

MECHANICAL ENGINEERING



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CLME

ANALYZING MULTIBODY CONTACT IN 3-D

The increased power of automated contact analysis in FEA software allows users to more accurately model system behavior.

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Four basic operations can enhance the clarity and contrast of digitized images, remove visual irregularities, and detect moving objects.

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LIGHT RAIL TRANSIT MAKES HEADWAY

Progress in light rail systems in North America has been achieved despite considerable obstacles.

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Samuel F.B. Morse, the inventor of the electromagnetic telegraph, was first a gifted painter and arts educator.

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These tools help assign dollar values to otherwise intangible benefits of flexible automation.

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Many old cruise liners have been updated with new propulsion machinery, navigation equipment, and engine room automation.

FIBER OPTICS EXTEND INTO FACTORIES

Expensive fiber-optic cabling has the technical edge over conventional wiring. As its high cost falls, industrial applications are expanding.

THE COVER

Automated 3-D contact analysis is used with superplastic forming analysis to determine the thickness of final formed parts. See page 46. (Photograph courtesy of Marc Analysis Research Corp.)



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Samuel F.B. Morse: A Master of Communication

The inventor of the electromagnetic telegraph and the code for transmitting information was first known as a gifted painter and arts educator. "Science and art are not opposed," he said.

Vilma Barr

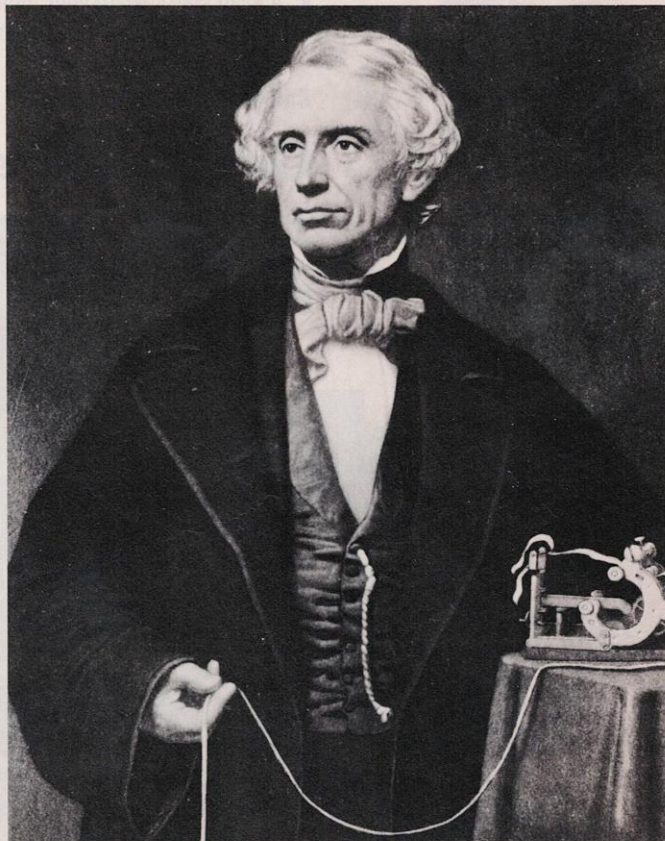
Contributing Editor
New York, N.Y.

At the age of 47, in 1838, Samuel Finley Breese Morse, one of the country's leading portraitists, put aside his palette and brushes and ended his career as an artist to devote his time to developing the telegraph. Ambitious, idealistic, restless, and brilliant, Morse was thoroughly engaged in the issues of the day. His seemingly disparate skills as a painter and inventor actually stemmed from a mind that grasped the elements of communication.

His talents were the subject of Carleton Mabee's 1943 Pulitzer Prize-winning biography, *Samuel F.B. Morse—The American Leonardo*. Publisher Harry N. Abrams last year brought out *Samuel F.B. Morse*, by art historian William Kloss, which shows how Morse recorded history in his paintings by depicting the leaders of the first half of the last century. But his classically composed canvases, now worth millions, were overlooked by many of his contemporaries, who seemed to favor scenes of action and confrontation.

