

Joseph Brown, Astronomer

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DOCTOR J. WALTER WILSON has noted that all of the faculty at Brown University before 1790, with the exception of President Manning, were science professors. These men were David Howell, Joseph Brown, Benjamin Waterhouse, Benjamin West, and Perez Fobes. No doubt. Joseph Brown had much to do with establishing this trend.[1]

Born on December 3, 1733, Joseph Brown was the son of James Brown and Hope (Power) Brown, and second oldest of the four Brown brothers, "Nick and Joe and John and Moe." His father, a merchant in Providence, died when Joseph was five, and the boy was brought up by his mother. It is interesting to note that he was a "consistent member of the Baptist Church, being the only one of the brothers who ever made a public profession of religion." [2] A testimonial to him written shortly after his death reads: "His Skill and Industry, in the earlier part of Life, in the Merchandize and Manufactures in which he was concerned, had rendered his Circumstances easy, if not affluent, and enabled him to indulge his natural Taste for Science." [3] Yet Joseph apparently had less interest in business than did his three brothers, and he spent a great deal of his time in intellectual pursuit. Professor Hedges points out that none of his business letters has survived, if indeed he ever wrote any.[4] His mind tended more toward science and mechanics than to trade and commerce.

On September 30, 1759, he married Elizabeth, daughter of Nicholas Power. They had four children, Mary, Obidiah, Eliza, and Joseph.

Though he was never a professional scientist of the type we have today, he was an enthusiastic amateur. His interest in electricity, for example, was probably aroused by an advertisement that appeared in 1764:

For the Entertainment of the CURIOUS, will be exhibited at the Court-House, a course of experiments in that instructive and entertaining Branch of natural Philosophy, call'd Electricity, to be accompanied with LECTURES on the Nature and Property of the Electric Fire; by William Johnson.... As the Knowledge of Nature tends to enlarge the human Mind, and give us more noble and exalted Ideas of the GOD OF NATURE, it is hoped that this Course will prove, to many, an agreeable Entertainment.[5]

Joseph Brown played an important part in getting Rhode Island College, now Brown University, under way. He was a trustee from 1769 until his death. An account of the second commencement mentions that "... the degree of Master [of Arts was conferred] on the Rev. Isaac Eaton, Messieurs William Bowen, Benjamin West, David Williams, Joseph Brown, and Abel Evans." [6] This was an honorary degree. Actually, Brown had very little formal education. Evidence of this may be seen in any of his letters; they are full of mistakes in spelling and grammar and are very poorly written, even in excess of the typical eighteenth-century letter. As the testimonial to him at the time of his death pointed out, "the Want of an early Education was an Obstacle in the Way of his literary Career; but the Efforts of his Genius in surmounting it excited the greater Admiration." [7] He was elected to membership in the American Academy of Arts and Sciences.

When, during the war, French soldiers left the College ruined, and it was without funds and faculty, Joseph Brown and Benjamin Waterhouse volunteered to teach without pay. The *Gazette* of September 4, 1784, lists Brown's appointment as professor of experimental philosophy. He was thus the second professor appointed by the trustees.[8] Unfortunately, he had a stroke on November 24, 1784, and he was never able to fill his appointment. Though he partially recovered and lingered for a little over a year, "a hope of his restoration to former usefulness" [9] was futile, and he passed away on his birthday, December 3, 1785. One obituary reported: "Saturday Evening last departed this Life, in 52d Year of his Age, JOSEPH BROWN,

Esq.; for many Years a very respectable Merchant of this Town; and Yesterday his Remains were decently interred at the North Burial-Place." [10] The normal obituary at the time was very short, something like the above. Another and much longer tribute was unusual indeed and was later reprinted as a broadside. [11]

Though Joseph Brown never lectured, there can be no doubt that his effect on students was great, long before his appointment as professor. Solomon Drowne, of the class of 1773, mentions Brown and astronomy several times in his Journal:

(September 1771) 28th: ... Spend This Week ... working upon my wooden Telescope.

(November 1771) 6th: ... This afternoon was an Eclipse of the Sun. which would have been visible, had not the sun been totally Eclipsed by intervening Clouds...

(April 1772) 26th: ... Talk with Mr. Brown concerning the Prism ...

