 1815 in the Bibliothèque Nationale: *M. de Chabannes à M. de Talleyrand; Aux Français, deux mots de vérité; Lettre à le Comte de Blacas*.
48. *On Conducting Air* . . . , pp. iv–v.
49. *Ibid.*, pp. v–vi.
50. Science Reference Library, London, *Specifications of Patents*, o.s., 1815 no. 3875 and 1815 no. 3963.
51. The showroom was at 56 Howland Street, the house at 1 Russell Place, where Chabannes was the ratepayer from late 1814 until late 1819 (St. Pancras ratebooks, Camden Libraries). Both buildings have disappeared.
52. The three heating pamphlets are: *Explanation of a New Method for Warming and Purifying the Air in Private Houses and Public Buildings*, 1815; *On Conducting Air By Forced Ventilation*, 1818; and *Appendix to the Marquis de Chabannes' Publication on Conducting Air by Forced Ventilation*, [1819]. Copies of all three are to be found in the Science Reference Library (former Patent Office Library), London.
53. Andrew Saint et al., *A History of the Royal Opera House Covent Garden*, Royal Opera House, London, 1982, p. 17.
54. *On Conducting Air* . . . , pp. 25–34.
55. *Appendix* . . . , passim; Public Record Office, WORK 1/9, 5/107 and 11/24/11.
56. *On Conducting Air* . . . , p. 64.
57. *Appendix* . . .
58. PRO, WORK 11/24/11.
59. *On Conducting Air* . . . , p. 26.
60. PRO, WORK 1/9, letter of 3 March 1819, and WORK 11/24/11, letter of 11 May 1819. Gilpin, doubtless a client of Chabannes, was probably an army clothes contractor of that name with premises in the Strand.
61. A. G. L'Estrange, *Life of Mary Russell Mitford*, vol. 2, 1870, p. 89.
62. A. G. L'Estrange (ed.), *The Friendships of Mary Russell Mitford*, vol. 1, 1882, p. 23.
63. A copy of *Le Phare Trompeur* . . . is in BL 11475 aa 13; there is none, apparently, at the Bibliothèque Nationale. The patent is in Science Reference Library, London, *Specifications of Patents*, o.s., 1821 no. 4582.

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64. In *Le Phare Trompeur* . . . , p. 36, Chabannes tells his readers he is just off in January 1822 to fish in Scotland. A pamphlet of 1823 in the Bibliothèque Nationale, printed in London, is called *Quelques Réflexions tracées à la hâte dans le Nord de l'Angleterre au sujet du Changement de Ministère en France*.
65. Fernand Baldensperger, *Le Mouvement des Idées dans L'Émigration Française*. 1924, vol. 1, pp. 129-30.
66. DBF says Chabannes emigrated to Brussels in 1824; a pamphlet of 1829 in the Bibliothèque Nationale, *Appel au jugement . . . de tous les Habitants . . . des Pays-Bas*, was published there.
67. *Dictionnaire Technologique*, vol. 2, 1822, pp. 288-91; vol. 4, 1823, pp. 375-8.
68. *Explanation of a New Method* . . . , p. 17.