The Educated Artist

More than anyone else in his time, Morse tried to raise the status of the



Inventor and invention. Morse is shown with an early model of the magnetic telegraph in this steel engraving by John Sartan, circa 1850.

Young-Morse Historic Site

artist in America to that of a professional. Much of the art produced in the United States during the pre-Revolutionary and Federal periods (with few exceptions, such as the work of Charles Wilson Peale) was either primitive or a translation of European-inspired art movements. Broadly educated, thoughtful, and literate, Morse represented a new type of artist who spoke and wrote effectively about the subject.

He was enrolled at Yale in 1805 at the age of 14 by his father, a Calvinist minister. Reverend Morse, who had also attended Yale, first had a pulpit in Charlestown, Mass., where Samuel was born, and then moved to Andover, Mass., to become one of the founders of the Andover Theological Seminary. He was also a historian and America's first geographer, the author of three definitive books on the young country's geography. Morse's inquiring intellect had roots on his mother's side as

well. His maternal grandfather, Samuel Finley, had been president of Princeton.

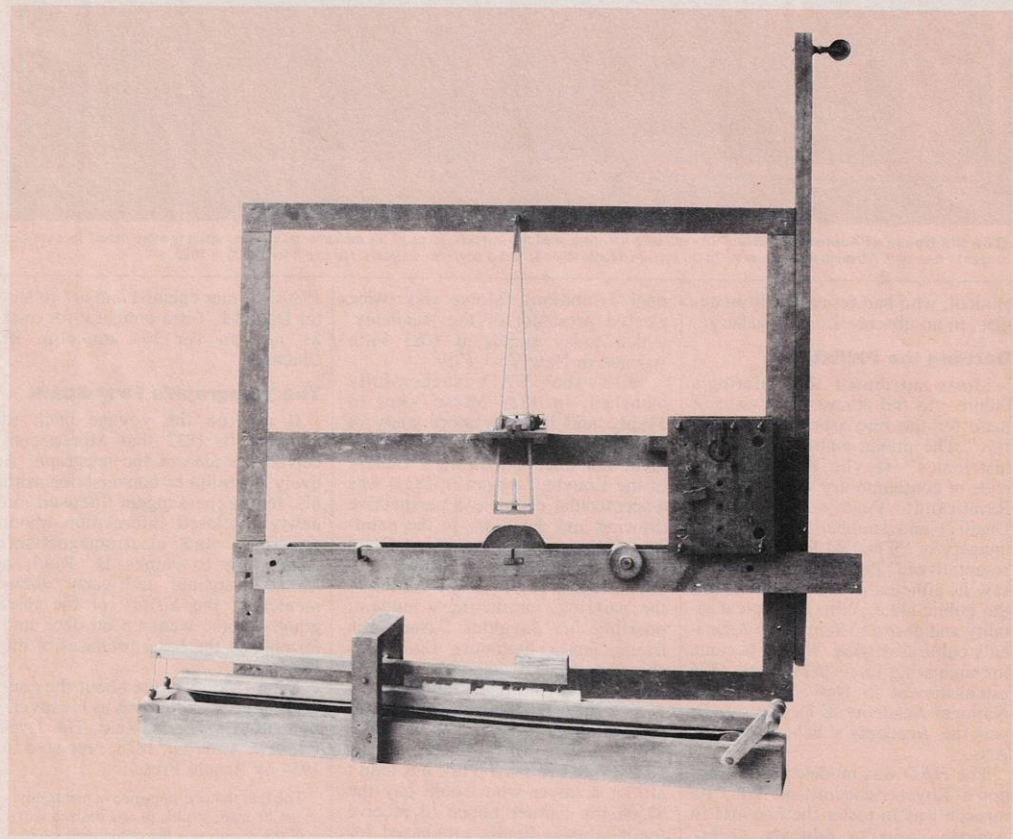
During his Yale years, Morse began painting small likenesses of his peers on ivory at \$5 a head. He also pursued his enthusiasm for nature and science, attending lectures on chemistry and galvanic electricity. After graduation in 1810, he went to Europe for four years of art study and returned to the United States to establish himself as a portrait painter. His reputation grew and, in 1820, he completed a portrait of James Monroe, the country's fifth president.