(August 1772) 3d: This Morning at about 8 the Senior and junior Classes go down to Mr. Brown's Apparatus, at the Works, to attend electrical and *Philosophycal* Lectures. Mr. Howell present. In the Forenoon and part of the Afternoon try electrical Experiments. Kill a Pigeon, etc., then darken the Room to construct the *Camera Obscura* which affords very pretty Diversion as some go out and ride, play. etc. & David stands upon his Head. We then carry out the Telescope and Micrometer up on the Hill and look at the Sun as long as we could see him, then at the Moon, then Stars, and lastly the Planet Jupiter, 3 of whose Moons we see. [12]

This last entry actually shows in operation the telescope and micrometer which had been used to observe the Transit of Venus in 1769.

It is worth observing that when each of the four Brown brothers contributed 200 pounds toward the building of University Hall, Joseph gave only 100 in cash. The other hundred was "to be paid in philosophical apparatus . . . as soon as a proper place is provided to put them in." [13]

It might also be worth mentioning some of Joseph Brown's other achievements. Along with Stephen Hopkins and the Rev. John Davis, he was on "a committee to draught instructions and prepare a model of the house proposed to be erected, which, if approved by the Corporation, is to serve as directions to the committee appointed to carry the same into execution." The report was accepted, and it was "Voted, That the Chancellor, the President, and Mr. Joseph Brown be a committee to prepare a complete model of the building." [14] This structure, now University Hall (National Historic Landmark, June 1962), graces the Brown University campus. Joseph Brown also designed or helped to design four other buildings in Providence. They are the Market Building, his own house on South Main Street, the John Brown House (now the headquarters and museum of The Rhode Island Historical Society), and the First Baptist Meeting House (National Historic Landmark, October 1960). [15]

According to the *Gazette* obituary, "his favourite Study was Mechanics; in this was the great Strength of his Genius discovered, Proofs of which, honorary to his Memory, are left behind him." Two contemporary accounts of one of his "Proofs" describe the "famous steam engine at Cranston ... the only one in America," referring to the steam engine used to drain mines, designed by Joseph Brown, consisting mostly of improvements on Newcomen's steam engine. Manasseh Cutler mentioned that "this curious machine was made under the direction of Mr. Joseph Brown, of Providence, and is a standing proof of the abilities of that able philosopher. The invention was not new, but he has made many valuable improvements, in simplifying and making the working of it more convenient, above what has yet been done in Europe." [16]

Count Luigi Castiglioni, only recently published in English, stated that "this machine was built by the brother of its present possessor with the knowledge he obtained from books about similar machines built in Europe, making a number of changes to adapt, with great ingenuity, to the circumstances of this country," [17] and went on to describe the machine in detail.

Joseph Brown also designed a fire engine, "the first ever made in this Town." [18] Dr. Wilson says that the steam engine and the fire engine show evidence of "a thoroughgoing understanding of mechanical principles and their application." [19]

Brown also conducted experiments with ships,[20] electricity and cannon,[21] and probably other things. Included in his will are quite a number of books on science: "Martin Philosophy 3 Vol.; Emerson's Mechanics; Priestly on Electricity; Dictionary of Arts and Sciences 4 Vol.; Longs Astronomy 2 Vol.; Derham's (?) Astronomy; Tannin on Algebra; Wilson on Navigation; Institute of Chemistry 2 Vol.; Watts on Astronomy." Also two items of interest, "a Barometer out of Order; 1 Thermometer." [22]

Thus far we have examined aspects of Joseph Brown's life apart from his work in astronomy. His role in the observation at Providence of the 1769 Transit of Venus has been described several times,[23] but never, so far as I know, have all the documents been taken together.

The importance of the 1769 Transit should not be underestimated. Donald Fleming writes:

In eighteenth-century America the symbolic act of allegiance to science and learning was the observation of the transit of Venus in 1769... For their ostensible purpose, determining the scale of the solar system, these observations left much to be desired; but they had something to do with the Anglicizing of Australia in the eighteenth century and the invention of motion pictures in the nineteenth, and above all, they supplied a mold for the casting and pooling of communal energy.[24]

When transits of Venus occur, they take place in pairs, eight years apart. There had been a transit in 1761 (the second ever to be observed; in all of history only five have been seen and recorded), the results of which, unfortunately, had been inconclusive. In 1769 astronomers had a second chance, so to speak, to get the answer they sought. Benjamin West wrote:

From these observations we expect to discover the distance of the Earth, the Planets and Comets, from the Sun; and consequently their magnitudes and quantity of matter will be known, as also their proportion of light and heat — These things being Once known, Astronomers in future will be able, from the like observations, to discover whether the Earth and Planets approach the Sun, or recede from him; and whether the Sun be diminished by its constant expense of light and heat. From a knowledge of all these things, methinks we shall have such a demonstration of the existence of a GOD, who made and governs all things, that even the reformed atheist must tremble when he reflects on his past conduct [25].

