

THE RITTENHOUSE EXHIBITION

By JAMES STOKLEY

Associate Director, The Franklin Institute Museum

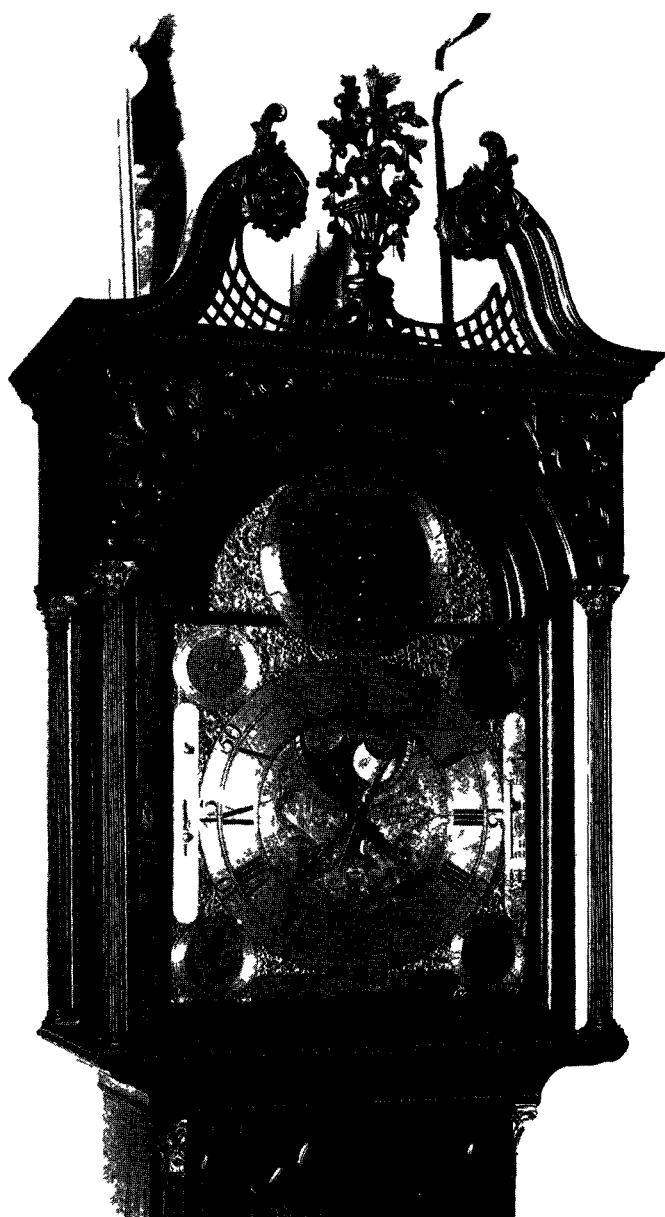
When the earliest plans were made to observe the two hundredth anniversary of the birth of David Rittenhouse,* it was decided that an exhibition of material relating to this pioneer astronomer should be held as one of the main features of the celebration. Accordingly, the chairman of the Rittenhouse Bicentenary Committee, Dr. John H. Pitman, appointed the following as a sub-committee on exhibits:

Miss Katharine Brinley Dr. Fiske Kimball
Dr. Albert P. Brubaker Mr. William B. Montague
Mr. Robert Grant Dr. Walter T. Taggart
Captain N. H. Heck Mr. James Stokley, *Chairman*

All the members of the sub-committee gave generously of their time and talents to make the exhibition a success, and the chairman wishes to take this opportunity to express his gratitude for their cordial coöperation.

Originally it was the intention to hold the exhibition in the new building of the Benjamin Franklin Memorial and The Franklin Institute. When it became evident that this building would not be ready in time, the permission of Mr. John Frederick Lewis was asked to hold it in the rooms of The Historical Society of Pennsylvania from April 4 to 23, 1932. This was readily granted, and the sub-committee hereby records its thanks to Mr. Lewis, and to Mr. Ernest Spofford,

*The celebration was held April 8-9, 1932, under the auspices of The American Philosophical Society, The Franklin Institute, The Historical Society of Pennsylvania, The History of Science Society, The Rittenhouse Astronomical Society, and the University of Pennsylvania.



