

The Dangers of Instrument-making

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The health of craftsmen was of little concern to the states of Early Modern Europe more concerned with warfare than social security. In the early Enlightenment however as the leaders of centralising states began to realise that the populations they governed could be exploited for more than cannon fodder, Bernardino Ramazzini (1633–1714), a notable medical practitioner who was also a learned professor of his subject in the University of Modena and subsequently in Padua, a curious enquirer into nature and good letters produced a pioneering volume that would become a standard work for nearly two centuries.¹ Careful enquiries among craftsmen and the labouring classes supplied the materials for his *De Morbis artificum diatriba* ('Discourse on the diseases of artificers', Modena 1700, revised edition, Padua 1713). This was translated into Italian in 1745 and into French, with large additions, by Antoine François de Fourcroy (1755–1809) in 1777. The translation was Fourcroy's first work produced for the newly founded Société Royale de la Médecine that had received several reports on occupational diseases.² Forty-five years later it was still, according to Patissier, the only work available on the subject in France.

As such Philibert Patissier (1792–1863), Docteur en Médecine (1805), elected to the re-founded Société Royale de la Médecine in 1823, and primarily interested in the therapeutic qualities of mineral waters on which he wrote several reports, renewed it. His work appeared at a moment when the health of the working classes was being discussed throughout Europe both in terms of the specific artisanal activity and of the environment in which it was executed. Ramazzini's work was based on his own visits to artisan workshops, and on the reports of his correspondents.³ Patissier in his edition (Fig. 1), brought Ramazzini's work up-to-date and rationalised its structure. His descriptions of artisan maladies and their causes however are applicable to the entire Early Modern period as to a good part of the nineteenth century. Those that concern the making and use of mathematical instruments are here abstracted and translated.

Casting the basic form of an instrument is fundamental to its production. Calcining and casting such metals as lead, pewter or copper however was dangerous work since, whatever precautions were taken, workmen would absorb quantities of possibly lethal emanations. Founders were particularly prone to asthma, to an enlargement of the spleen and to wasting away; working copper (and so brass), could lead to intestinal colic, loss of weight and to hectic fever. The solution for Patissier was that during open-air work a damp sponge

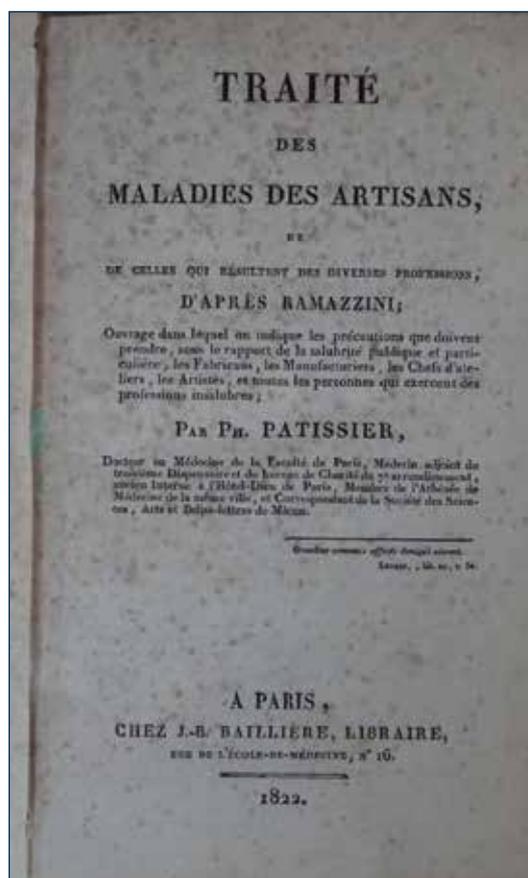


Fig. 1 Title page of the treatise by Patissier, 1822.