In short, these astronomers of the Enlightenment hoped to solve the 'final' problem of astronomy — the size of the solar system —and "to complete the Newtonian system of the world by determining its actual scalar dimensions." [26] For this purpose, nineteen or more observations were made in the English colonies of North America alone, and at least one hundred fifty separate attempts were made by scientists around the world [27]. Donald Fleming calls the Providence observations "the most striking single episode in the history of science in colonial Providence.[28] Incidentally, Transit Street was so named because the observation took place there, near Benefit Street.[29] The story of the observation follows:

Joseph Brown read John Winthrop's account of the transit of 1761 and, realizing the importance of the 1769 transit, sent to London for a telescope. At the meeting of the Corporation of the college on September 7, 1768, the "Corporation . . . voted that the President write to Mr. [Morgan] Edwards to purchase for an Air Pump. a Telescope and a Microscope out of the Monies at any Time in his Hands by the Consent of the Donors & that this Corporation will replace said Money if required out of the Fund raised or to be raised in this Country.[30] Interestingly enough, Joseph Brown is not listed among those who "were Present" at this meeting. Anyway, according to West, "afterwards, taking notice of the application of the American Philosophical Society to the Assembly of Pennsylvania. for an apparatus for observing the Transit of Venus, he found the orders he had sent were incomplete: He then advised with the author [West], as

mentioned, and thereupon ordered a micrometer to be added. —Mr. Brown's expense, in this laudable undertaking, was little less than One Hundred Pounds, sterling, besides near a month's time of himself and servants, in making the necessary previous experiments and preparations.[31]

The instruments for the observation arrived "about one month" before the transit. West wrote that "it consisted of a three feet reflecting telescope, with horizontal and vertical wires for taking differences of altitudes and azimuths, adjusted with spirit-levels at right angles, and a divided arch for taking altitudes; a curious helioscope, together with a micrometer of a new and elegant construction, with rack motions, fitted to the telescope." [32] Also included were a sextant and "two good clocks." Lownes notes that the Providence observers seem to have had the only helioscope.[33]

Though Brown was the prime mover for the observation, Benjamin West directed the proceedings. It was a joint effort and could not have been successful without the talents and backing of both men. It is not fair to attempt to dismiss Brown's part, as did the Reverend David Rowland, pastor of the First Congregationalist Church in Providence, in a letter to Ezra Stiles. Rowland wrote that West's "marginal notes which are designed to do so much honor to Mr. Brown were forced [into the pamphlet] by him, contrary to Mr. West's Inclination, and what was really just and right ; and the advantage taken because Mr. West's circumstances were low and he was not able to support the press." [34] Dr. Wilson explains that there was high feeling between the Congregationalists and the Baptists at the time, and that West was a Congregationalist and Brown a Baptist. He says, "I haven't a doubt but that without West's astronomical and mathematical knowledge the observations could not have been made. Nor that without Joseph Brown's inspiration, financial backing, and also skill and contrivance in manipulating the apparatus, they would not have been undertaken nor completed." [35]

Assisting West and Brown were Stephen Hopkins, Moses Brown, Dr. Jabez Bowen, Joseph Nash, and Captain John Burrough. David Howell was also there, according to his letter of June 5, 1769. [36]

Preparations were begun about a month in advance. Latitude and longitude were determined, clocks were regulated to an accuracy of one second, the instruments were readied. The third of June arrived. "All was calm, and not a cloud to be seen." [37] Each necessary task was assigned to one of the gentlemen. A short newspaper report printed one week later mentioned that "the Apparatus used on the Occasion is extremely accurate and curious, and was lately imported from England for that Purpose by the ingenious JOSEPH BROWN, Esq.; to whom the Public are much indebted." [38] In solving one of the most important problems. Brown indeed displayed his ingenuity:

The latitude of the place being of great consequence. and the sextant and stile not giving it exactly alike, the persevering Mr. BROWN contrived to make use of the micrometer as a lens. when he placed on his house, twenty-seven feet high. and exactly perpendicular to a center on a horizontal platform below. on which was drawn a meridian line; the Sun's image on this platform was seen to move very sensibly -- By this the latitude was finally determined. The Sun's meridian altitude, being taken for several days by this long stile, the latitudes thence found did not differ from each other more than 15 seconds. -- At the time this was done, we had seen no account that a glass had been made use of. as here described: but since this went to the press, we learn from Dr. LONG's astronomy, that he found the latitude of Cambridge, in England, by the same method.[39]

All observations thus completed, West published his famous pamphlet. Aside from newspaper accounts, it was the first of the findings published and the only one published independently. West's account concludes, "When the Sun's parallax is known, the distance of the earth, and of all the planets, from the Sun, will be known likewise." Joseph Brown must have been well aware of this, and he must have been pleased with the findings that he labored so long and hard to procure. An abstract of West's report appeared in the *Transactions of the American Philosophical Society*. The notes at the beginning state:

As it appears by sonic letters of the Astronomer Royal. Which have been communicated to this Society, that most of the Northern Observers. both in Russia and Sweden, were greatly

disappointed. by the unfavorable state of the weather, in their noble and public spirited endeavors to observe the late Transit;: the *American* Observations have become of greater importance, in order to a comparison with those of Greenwich, and therefore the Society, think it very material to preserve their Transactions. such of the observations made on the Continent as they have been favored with. The Account of the Providence Observations. drawn up by Mr. WEST, was transmitted by Mr. JOSEPH BROWN. and being Laid before the Society by Dr. SMITH: the following Abstract thereof was ordered to be published at a Meeting, May 18th, 1770. [40]

Brown probably played an important part in seeing to it that West published his findings and, again, supplied financial backing.

As a result of observing the transit, Lownes says "American Astronomy came of age. Rarely has a single event so affected the course of a science." He further notes that "the American observations were among the best [in the world]." [41]

There are but sketchy records of any other astronomical observations Brown might have performed. Since his only published paper is very short, somewhat difficult to obtain, and also of interest to us, it is here in its entirety:

An Observation of a Solar Eclipse, October 27. 1780, at Providence. By JOSEPH BROWN. Esquire.

My apparatus for the observation of the solar eclipse was a three-fret reflecting telescope with spirit levels: a small graduated semi-circle of about 4½ inches radius. and rack motions for taking altitudes: and a glass micrometer fitted with rack motions, I believe of *Dolland's* construction, having a radius graduated to 1/500 part of an inch: A reflecting telescope of near two feet: and a prospect-glass of three feet four inches length, which I mounted on a convenient stand.

On the 20th, I moved my clock into a convenient part of my house; and from that time to the day of the eclipse. I was constantly employed in taking corresponding altitudes of the sun with my telescope. and constructing a meridian-line. Our observations of the eclipse were as follows The beginning was not accurately noted.

First seen in correct time.	10h 58' 11"
Just touches a black spot in or near the middle of a macula at the right hand.	11h 21' 32"
Just touches the first of four spots all nearly in a range in a macula at the left hand,	11h 30' 52"
Ditto the spot nearest the centre of the sun's disc.	11h 33' 20"
The end of the eclipse as seen by Mr. <i>West</i> in the small telescope.	1h 39' 1"
Ditto by my brother in the spy-glass.	1h 39' 8"
Ditto last seen by myself in the largest reflector,	1h 39' 16"

I took the diameter of the sun while the eclipse was on, and made it three inches and 434/500: which. by my table. constructed in the year 1769,. previous to the transit of Venus, makes the sun's apparent diameter 32' 18": And the smallest I saw the bright part of the sun was 140/500 of an inch: So small I am certain it was, and it might probably be a very little less, tho' I believe this to be pretty exact : and this. I think. makes the sun to be 11 digits and 3/10 eclipsed, or very nearly so.[42]

I leave it to the reader to decide for himself to what extent scientific competency is demonstrated by that paper. Benjamin West's account of a later eclipse is published in the same volume. West goes into considerably more mathematical detail. The following, however, is of interest, since it shows Brown and West at work together:

This eclipse was observed in Providence by Mr. Joseph Brown and myself, at Mr. Brown's house. The morning of the 23d of April was cloudy, and despaired of seeing the sun that day; but a little before twelve o'clock. the clouds seemed to break. and the sun, now and then, made its appearance. which gave me some hopes of seeing some part of the eclipse: . . .The air continued unfavourable to our observation till a few minutes before the middle of the eclipse, when the sun again appeared and gave us a good opportunity of observing quality of the eclipse when at the greatest: -- for which purpose, Mr. Brown applied the micrometer, and found the lucid part of the sun, when in its last state, 1288 micrometer measure. This was not done at a single operation. But by a number of trials, till he found the bright part of the sun was in its least state. After reading off the numbers from the micrometer for the quantity of the eclipse, Mr. Brown immediately, at my request, took the length of the chord joining the cusps. which I believe was done with great care, and found it 1380. . .

Mr. Brown and myself both noted the same second for the last contact, which was at 2h 53' 16" apparent time. There were some thin white clouds about the sun, yet I think the observation was pretty good.[43]

Additional information concerning Joseph Brown's work in astronomy is furnished in a letter by him to David Howell, July, 13, 1782, concerning repair of the telescope, and in two short manuscripts, one of them possibly in the hand of Brown, consisting of a description of the reflecting telescope, and the other giving directions on how to use the micrometer, both written about 1783.[44]

No more fitting conclusion occurs to the writer than that of Dr. Wilson : "No one would claim that Joseph Brown became a great scientist, and it would be a mistake to imply that he was of great importance in the history of science. His importance was not that of the spectacular discoverer of fact or theory but rather that of the many quiet men who by their intellectual activity and interest keep the fires of scholarship alive and pass them on to be fanned by the drafts of greater genius." [45]

{West, "An Account of the Observations in Providence, in the State of Rhode-Island, of the Eclipse of the Sun which happened the 23d Day of April, 1781. B BENJAMIN WEST, Esquire, F. A. A. Communicated by the Reverend President WILLARD.— An Entoiteil of the American Academy.Vol. I, 1785, pp 156-158.

44Mss...Archives. John Carter Library. 4r•Wilson. op rit.. p. 12Ft.

1. J. Walter Wilson, "Joseph Brown, Scientist and Architect," *Rhode Island History*. July and October 1945, p. 69.
2. Reuben Aldridge Guild, *Life, Times, and Correspondence of James Manning and the Early History of Brown University* (Boston, Gould and Lincoln, 1864). p. 162 (hereafter cited as *Manning and B. U.*).
3. *Providence Gazette and Country Journal*, December 10, 1785 (hereafter cited as *Gazette*). Original and microfilm in The Rhode Island Historical Society Library.
4. James B. Hedges, *The Browns of Providence Plantations: Colonial Years* (Cambridge, Harvard University Press, 1952), p. 12.
5. *Gazette*, March 3, 1764.
6. Reuben Aldridge Guild, *Early History of Brown University including the Life, Times, and Correspondence of President Manning* (Providence, Brown University, 1897) pp.164-165 (hereafter cited as *B. U. and Manning*).

