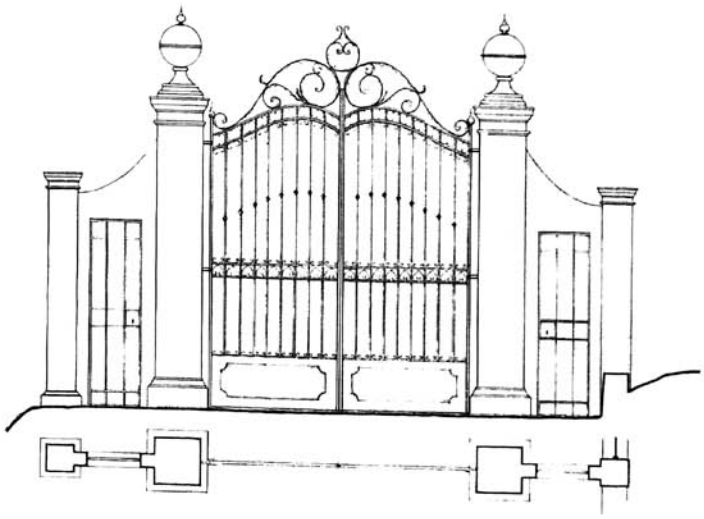


VILLA DI CASTEL VITONI AT LAMPORECCHIO SOPRA VINCI

ACHADEMIA LEONARDI VINCI IX

1996

SPECIAL VOLUME ON LEONARDO'S THEORY AND PRACTICE OF ART
PUBLISHED IN CELEBRATION OF THE GIUNTI FACSIMILE EDITION
OF LEONARDO'S LIBRO DI PITTURA (CODEX VATICANUS URBINAS LAT. 1270)
AND PRESENTED BY MERCEDES-BENZ ITALIA SPA

APPENDIX

Leonardo's 'Automobile' and Hans Burgkmair's Gala Carriages

[M.E.R.]

LEONARDO'S SUPERIORITY in technological innovations is best shown by Hans Burgkmair's woodcuts of 1516–18 representing the manually propelled gala carriages from the triumphal procession of Emperor Maximilian I – a simple system of motion transmission requiring a man cranking along either inside or outside the float.[1] In fact, long before then, in 1478, Leonardo had planned one such carriage that could be self-propelled, apparently by the energy released from a complex system of multiple springs. Often referred to as Leonardo's 'automobile', and known only from rough, preliminary sketches on
26 a sheet of the Codex Atlanticus (f. 296 v-a), it may be taken to suggest his early involvement with the organization of festivals and parades in the Florence of the Medici.[2] Such a destination of the vehicle, as first suggested by Carlo Pedretti,[3] is hinted at by the sketch of a coat-of-arms on the newly
27 discovered verso of the Codex Atlanticus sheet.[4]

Another sheet of the Codex Atlanticus, f. 320 r- 29-31
a, again of about 1478,[5] a drawing at the Uffizi dated 1478,[6] and an early sixteenth-century copy of Leonardo's technological drawings,[7] show that the planned vehicle must have engaged Leonardo's ingenuity the way an important commission would. As such, it must have caused Leonardo to reconsider the problem from time to time, approaching it in terms of variations on the theme,

[1] Hans Burgkmair The Elder (1473-1531) of Augusta, possibly a pupil of Schongauer, like Dürer had ties with Italy in general and Venice in particular, and developed great procifiency as a woodcut illustrator. His *Triumphzug* of 1516-18, as commissioned by Maximilian I is a detailed and accurate document of contemporary costume and technology. Cf. H.A. Schmid, *Forschungen über Hans Burgkmair*, Munich, 1888. See also *The Clockwork Universe: German Clocks and Automata 1550-1650*. Edited by Klaus Maurice and Otto Mayr. Smithsonian Institution, Washington, D.C. [Neale Watson Academic Publications, New York], 1980.

[2] Cf. Carlo Pedretti, *The Codex Atlanticus of Leonardo da Vinci. A Catalogue of Its Newly Restored Sheets*, New York, 1978-1979, Vol. II, pp. 125-26, new folio number 812 r. The studies on the subjetct are as follows (in chronological order): Guido Semenza, 'L'automobile di Leonardo', in *Archeion*, IX, i, 1928, pp. 98-104; Arturo Uccelli, 'L'automobile a molle e Leonardo da Vinci', in *La lettura*, no. 3, March 1936, pp. 7-8; Id., 'Leonardo e l'automobile', in *Raccolta Vinciana*, XV-XVI, 1935-1939, pp. 191-9; Giovanni Canestrini, *Leonardo costruttore di macchine e di veicoli*, Rome, 1939, in particular pp. 67-129 (section reprinted from the author's *L'automobile: il contributo italiano all'avvento dell'autoveicolo*, Rome, 1938, pp. 287-334), Jotti da Badia Polesine, *Leonardo e l'automobile*, Milan, 1938; Augusto Marinoni, 'L'automobile e la bicicletta di Leonardo', in *Atti della Società Leonardo da Vinci*, LXXIII, vi, 1975, pp. 285-92.