In 1821, he undertook a massive project on speculation. This was his depiction of "The Old House of Representatives," a canvas measuring $86\frac{1}{2} \times 130\frac{3}{4}$ in., which now hangs in Washington's Corcoran Gallery of Art. The painting shows a scene of quiet reason, in which nearly 100 people go about their daily tasks of

running the Republic.

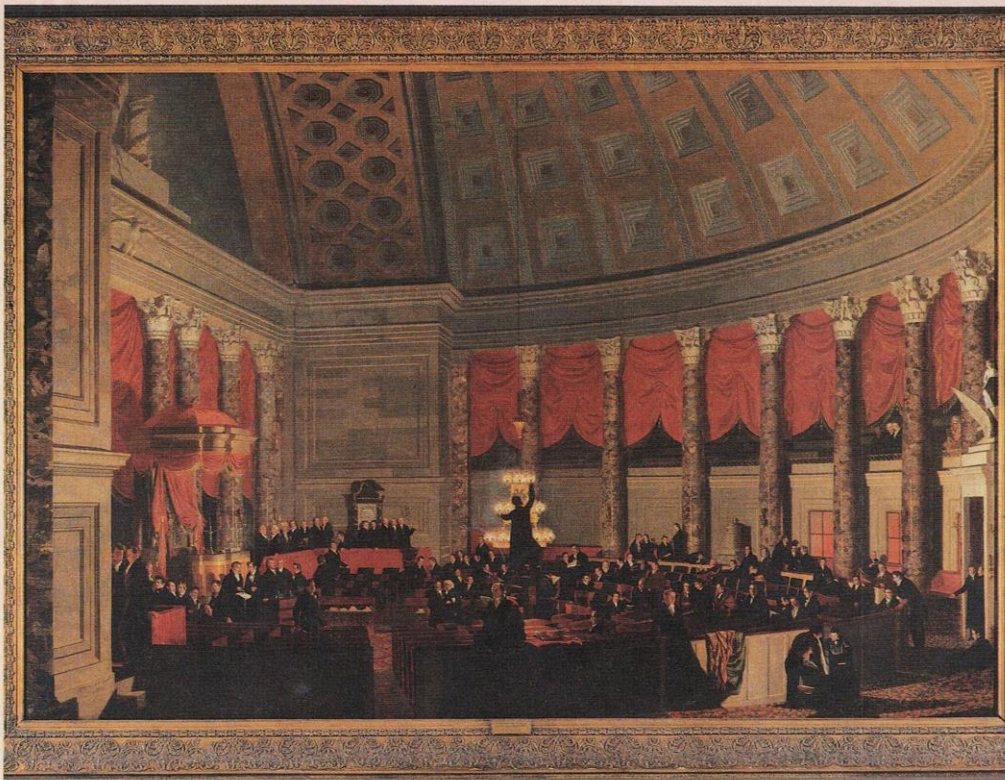
No interior scene of such monumentality had been painted in America. Morse made the hall the symbolic focus of his painting. He presented the House in night session, illuminated by the Argand oil lamps of the chamber's great chandelier. A room next to the House floor was put at his disposal so subjects could sit for him at their convenience and then return to the House floor to vote. Some of the 94 participants asked for second portraits, for which each paid \$20.