Top of the musical and astronomical clock owned by the Drexel Institute
The upper dial is the orrery to show the aspect of the planets



Top of the musical and astronomical clock owned by the Drexel Institute
The upper dial is the orrery to show the aspect of the planets



for their valuable assistance, without which the exhibition could not have been held.

Rittenhouse has many claims to fame, a fact which was well brought out in the papers by Dr. Babb and others presented at the various meetings. In the exhibition the sub-committee endeavored to show these various phases of his character. Though not his greatest contribution to knowledge, Rittenhouse is doubtless best known for his clocks. It is not known exactly how many clocks he made, but approximately forty are in existence today. Sixteen of these were on display, one being already in the possession of The Historical Society, and the others on loan. An eloquent tribute to the maker's skill is afforded by the fact that all but two were in running order, and in operation during the exhibition. Most of them were able to strike the hours, and the chiming of the clocks during the Bicentenary dinner, on Friday evening, April 8, made it seem as if Rittenhouse himself were taking part in the celebration.

The George W. Childs clock, now the property of the Drexel Institute, and regarded by all authorities as Rittenhouse's horological masterpiece, was on view. Unfortunately, it is not at present in running order. When running, this remarkable instrument tells the time of day, the day of the week and of the month, the month of the year and the equation of time. It strikes the hours, halves and quarters, and any one of ten tunes may be played at the hour on a set of chimes. A small orrery above the face shows the position of the Sun and the other members of the Solar System, and a smaller lunarian shows the position of the Earth and Moon. The phases of the Moon are shown in the usual way.

This clock was made for Joseph Potts, a wealthy Quaker of Philadelphia, for \$640. According to the traditional story, Potts declined to pay this amount,

and the clock was then purchased by Thomas Prior in 1774. In the meantime, Potts engaged Rittenhouse to make him a very simple wall clock, the only one of this type that he is known to have made. This second clock is still in the possession of one of the descendants of Joseph Potts, Dr. Edward Potts Cheyney, who kindly loaned it. Prior's clock was later acquired by William Barton, Rittenhouse's biographer, then by James Swain, and by George W. Childs in 1879. In 1898, Mrs. Childs gave it to the Drexel Institute.

A clock nearly as elaborate as the Drexel specimen, and which was also exhibited, is the property of the Pennsylvania Hospital. This also shows the position of the planets, and plays one of six tunes on the hour. The time-keeping mechanism is in good running order.

Unique among Rittenhouse's clocks is the thirty day one loaned by the University of Pennsylvania. This was made for Rev. William Smith, first provost of the College, later the University, and has no hour hand, the hours being indicated by numbers on a dial which rotates behind a rectangular orifice. It is said that Smith preferred this arrangement because he used the clock for timing his classes, which were each one hour in duration, and was therefore not so much concerned with the hours. The clock is still in a sense the official timepiece of the University, for it tells time in the office of President Gates.

Most of the clocks that Rittenhouse made were eight-day ones, but two one-day clocks were also shown. Dr. Josiah H. Penniman loaned his, the wedding gift to him of the University alumni. The other one-day clock shown is the property of Hon. J. Ambler Williams, and was formerly the property of Governor Pennypacker. A particularly fine clock is the one loaned by Mr. F. J. Stokes. The two loaned by Mr. John Frederick Lewis should also be rated among the finest specimens of Rittenhouse's work. Other clocks were



Wall clock owned by Edward Potts Cheyney, LL.D. This is the clock
made for Joseph Potts after he refused the one now owned by
Drexel Institute



loaned by Mr. Douglass Leaf; Mrs. Margaret L. Montague, who also sent a clock made by Benjamin Rittenhouse, David's brother; by Mrs. E. P. Passmore and by Mrs. Thierry Van C. Phillips.

Of the sixteen clocks shown, the plainest was the one loaned by the American Philosophical Society, which is contained in a simple pine case, probably the work of Rittenhouse himself, unlike the more elaborate cabinet work of the others. But from a scientific point of view, this clock is the most important of all, for it is the one that Rittenhouse used at Norriton to time his observations of the transit of Venus on June 3, 1769. It was from these observations, in comparison with those made in England at Greenwich, that the solar parallax was determined to be $8''.805$, in strikingly close agreement with the best modern value of $8''.803$. Rittenhouse was assisted in his astronomical work at Norriton by William Smith and John Lukens, the surveyor-general of Pennsylvania. A full account of the observations is given in the first volume of the *Transactions of the American Philosophical Society*.