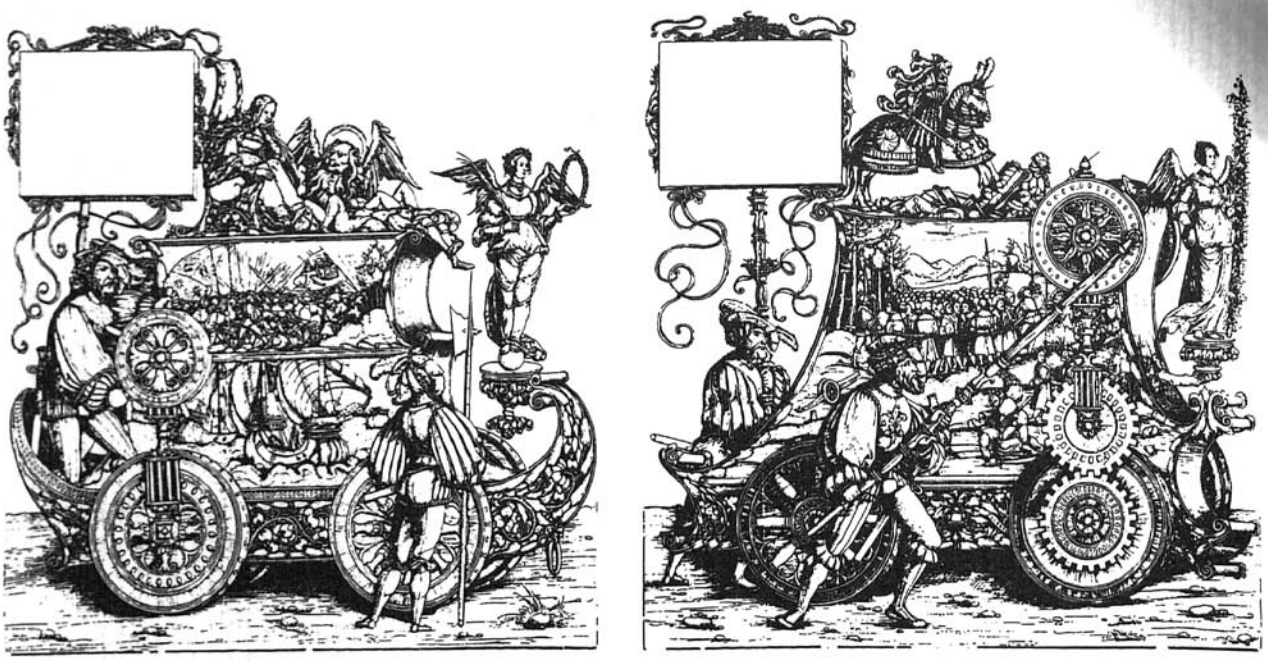
[3] Cfr. Carlo Pedretti, *Leonardo architetto*, Milan, 1978 (English editions: London, 1986, and New York, 1991), p. 320, fig. 504.

[4] The sketch, not by Leonardo, is inscribed 'azzurro | oro | R[osso] | b[ianco]', namely, 'Blue, Gold, Red, White'. According to Pedretti, *Codex Atlanticus Catalogue*, cit. (as in note 2 above), sub numero, 'This might refer to some decoration for tournaments, such as the famous one of 1475 which was the occasion of Poliziano's *Stanze per la giostra di Giuliano de' Medici*'.

[5] New folio number 878 r and v. This is the parent sheet of the Windsor fragments RL 12438, 12460 and 12464 (figure studies), which confirm the date about 1478 for the technological drawings, at the time of Leonardo's studies for an *Adoration of the Shepherds*. Cf. Carlo Pedretti, *Leonardo da Vinci. Fragments at Windsor Castle from the Codex Atlanticus*, London, 1957, pl. 22.

[6] Florence, Uffizi, GDS, no. 446 E (Popham, pl. 127). Facsimile in *I Disegni di Leonardo da Vinci e della sua Cerchia nel Gabinetto Disegni e Stampe degli Uffizi a Firenze ordinati e presentati da* Carlo Pedretti. *Catalogo di* Gigetta Dalli Regoli, Florence, 1984, pl. 7.

[7] Florence, Uffizi, no. 4085 A r (Pedretti-Dalli Regoli, pl. 43 r). 32
Cf. Pedretti, Richter *Commentary*, Vol. II, pp. 398-9, pl. 48.
Carlo Pedretti has suggested to me that this early copy may be the key to explain Leonardo's intention of using the springs for programmable control not motive power for the two large toothed wheels hinted at in the upper drawing of CA f. 269 v-a. He believes that motive power is provided by coiled springs inside the tambours (lightly indicated at the center of the toothed wheel in the ground plan on the same Codex Atlanticus sheet). The springs provide a restoring force to the crossed arms which are actuated by cams on the top of the large gears. The springs in the lower portion cooperate with smaller cams located on the hubs of the two large gears for speed regulation in conjunction with the corner mounted sprockets (detailed in Figures 29 and 30). The right side is for steering – the left 29, 30
for propulsion. The latter driving the rear wheel via the corner cog and lantern gearing below (shown in the isometric view). Rack-and-pinion steering (the first ever) is detailed in the lower left figure which is reversed from the plan drawing, the vertical linkage connecting to the tiller (or in a separate embodiment hinted at by the isometric) directly connected to a wheel pivoting under the carriage. The springs would therefore act as an escapement device in a clock mechanism, a principle applied to a comparable spring device for a flying machine in CA, f. 314 r-b, as discussed in note 9 below. It is interesting to note 33-35
that the related sketches in CA, f. 320 r-a, had already been cat- 30
alogued by Pedretti (*Codex Atlanticus Catalogue*, cit. sub numero) as pertaining either to a clock or to a self-propelled vehicle.