The painting received critical acclaim when it was displayed in 1823, but it failed to find a buyer or achieve popular support even though it was exhibited in Boston, New York, Hartford, and Albany. Morse had spent 18 months and hundreds of dollars to produce it. He finally sold it for \$1000 in 1829. It was acquired years later by the Corcoran from Daniel Huntington, a former Morse



Early receiver. Morse used this telegraphic reception device in a demonstration made for President Martin Van Buren and members of his cabinet in 1838. The rectangular frame is a canvas stretcher that Morse had used for his paintings.

National Museum of American History, Smithsonian Institution; photo by Alfred Harrell



"The Old House of Representatives." Morse made the room itself the symbolic focus of his monumental canvas, which is more than 7 feet tall and almost 11 feet long. Although the work won critical acclaim, Morse failed to find a buyer for six years. He sold it for \$1000 in 1829.

student, who had rescued it from neglect in an obscure London gallery.

Battling the Philistines

Morse attributed the painting's failure "to the almost total want of taste for the fine arts in our country." The public embraced "gothic histrionics" (as he described the style of contemporary works such as Rembrandt Peale's "Court of Death") and snubbed the idealized imagery of "The Old House of Representatives." Philistinism, as Morse saw it, afflicted artists, patrons, and the public alike. With his typical vitality and desire to help guide America's cultural destiny, Morse became the animating force behind the 1826 establishment in New York of the National Academy of Design (NAD) and the Academy's School of Fine Arts.

The NAD was modeled after London's Royal Academy of Arts. Its mission was to foster the fine arts in America and to educate young American artists. Operating money was raised from the proceeds of an-

nual exhibitions. Morse was twice elected president of the Academy, which today stands at 1083 Fifth Avenue in New York City.

With the NAD successfully launched, in 1829 Morse went to France and Italy for more study of classical art and design. His second great monumental painting, "Gallery of the Louvre," begun in 1831, was a spectacular example of perspective drawing and detailing. In the painting, Morse rehung the Salon Carré with his own choices from the Louvre's riches. He is at the center of the painting, instructing a student, possibly his daughter Susan. His friend James Fenimore Cooper is shown on the left side of the painting with Cooper's wife and daughter.

As "The Old House of Representatives" had, "Gallery of the Louvre" received critical praise after its 1833 exhibit in New York but didn't attract a buyer who would pay the \$2500 the painter hoped to receive for it. It was finally purchased for \$1300 (with the frame and on credit) the following year. In the early

1980s, former chemist and art collector Daniel J. Terra bought it for over \$1 million for his museum in Chicago.

The Telegraph's First Spark

It was on the voyage back to America in 1832 that Morse conceived the idea of the telegraph. A lively post-dinner conversation with his fellow passengers focused on newly disclosed information about electricity and electromagnetism. According to James D. Reid, a Morse associate and early documenter of the history of the telegraph, Morse went up on deck and formulated the basic premises of the telegraph.

Later, Morse wrote about the conceptual process that led to his invention (from James D. Reid, *The Telegraph in America*, 1878, reprinted in 1954 by Arnold Press):

The fact that the presence of electricity can be made visible in any desired part of the circuit was the crude seed which took root in my mind, and grew into form, and finally ripened into the in-

vention of the telegraph.

Either by the electro-chemical or electro-magnetic effect of a current, marks might be made at distances so great and in such variety as to render possible the easy communication of and record of an intelligible language.

I see no reason why intelligence may not be transmitted instantaneously by electricity.