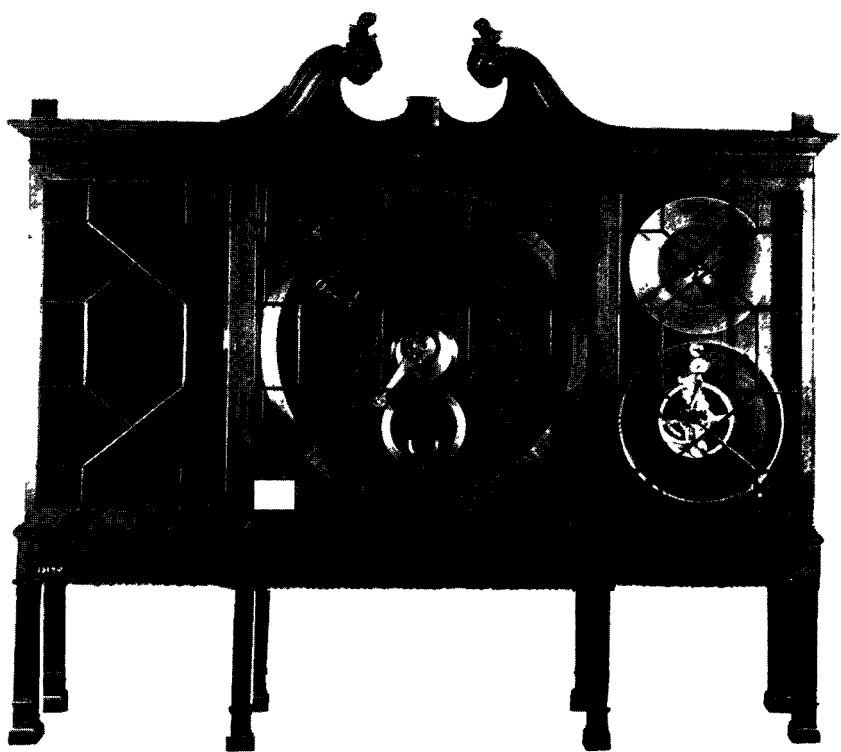
Three other instruments used at the Norriton observatory were also displayed. One was the Gregorian reflecting telescope, made by Nairne of London, which was used by Smith. This instrument, of two feet focus, was sent over to the Colonies by Thomas Penn, who requested that after making observations of the transit it be presented in his name to the College. The telescope is still the property of the University, which kindly loaned it. The other two instruments of the Norriton observers were the Dollond refracting telescope used by Rittenhouse himself, and his transit telescope, with which he made the time observations to adjust the clock. This was the first transit made in what is now the United States, and Dr. W. C. Rufus has expressed the opinion, in conversation with the writer, that it was also the first telescope made in the Colonies. The transit

and the Dollond refractor were both loaned by the American Philosophical Society, the present owners.