should be worn covering the nose and mouth, indoors, workshops should be furnished with an up-draught chimney, but although working in great heat, cold drinks should be avoided.⁴ Turning parts of instruments made of wood, was also not exempt from danger. 'They are, in effect, obliged to keep their hands and arms in a continual effort in order to press on and restrain the chisel as necessary so as to remove from the wood only what is needed, and continually to move their right foot to keep the wood they are working in rotation. The circular movement of the lathe also tires their eyes, constantly fixed on their work and causes giddiness'. Wood in itself however was not noxious apart from cypress, which for some workers could cause headaches. Cabinet makers and joiners however Patissier declared were subject to few problems arising from their work, which was rather salubrious than otherwise.⁵

Not so for pewterers who would occasionally make sun dials (Fig. 2), weights and more rarely other instruments. They, in casting the metal were exposed to lead vapours, which could provoke colic and asthma. Milk, emulsion of almonds and infusions of barley were seen as therapeutics, but better protection was to work beneath a very large chimney oppo-

site a door or window, and to keep the face averted when pouring lead into moulds. Best of all was to work with a chimney fitted with an updraught furnace of the kind developed by Jean Pierre Joseph Darcet (1777–1844). In this a metal tube from the furnace was run up to about one third the height of the chimney; as it heated up the air, it contained rarefied and was expelled, while contaminated air from the workshop was dragged into the vacuum thus created. 'The effect of these furnaces is such that the fumes produced in the middle of the workshop are drawn directly towards the chimney opening'.⁶

Darcet had developed his simple solution for the evacuation of noxious fumes specifically to protect gilders. He had been stimulated by the prize competition on the subject established at the Académie des Sciences from a bequest by the sculptor in bronze and playwright Antonio André Favrio (1759–1814), well aware of the dangers run by the craftsmen and women⁷ who gilded his work. Almost all the stages of this work were dangerous as the fumes of acids and mercury were inevitably absorbed through the mouth, nose and skin. A badly ventilated workshop became 'a grave for the workers there, the air they breath being continually charged with carbonic acid, azotes, mercury, mercuric oxides, nitric acid, nitric gas, that quickly destroy their health'.⁸ The chief result of all this was what became known as 'mercury trembling'. Although this could manifest itself in a sudden, violent attack, in most cases it developed slowly: 'firstly the workman's arms become less steady, they shake, then become agitated, finally they tremble'. This trembling increased in intensity if work was continued, until it generalised and became convulsive. It then became impossible for the sufferer to carry out actions requiring muscular force such as walking, mastication, using the hands and the like. This could be followed by momentary loss of consciousness, insomnia, and delirium. Meanwhile the skin became dry, hot and dark in colour, and appetite diminished and eating itself difficult. 'Ordinarily they are fed like children because the arms, where the trembling begins, are more affected than the legs, and it usually the former that are the last to be healed'.

Patissier gives a harrowing collection of reports on gilders' maladies, which were only intensified by the fact that many such work-



Fig. 2 A dangerous instrument. Equinoctial dial in pewter, not signed, French, mid-18th century. A compass with a 16-point wind-rose and a 360° scale is mounted at the centre of the three-ring sphere. An hour scale reading to 7½ minutes is marked on the outside of the ring set in the plane of the celestial equator. A decoratively cut indicator is mounted on the polar axis of the instrument and may be turned around the hour ring. To the find the time, once the instrument is correctly oriented, it suffices to push the indicator round the hour scale until it casts no shadow. Its position on the hour scale then marks the time.

men and women not only ate in their workshops but even lived in them.⁹ Remedy could come from the installation of Darcet's evacuating furnace combined with other simple precautions:

'Gilders should: 1 on leaving the workshop carefully wash their mouth, face and hands; 2 never take there meals there; 3 accustom themselves to working in gloves made of gut, or waxed taffeta; 4 change their clothes on arriving at the workshop, put on an overall attached at the wrists and by a belt. This will be their working garment that they will exchange on leaving for their own clothes, and which they will keep in a locker away from refuse and above all the fumes of the workshop.'¹⁰

These precautions observed, thought Patissier, gilding could become as little insalubrious as other crafts.