Hans Burgkmair, Manually propelled gala carriages from the triumphal procession of Emperor Maximilian, *c.* 1516-18.

namely of 'carriages of easy movement'. A cryptic sentence in Paris MS. B, f. 95 v (5 v), *c.* 1487-90, may hint at the kind of self-propelled vehicle running on ice as later invented by Simon Stevin: 'Just as on a frozen river a man may run without moving his feet, so a car might be made that would slide by itself'.[8] Arbalest-like springs as in the 1478 project also appear in Leonardo's studies of flying machines on sheets of the early 1490s.[9] Some twenty-five years later, in France, Leonardo's mechanical lion was again a self-propelled device, an automaton far advanced technologically, but known only from contemporary and later accounts, again as a Medici commission.[10] This in 1515, on the occasion of the solemn entry of the new King of France, Francis I, into Lyons, where the Florentine colony was to greet him with a symbol of the new Medici pope, Leo X, and of his nephew Lorenzo di Piero, governor of Florence.[11] The lion is an old emblem of Florence best known from Donatello's *marzocco*, and in fact lions were kept in cages on the back of the Public Palace,[12] the way a she-wolf is still kept in the Capitol in Rome. Leonardo's mechanical lion walked up to the King, stood on its hind-quarters and opened its breast to show that in the place of its heart it carried the Florentine lilies – the *fleur-de-lis* that Louis XI of France had given to Florence as a heraldic token of friendship, an event commemorated by Ghirlandaio's famous decoration of the *Sala dei Gigli* in Palazzo Vecchio in 1480. Leonardo was then twenty-eight years of age, thus at the very beginning of his extraordinary career as an artist and inventor – the time of his 'automobile'.

[8] Richter, § 1120: 'Siccome per lo fiume diacciato l'omo corre sanza mutazione di piedi, così un carro fia possibile fare che corra per sé'. This is fully discussed by Carlo Pedretti on pp. 143-8 of the present volume, where the correct sequence of the sheets in the last signature of Paris MS. B (Ash. MS. I) is also established.

33-35 [9] Cf. CA, f. 314 r-b (863 r), *c.* 1493-5, with a detail of the motor inscribed 'fondamento del moto', i.e. ground plan of the motor. A model of the device, as constructed by Alberto Gorla, was presented as a clock mechanism at the recent Leonardo exhibition in Speyer, Germany (exhibition catalogue, p. 132), but it was curiously positioned upright when this is clearly not the case. Cf. Luca Beltrami, 'L'aeroplano di Leonardo', in *Leonardo da Vinci. Conferenze fiorentine*, Milan, 1910, pp. 13-26. For a correct interpretation of the clock mechanism, see Carlo Pedretti, 'Il «tempo delli orilogi»', in the author's *Studi Vinciani*, Geneva, 1957, pp. 99-108, in particular pp. 106-8 and fig. 46.

[10] This used to be known only through the mentions by Vasari and Lomazzo, who did not indicate the precise occasion of the event nor its symbolism. The missing information is supplied by the *Descrizione delle felicissime nozze della Cristianissima Maestà di Madama Maria Medici Regina di Francia e di Navarra* by Michelangelo Buonarroti the Younger (Florence, 1600), p. 10, as reproduced by Pedretti, *Leonardo architetto*, cit., p. 322.

[11] Pedretti, *Leonardo architetto*, cit., p. 209, and, by the same author, 'Leonardo at Lyon', in *Raccolta Vinciana*, XIX, 1962, pp. 267-72.

[12] This is mentioned by Leonardo himself on a sheet of the Codex Atlanticus, f. 249 r-a (673 r), dating from his French period, June 24, 1518. He shows the ground plan of a building inscribed: ' stanze de' lioni di Firenze'. Cf. Carlo Pedretti, *Leonardo da Vinci's Architectural Studies after 1500*, Geneva, 1962, pp. 110 and fig. 59. Those lions are also mentioned in a text on the tongue of animals on a sheet of anatomical studies at Windsor, RL 19114 v (C. IV, 9 v), *c.* 1506 (Richter *Commentary*, note to § 1232): 'I once saw how a lamb was licked by a lion in our city of Florence, where there are always from twenty-five to thirty of them, and they bear young. With a few strockes of the tongue the lion stripped off the whole fleece with which the lamb was covered, and having thus made it bare he ate it...'.