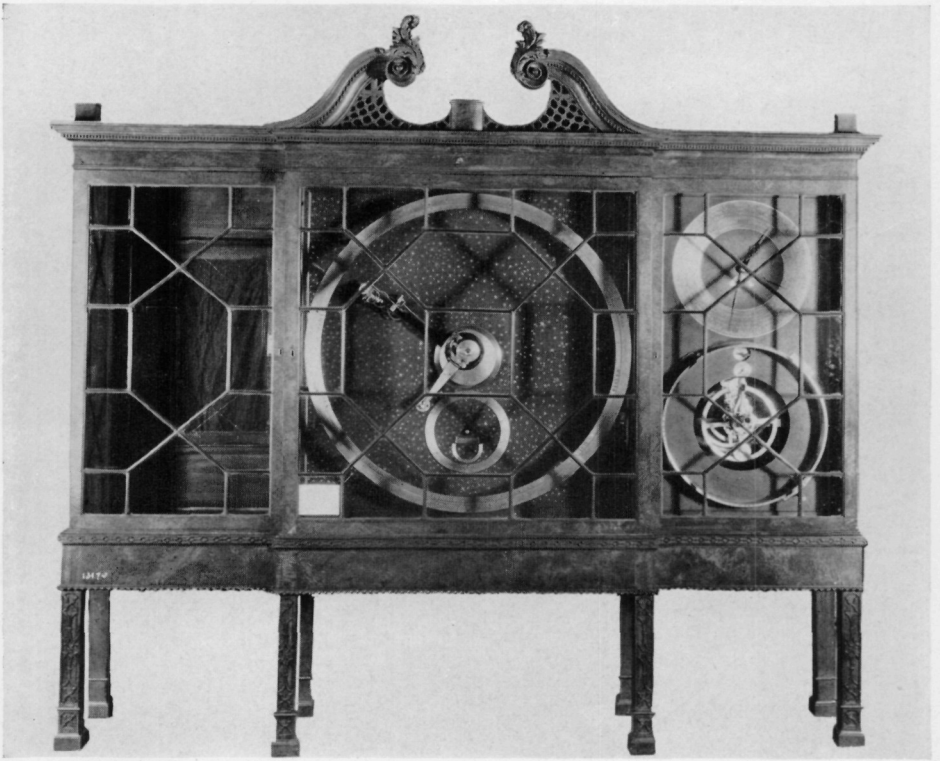
Rittenhouse's greatest mechanical production was not a clock, but the renowned planetarium, or "orrery." This is described by Dr. Smith in the first article in the first volume of the *Transactions of the American Philosophical Society*. The instrument is contained in a mahogany case 7 feet, 8 inches high, 8 feet, 6 inches long and 17 inches deep. It is supported on six legs. The case is regarded as one of the outstanding pieces of Colonial cabinet work and has been shown, by the researches of Dr. Babb, to have been made by John Folwell.

The orrery is in three parts. The center, four feet square, shows the Sun, and the planets Mercury, Venus, Earth, Mars, Jupiter and Saturn, all that were then known. The Earth, Jupiter and Saturn are shown with one or more moons, and the latter with the characteristic rings. By turning a crank at one side, the planets are made to turn in their proper periods. This is accomplished by means of an intricate mechanism. Probably no other instrument of this kind has ever reproduced the planetary motions with such precision, for each orbit is represented with its proper eccentricity and inclination.

The right hand section, twenty-seven inches wide, shows the motions of the Moon, and enables the place of visibility, duration, character, time of day, month and year of eclipses of the Sun or Moon to be predicted over a period of 5000 years before and 5000 years after the time it was built. In effect, by means of a diagonal mirror at the center, the observer sights from the Moon along that body's shadow in space, and as the mechanism is operated he can see when it crosses a small sphere representing the Earth, or when it passes above or below. When the sights show the shadow to cross the Earth, a solar eclipse is indicated,



The Rittenhouse Orrery loaned to The Franklin Institute by the University of Pennsylvania. The center section shows the motions of the planets and their satellites, and the right-hand section the eclipses of the Sun and Moon, the dates of which are read on the dial above



The Rittenhouse Orrery loaned to The Franklin Institute by the University of Pennsylvania. The center section shows the motions of the planets and their satellites, and the right-hand section the eclipses of the Sun and Moon, the dates of which are read on the dial above

and then the time and date can be read on the dial above. A smaller sphere, representing a hypothetical planet on the side of the Moon opposite the Earth, serves for prediction of lunar eclipses. When the Moon is in the Earth's shadow, the Moon's shadow, if it were still present, would fall on a body so located. Therefore, when the sights show the shadow to fall on this "planet," the device indicates an eclipse of the Moon, and the time and date may be read.

The left hand section is now empty, but originally contained models of Jupiter and Saturn on larger scales. This is said to have been removed by Rittenhouse himself, after it had been rendered incomplete by Herschel's discovery of Uranus in 1781 and of a new satellite of Saturn in 1789. Probably he intended to rebuild it, incorporating the newer discoveries; but, if so, it was never completed, and this mechanism is now lost.

The Orrery shown in the exhibition is the second that Rittenhouse made, and is the property of the University of Pennsylvania, for which it was constructed. In August, 1931, the University deposited it with The Franklin Institute, for eventual display in the new Franklin Institute Museum. Since then it has been restored in the Institute's shops, and placed again in running order. So that the ingenious mechanism of Rittenhouse can be shown, the solid wooden doors at the rear have been replaced by doors with glass panels.