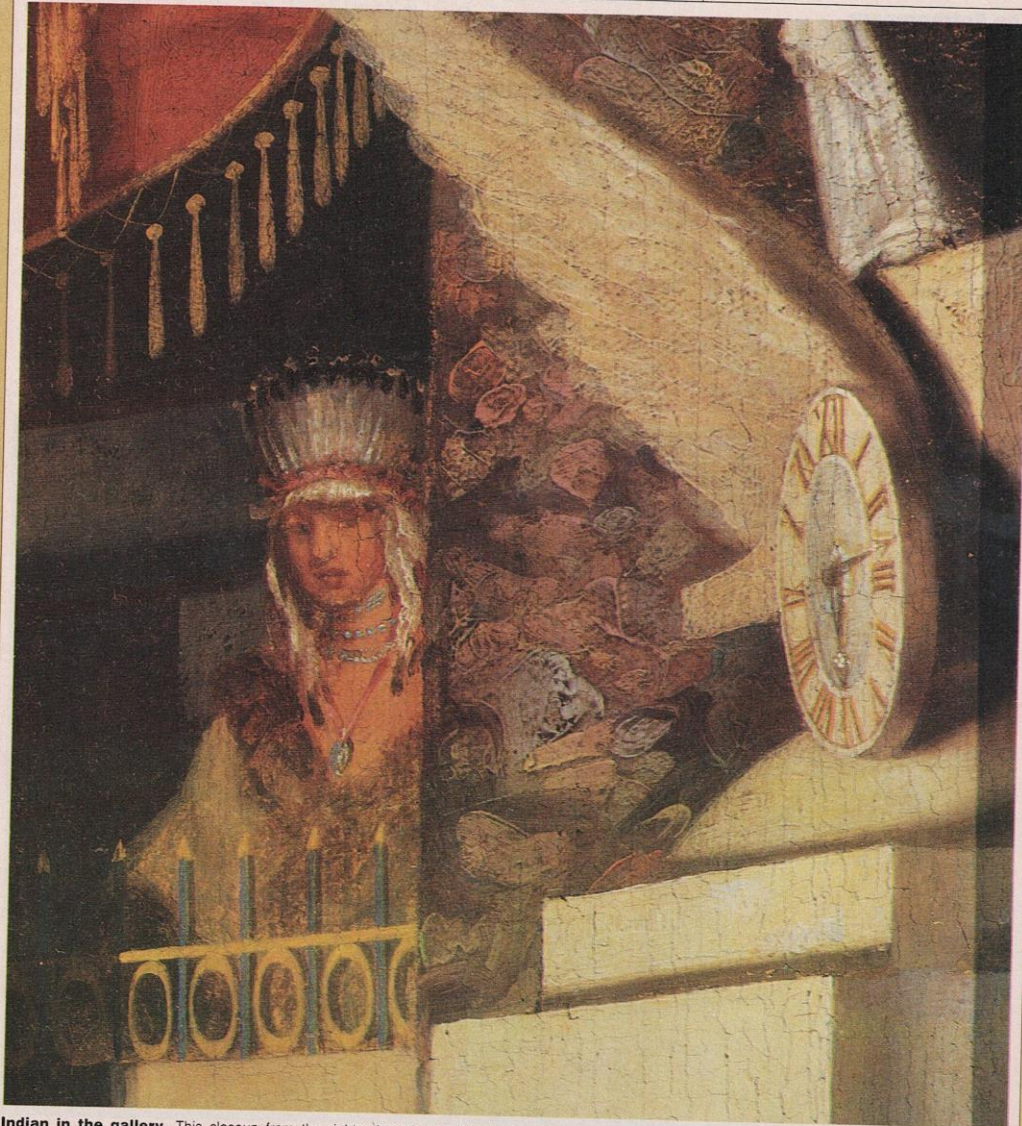
While Morse's prediction was correct that the information transmission would be instantaneous, devel-

oping and funding his invention was a slow and arduous project. In 1833, he began to fabricate various mechanical devices that would permit the electric circuit to be opened and closed to send signals and make recording the received message possible. He completed a prototype instrument in 1835, the year New York University appointed him Professor of the Literature of the Arts of Design.

Morse's studio at NYU became

the center of his investigations into the telegraph. Leonard D. Gale, NYU professor of geology and mineralogy, analyzed the problems that Morse was encountering in his working model, suggested that his battery and magnet were too weak, and helped him develop a multicelled battery and a multiloop magnet. In 1837 Gale became an official partner in Morse's enterprise.