7. *Gazette*, December 10, 1785.
8. There appears to be some question as to who was the first. President Manning wrote on August 3, 1784, to John Rippon: "I forgot to mention that the Hon. Joseph Brown, a member of the Corporation, a philosophical genius, was at our last meeting chosen Professor of Experimental Philosophy in this College: and Dr. Benjamin Waterhouse, M.D., of Leyden, was chosen Professor of Natural History, both of whom engaged to give lectures in their respective branches, without any expense to the College while destitute of an endowment" (*Manning and B.U.*, p. 381). However, Guild points out in *Manning and B. U.* (p. 162) that David Howell was the first professor appointed by the Corporation. All three were probably appointed at about the same time.
9. James Manning, letter "To the Honorable David Howell, Member of Congress in Philadelphia," December 23, 1784 (*Manning and B. U.*, p. 397).
10. *United States Chronicle* (Providence), December 8, 1785.
11. *Gazette*, December 10, 1785.
12. Marion E. Brown, ed., *Solomon Drowne, Student: His Papers and Journals. 1753-1774* (Providence, M.A. Thesis in American Civilization, 1954), pp. 54, 59, 89, 110-111. Original ms. in Archives, John Hay Library, Brown University.
13. Wilson, *op. cit.*, p.124.
14. Reuben Aldridge Guild, *History of Brown University with Illustrative Documents* (Providence, Providence Press Company, 1867), pp. 230-231.
15. For further information on these buildings or on Joseph Brown as an architect, consult any of the books listed by Wilson, *op. cit.*, p. 70.
16. William Parker Cutler and Julia Perkins Cutler, *Life, Journals, and Correspondence of Rev. Manasseh Cutler, LL.D.*, 2v. (Cincinnati, Clarke, 1888), v. 1, p. 207.
17. Samuel Hough. "Castiglioni's Visit to Rhode Island." *Rhode Island History*, April 1967 (translation and annotation of chapters on Rhode Island in Luigi Castiglioni, *Viaggio negli Stati Uniti dell' America Settentrionale fatto negli anni, 1785, 1786 e 1787... con alcune osservazioni vegetabili piu utili de quel paese*. [Travels in the United States of North America made in the years 1785, 1786, and 1787 with some observations on the most useful plants of that country], 2v., Milano, 1790), p. 56.
18. Marion E. Brown, *op. cit.*, pp. 85-86.
19. Wilson, *op. sit.*, p. 79.
20. Letter by Joseph Brown. September 8, 1782, Archives, John Hay Library.
21. Dr. Wilson gives a good account of these. The letter of September 8, 1782 (note 200, also describes an experiment with static electricity.
22. Will of Joseph Brown, March 30, 1785, photocopy of original, the Rhode Island Historical Society Library.
23. Albert E. Lownes, "The 1769 Transit of Venus," *Sky and Telescope*, II, 6, pp. 3-5. Harry Woolf, *The Transits of Venus, A Study of Eighteenth-Century Science* (Princeton. Princeton University Press, 1959), pp. 173-174. Wilson, *op. cit.*, pp, 73-74,
24. Donald Fleming, *Science and Technology in Providence: 1760-1914* (Providence. Brown University, 1952 p. 13. Some of these claims are documented in Woolf, *op. cit.*
25. Benjamin West, An Account of the Observation of Venus upon the Sun. the third day of June ,1769, at Providence, in *New England* (Providence, John Carter, 1769). pp. ii-iii. Original in John hay Library.
26. Woolf, *op. cit.*. p. vii.
27. *Ibid.*, pp. 170, 182-187.
28. Fleming, *op. cit.*. p. 19.
29. "Transit Street — Origin of its Name," *Providence Journal*, October 23, 1855 (clipping on file in John Carter Brown Library).
30. Corporation Minutes, September 7, 1768,vol. p. 31, ms., Archives, John Hay Library.
31. West, *op. cit.*, p. 10.
32. *Ibid.*, p. 11.

33. Lowes, *op. cit.*, p.4.
34. Franklin Bowditch Dexter, ed., *Extracts from the Itineraries and other Miscellanies of Ezra Stiles, D.D., LL.D., 1755-1794, with a Selection from His Correspondence* (New Haven. Yale University Press, 1916), p. 562.
35. Wilson, *op. cit.*, p. 74.
36. Lownes mentions this letter on p. 5, *op. cit.*, but I am unable to find the original or a copy.
37. :West, *op. cit.*, p. 15.
38. *Gazette*, June 10, 1769.
39. West, *op cit.*, pp. 19-20.
40. West, "An Abstract of *Mr. BENJAMIN WEST'S* Account of the Transit of Venus, as observed at Providence in New England, June 3d, 1769," *Transactions of the American Philosophical Society*, Vol. 1, January 1, 1769 to January 1, 1771.
41. Lownes, *op cit.*, pp. 3, 5.
42. Joseph Brown, "An Observation of a Solar Eclipse, October 27, 1780 at Providence," *Memoirs of the American Academy*, Vol. I, 1785, pp. 149-150.
43. West, "An Account of the Observations in Providence, in the State of Rhode Island, of the Eclipse of the Sun which happened the 23d Day of April, 1781. By BENJAMIN WEST, Esquire, F. A. A. Communicated by the Reverend President WILLARD," *Memoirs of the American Academy*, Vol. I, 1785, pp. 156-158.
44. Mss., Archives, John Hay Library
45. Wilson, *op cit.*, p. 128.