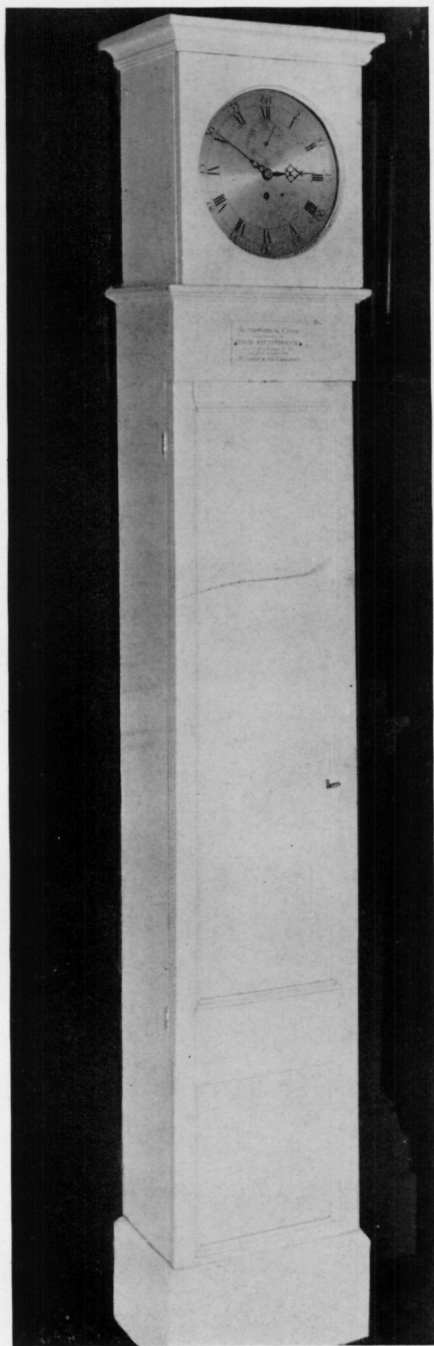
This orrery is now unique, as the first is no longer in existence. It was purchased by Princeton University, and its exact fate is something of a mystery. Dean W. F. Magie has informed the writer that the center section, showing the Solar System, was at Princeton when he joined the faculty in 1879; but it was not in the case, which seems to have disappeared still earlier. Even then it was not in running order, and some addi-

tional parts were removed for use in apparatus to observe the eclipse of 1881. These apparently were not replaced. What was left was shown in Chicago, in 1893, at the World's Fair, but was returned later and placed under the platform in the science lecture room, according to Mr. V. Lansing Collins. A gentleman who was a student at Princeton about 1903 reports that he saw some parts of it when working in the shops of the Physics Department. Since then the last trace of it seems to have vanished.

Rittenhouse was also a noted surveyor. He made his own instruments, and a number of these were shown. A surveyor's compass that he made† for George Washington is now in the United States National Museum in Washington but could not, unfortunately, be obtained for the exhibition. The Museum did, however, very generously lend several other instruments, including two zenith sectors made by Rittenhouse and Andrew Ellicott; a surveyor's compass made by Rittenhouse and George Evans, and a transit instrument made by Ellicott. Other surveying instruments made by Rittenhouse, some in collaboration with others, that were shown included a compass and tripod, by Rittenhouse and Potts; loaned by Mr. William E. Montague II.; a compass, loaned by the Germantown Historical Society; a level, loaned by The Historical Society of Montgomery County; and a very primitive form of level made and used by John Sellers, an associate of Rittenhouse, loaned by Mr. Horace Wells Sellers.

Still another distinction of Rittenhouse was that he was the first director of the United States Mint, and through the kindness of the Mint it was possible to show a balance which he made and used during his term of service. The Mint also loaned a portrait, and a

† The compass is marked "Rittenhouse Philadelphia," and is probably by David, although it has been attributed to Benjamin. So far as we know, however, the latter always marked his work with his full name.



Astronomical clock made by David Rittenhouse and used by him at
Norriton while observing the Transit of Venus, June 3, 1769
Owned by the American Philosophical Society

colored reproduction of a painting of the first Mint, at what is now 37-39 North Seventh Street, and which is occupied as a workshop for The Franklin Institute Museum.