Although he was widely respected for both his art and his science,



Indian in the gallery. This closeup from the right edge of "The Old House of Representatives" reveals a strange element. An Indian watches the proceedings from the visitor's gallery.

Collection of the Corcoran Gallery of Art

Morse had a difficult time making a living, existing in what he described as "genteel poverty." His first wife, Lucretia, had died in 1825 at the age of 25 from what is thought to have been a heart ailment, and his two children had been living with relatives. A welcome infusion of funds in 1837 from Alfred Vail, a former student and a member of a wealthy New Jersey industrial family, allowed Morse to keep his emerging company afloat.

The Entrepreneur

Morse stopped painting, disillusioned over the lack of recognition and acceptance of his art, and devoted his energies to the telegraph. With characteristic zeal, he convinced a skeptical nation, and later the world, of the importance of the invention. From October 6, 1837, when he filed his first U.S. patent, he promoted his invention tirelessly at home and abroad.

In early February of 1838 he successfully demonstrated the telegraph before an audience of scientists at Philadelphia's Franklin Institute. Two weeks later, President Martin Van Buren and his cabinet witnessed another successful demonstration.

But the bureaucracy withheld the patent issuance until 1839. And Morse's request for a \$30,000 government-supported development grant was not approved until 1843.

By this time, Morse was scraping the bottom of the barrel financially. "I have not a cent in the world," he wrote to Alfred Vail. But this did not stop him from running unsuccessfully for mayor of New York on the Native American ticket in 1836 and again in 1841. At NYU, he taught the first course in the daguerreotype photographic process. One of his star students was Matthew Brady, the famous Civil War photographer.

The Telegraph Clicks

Morse and his team worked feverishly to produce a working model of the telegraph and construct a Washington-to-Baltimore line by the spring of 1844. On May 24, a distinguished assemblage of lawmakers and their guests gathered in the Capital's Supreme Court chamber. The famous "What hath God wrought!" message from Numbers 23 in the Bible was sent to Baltimore and verified by Alfred Vail. When the government turned down Morse's offer to sell it the patent rights for

\$100,000 so he could resume painting, he rededicated himself to his invention and returned to Europe the next year to establish his overseas patent rights.