Barometer makers, and those who silvered parts of instruments were subject to the same dangers as gilders and should take the same precautions. The makers of coloured

glass should do the same as they could absorb the harmful vapours of lead oxides. Glass-blowers of thermometer and barometer tubes and of other occasional instruments, risked dropped and lined cheeks while those who polished glass were liable to pulmonary infections because they constantly exercised their thoracic members, and more generally were so victim of fatigue that they seldom worked after the age of forty-five.¹¹ Using at least one of their products, the microscope, was dangerous for eyesight and microscopical observers together with watchmakers, painters on enamel, engravers, and those engaged in any sort of minute work, all ended by wearing eye-glasses, if they did not go blind as Rammazzini thought most clockmakers did, before they reached old age.¹² They were subject to weak eyesight, myopia, amaurosis, and cataracts.¹³ Apart from concave lenses for the short sighted, there were however few remedies available, 'medecine supplies no remedy apt to restore vigour to old eyes'.

The sedentary nature of these occupations also exposed their practitioners to maladies that they shared with calculators, writers and the learned in general. These were stoppage of

the liver, and the spleen, gastric problems, weakness in the legs, stasis of venous blood and a cachectic appearance. Prolonged use of one hand only could lead to lassitude in both it and the arm ending eventually with a paralysis. The close concentration needed for such sedentary occupations, both manual and intellectual, could lead to a tendency for migraines, head colds, and inflammation of the eyes already weakened by close work in bright light or on white paper. They could be remedied by moderate exercise every evening and on feast days, infusions should be drunk, tobacco could reduce head-aches, eyes should be washed morning and evening in a water and alcohol solution and a green taffeta shade should be worn when working in strong light.

Ramazzini and Patissier were concerned to be comprehensive in their surveys of artisans' maladies. The diseases they listed varied in gravity. Nonetheless their accounts reveal that particularly in the casting and gilding of metal, the makers of instruments were exposed to dangers specific to their occupations

in addition to those endemic to the insanitary conditions of Early Modern urban life. Fine instruments were costly for both maker and consumer.

Notes and References

1. For Ramazzini and the varying interpretations of his work, see Julien Vincent, 'Ramazzini n'est pas le précurseur de la médecine du travail: médecine, travail et politique avant l'hygiénisme', *Genèses*, **89** (2012), pp. 88-111.

2. Lawrence Brockliss & Colin Jones, *The Medical World of Early Modern France* (Oxford, 1997), p. 455. Fourcroy's translation was reprinted in Paris in 1841 as part of the *Encyclopédie des sciences médicales*, 7th division. An English translation was published by W. C. Wright, *Diseases of workers* (Chicago, 1940). For these editions and for Fourcroy see W. A. Smeaton, *Fourcroy, chemist and revolutionnaire...* (Cambridge, 1962).

3. Ph. Patissier, *Traité des maladies des artisans et de celles qui résultent de diverses professions d'après Ramazzini...* (Paris, 1822), translation of Ramazzini's original preface, p. xiv.

4. Patissier (note 3), pp. 31-2.

5. *Ibid.*, pp. 324-26.

6. J. P. J. D'Arcet, *Mémoire sur l'art de dorer le bronze* (Paris, 1818). Darcet's furnace was rapidly adopted and subsequently mentioned in most treatises on hygiene as for example in Louis Rostan, *Cours élémentaire d'hygiène* (Paris, 1828), pp. ii 420-1. Already in 1818 it had been made obligatory for all new gilding workshops opened in Paris.

7. Women made up a high proportion of gilders; in Geneva they constituted the majority. L. Mottu-Weber 'Inventeurs genevois aux prises avec la maladie des doreuses et doreurs' in C. Verna, ed., *Artisans, industrie. Nouvelles révolutions du Moyen Âge à nos jours* (Paris, 2004), p. 291.

8. Patissier (note 3), p. 34.

9. *Ibid.*, pp. 30-49.

10. *Ibid.*, p. 49.

11. *Ibid.*, pp. 75, 309.

12. *Ibid.*, p. 351.

13. Such was indeed the case of the late 18th century watch and chronometer maker George Margetts (1748-1804), who, threatened with blindness (probably from a cataract), underwent an eye operation in 1801. JBG in *The Philosophical Magazine*, **23** (1806), pp. 76-9, reprinted in full in Jonathan Betts, *Marine chronometers at Greenwich, ...* (Oxford, 2017), pp. 231-2.

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