The principal portraits of Rittenhouse are four in number, and three of these were displayed. One is by John Trumbull, and was loaned by Mr. John Frederick Lewis, its owner. The others are by Charles Willson Peale, one of which was loaned by the American Philosophical Society, for which it was originally painted, at the time of Rittenhouse's service as president of that organization. Another portrait by Peale was loaned by the University of Pennsylvania, of which Rittenhouse was vice-provost. A third portrait by Peale, showing Rittenhouse with a telescope, is the property of the Brook Club in New York, and could not be obtained for the exhibition. There is, however, a well-known engraving of this portrait by Savage, of which three copies were shown, including a very fine colored one belonging to The Historical Society.

A portrait in a different medium, and that is less well known, though it probably gives us the best idea of Rittenhouse's features, is the marble bust by Ceracchi, loaned by the American Philosophical Society.

Several miniatures of Rittenhouse, and members of his family, were loaned by Miss Elizabeth Sergeant Abbot, one of his lineal descendants. Miss Abbot also loaned a number of very interesting personal items, such as Rittenhouse's shoe buckles, his cuff links and coat buttons, and a number of letters from Thomas Jefferson.

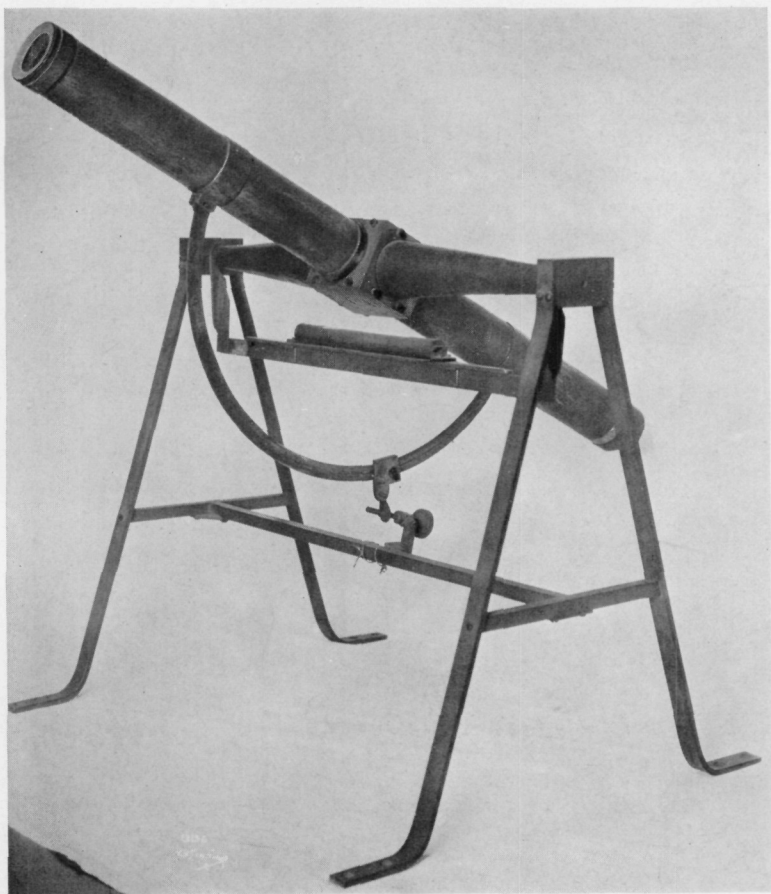
Other interesting documents were loaned by the University of Pennsylvania. Several of these are by William Smith and relate to the Orrery. These show that Smith personally advanced the money in payment for the machine, and that it was some time before he was reimbursed. A very important document was loaned

by the American Philosophical Society. This is a volume of manuscript notes by Rittenhouse on some of his astronomical observations. Important Rittenhouse letters, including the manuscripts of several of his published papers, were loaned by Mrs. Margaret L. Montague.

In addition to the exhibits mentioned above, numerous other interesting and important objects were shown, but space limitations prevent specific reference to each of them. Following is a list of the exhibitors, and the material loaned by each. The Rittenhouse Bicentenary Committee, speaking through the chairman of its sub-committee on exhibits, wishes to take this opportunity of thanking those who have so generously loaned valuable objects, thereby making it possible for so full an exhibition to be held.

Loaned by Miss Elizabeth Sergeant Abbot:

Two miniatures of David Rittenhouse
 Miniature of Mrs. Waters by Malbone
 Miniature of Mrs. Sergeant by St. Memin
 Miniature of William Barton by St. Memin
 Photograph of painting of William Barton
 Photograph of painting of J. D. Sergeant from original at
 Princeton University
 Engraving by Savage from Peale portrait of David Rittenhouse
 Shoe buckles, cuff links and coat buttons of David Rittenhouse
 Shoe Buckles of Elizabeth Rittenhouse
 Cloak pin and bookplate of William Barton
 Portrait of Mrs. William Barton and their child
 Commonplace book containing letters of David Rittenhouse
 Copy of Benjamin Rush's eulogy on David Rittenhouse
 Copy of Paxton pamphlet by William Barton
 Genealogy of the Rittenhouse family by J. D. Sergeant
 Letter by David Rittenhouse dated Philadelphia, June 14,
 1777, regarding the Washington Coach
 Letter by David Rittenhouse, Norriton, October 22, 1793
 War Office notice, June 11, 1777
 Letter by Hannah Rittenhouse, dated "Sept. 28."
 Nine letters to David Rittenhouse from Thomas Jefferson



Transit instrument made by David Rittenhouse and used by him while observing the Transit of Venus, June 3, 1769. Owned by the American Philosophical Society

Loaned by the American Philosophical Society:

Refracting telescope by Dollond used by David Rittenhouse
Transit instrument made and used by David Rittenhouse
Clock made and used by David Rittenhouse
Painting of David Rittenhouse by C. W. Peale
Marble bust of David Rittenhouse by Ceracchi
Volume of manuscript observations by David Rittenhouse
"Memoirs of the Life of David Rittenhouse," by William Barton, Philadelphia, 1813; presentation copy with author's autograph inscription
Eulogy on David Rittenhouse by Benjamin Rush
"Proposals for Erecting a Monument," etc.; pamphlet proposing a monument for Rittenhouse and other early Philadelphians

Loaned by Mr. Herbert T. Ballard:

Engraving by Savage of Peale portrait of David Rittenhouse
Three autograph documents by David Rittenhouse

Loaned by Mr. Edward T. Boggs:

Photograph of the Rittenhouse home at Norriton

Loaned by Dr. Edward Potts Cheyney:

— Wall clock made by David Rittenhouse

Loaned by the Drexel Institute:

Musical and astronomical clock made by David Rittenhouse

Loaned by The Franklin Institute:

Orrery made by David Rittenhouse (On deposit with The Franklin Institute by the University of Pennsylvania)
"Nigger Head" from the Rittenhouse paper mill.

Loaned by the Germantown Historical Society:

Painting of Rittenhouse Mill, by L. C. Ball, 1889
Painting of birthplace of David Rittenhouse by L. C. Ball, 1889
Sower Bible with Rittenhouse family data
Windsor chair used by David Rittenhouse
Grindstone made of millstone from Rittenhouse mill
Three treenails from Rittenhouse mill
Three watches from Rittenhouse family
Portrait of David Rittenhouse in frame made of wood from birthplace
Surveyor's compass made by David Rittenhouse
Letter from Governor Snyder regarding removal of militia from Fort Rittenhouse

Loaned by The Historical Society of Montgomery County:

Surveyor's level made by David Rittenhouse

Loaned by The Historical Society of Pennsylvania:

Dr. George Logan's certificate of membership in The American Philosophical Society, dated February 1, 1793, and signed by David Rittenhouse

David Rittenhouse's bill for surveying the Delaware River, dated August 25, 1775

Order for payment of Henry Wynkoop's salary, dated September 21, 1782, and signed by David Rittenhouse

David Rittenhouse's account of cash paid to John Nicholson for soldiers of Pennsylvania Line, August 2, 1781

A number of receipts and various documents signed by David Rittenhouse

David Rittenhouse's notes as Vice-President of the Council of Safety on petition of Jean Duperon, dated February 11, 1777

Letters of David Rittenhouse:

To Captain Palmer, dated September 30, 1776

Colonel Hart, dated November 27, 1776

Peter Rhoads, dated November 27, 1776

John Maxwell Nesbitt, dated February 11, 1777

Joseph Ferree, dated May 16, 1777

Hon. John Bayard, dated November 6, 1778

Mr. Mitchell, dated November 18, 1779

President of the State of Pennsylvania, dated May, 1781

President of Council, dated February 27, 1783

Edward Bartholomew, dated March 31, 1783

William Hay, dated April 21, 1783

John Bayard, dated May 14, 1783

Charles Biddle, dated January 13, 1785

James Irvine, dated May 12, 1785

Dr. Williams, dated September 17, 1787

John Nicholson, dated December 12, 1789

John Nicholson, dated April 30, 1790

John Donaldson, dated May 10, 1790

John Nicholson, dated August, 1790

Benjamin Franklin Bache, dated January 10, 1794

The Treasurer of the Mint, dated November 18, 1794

John Kean, dated December 16, 1794

Thomas McKean, dated December 26, 1795

John Vaughan, dated January 4, 1796

J. Donaldson, undated

Thomas Willing, undated

Portrait of David Rittenhouse by St. Memin

Colored engraving by Savage of the Peale portrait of David Rittenhouse

Various prints of David Rittenhouse, his birthplace, his home,
and his paper mill
Clock made by David Rittenhouse
Protractor which belonged to David Rittenhouse
Benjamin Rittenhouse's surveying instrument

Loaned by Mr. Douglass Leaf:

Eight-day clock made by David Rittenhouse

Loaned by Mr. John Frederick Lewis:

Two eight-day clocks made by David Rittenhouse
Painting of David Rittenhouse by John Trumbull

Loaned by The Library Company of Philadelphia:

Water color sketch of Fort Rittenhouse by Poulson
"Transactions of American Philosophical Society," Volume
II., presentation copy with inscription by Rittenhouse
Letter from William Smith referring to David Rittenhouse as
Franklin's successor

Loaned by Mrs. Margaret L. Montague:

Eight-day clock made by David Rittenhouse
Eight-day clock made by Benjamin Rittenhouse
Medal of David Rittenhouse struck by United States Mint,
1871
Two autograph letters by David Rittenhouse to John Page;
on magnetism, and on transit of Venus
Manuscript of article by David Rittenhouse, in 1780, on an
optical illusion
Manuscript of article by David Rittenhouse on the discovery
of a comet
"Pennsylvania Chronicle and Universal Advertiser," May 9
to 16, 1768, containing account of the Orrery
Piece of paper made in the Markle Mill
Piece of white paper from same mill, with watermark

Loaned by Mr. William E. Montague, II.:

Surveyor's compass on tripod, made by Rittenhouse and Potts

Loaned by Mrs. E. Pusey Passmore:

Eight-day clock by David Rittenhouse

Loaned by Dr. Josiah H. Penniman:

One-day clock by David Rittenhouse
Diploma of the University of the State of Pennsylvania,
signed by David Rittenhouse as vice-provost

Loaned by the Pennsylvania Hospital:

Musical and astronomical clock made by David Rittenhouse

Loaned by Mrs. Thierry Van C. Phillips:

Eight-day clock by David Rittenhouse

Loaned by Mr. Horace Wells Sellers:

Surveyor's level made by John Sellers

Loaned by Edgar Fahs Smith Memorial Library, University of Pennsylvania:

Autograph letter by David Rittenhouse as director of Mint

Four stipple engravings of David Rittenhouse by various artists

Silhouette of David Rittenhouse

Photograph of Peale portrait of David Rittenhouse

Loaned by Mr. F. J. Stokes:

Eight-day clock by David Rittenhouse

Loaned by the United States Mint:

Portrait of David Rittenhouse, after Peale painting

Balance made and used by David Rittenhouse

Picture of first United States Mint on Seventh Street, Philadelphia

Loaned by the United States National Museum:

Six-foot zenith sector made by David Rittenhouse and Andrew Ellicott

Nineteen-inch zenith sector made by David Rittenhouse and Andrew Ellicott

Surveyor's compass made by David Rittenhouse and George Evans

Transit instrument by Andrew Ellicott

Loaned by the University of Pennsylvania:

Thirty-day clock made by David Rittenhouse

Portrait of David Rittenhouse by Charles Willson Peale

Gregorian reflecting telescope by Nairne, London

Letter from William Smith regarding money advanced for orrery

Memorandum from William Smith regarding money advanced for orrery

Memorandum regarding Smith's payments

Letter to David Rittenhouse from Charles Pettit regarding cost of orrery and David Rittenhouse's reply

Report of Committee on Orrery

Album of Hetty Barton

Photostat copies of University minutes regarding David Rittenhouse

Loaned by Hon. J. Ambler Williams:

Eight-day clock by David Rittenhouse.