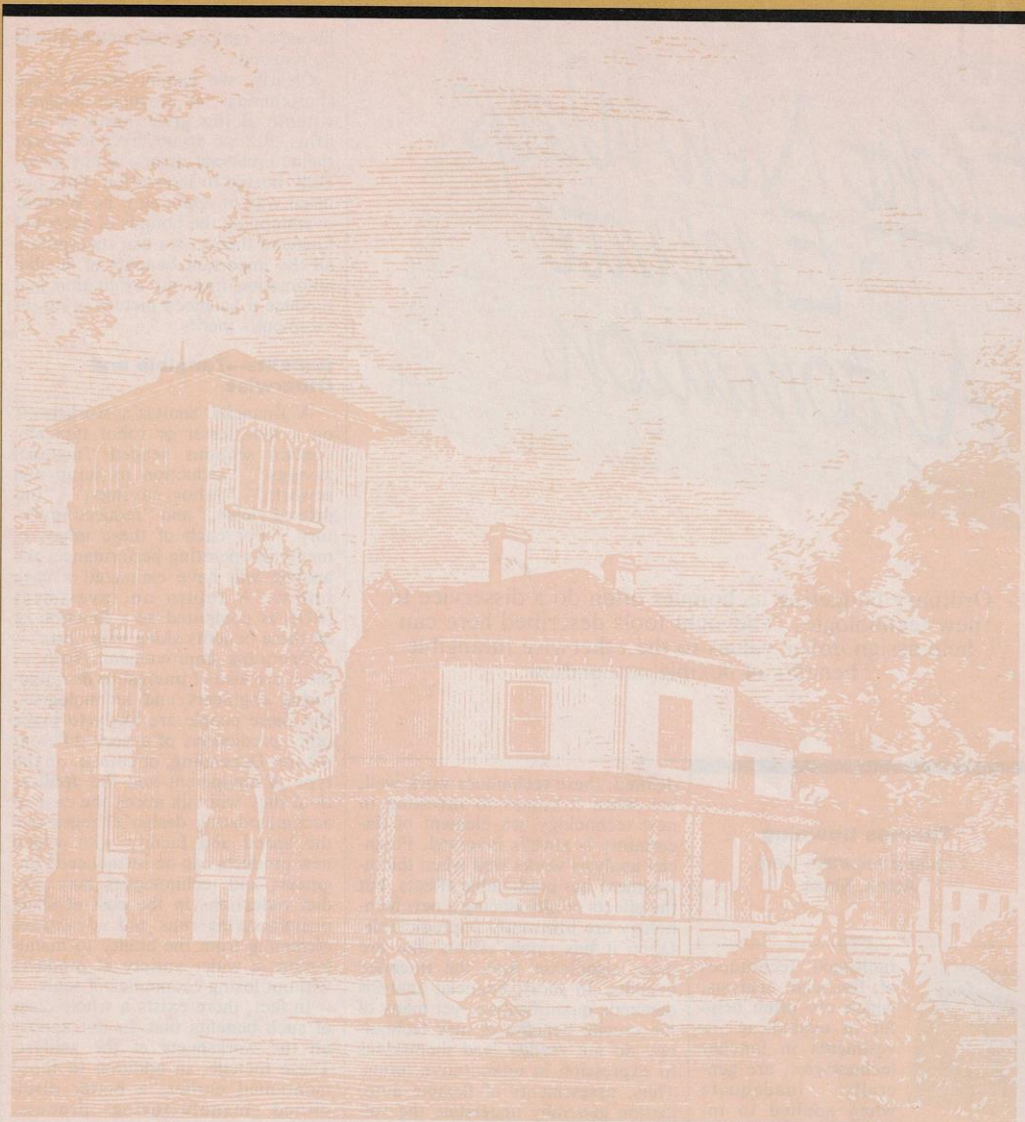
The experimental Washington-to-Baltimore line became fully operational on April 1, 1845. The basic charge was one cent for every four characters. The system's first 150-pound relays were of #16 cotton-covered copper wire saturated in gum shellac. Power was supplied by 100 Grove cells, renewed three times a week. Circuits were left open when the line was not in use; an instrument was connected in such a way that an operator started and stopped it at the distant station by dropping a brake on the flywheel when manipulation of the keys was suspended.

Morse's relentless pursuit of international patents paid off handsomely. In Paris in 1858 he was presented the equivalent of \$80,000 by 10 governments, including Russia and Turkey, as a gesture of their gratitude for the savings that the telegraph had made possible in their countries. By 1861, telecommunications technology in the United States had linked the eastern and western lines at Salt Lake City.



Samuel J. Terra Collection, Terra Museum of American Art

"Gallery of the Louvre." Morse depicted his choices of the museum's best paintings and put himself at the center, instructing a student.



Young-Morse Historic Site

Locust Grove. Once his telegraph began to pay off, Morse purchased a 100-acre estate on the Hudson River near Poughkeepsie, N.Y. He collaborated with architect Alexander Jackson Davis on the design of additions to the house.

Just Rewards

Two years after the commercialization of the telegraph, Morse's earnings permitted him to leave poverty behind. He purchased Locust Grove, a 100-acre estate on the Hudson River near Poughkeepsie, N.Y., and retained architect and landscape designer Alexander Jackson Davis. They worked together to design additions to the home. The octagonal, Italian villa-style home was counterbalanced by a four-story, Tuscan

tower with a skylighted billiard room on the east side. A three-sided library was framed by a veranda.

Morse had remarried and started a second family in 1848. He also purchased a New York City townhouse at 5 West 22d Street, near Madison Square. Locust Grove eventually became the Morses' summer retreat.

The artist and inventor did not feel that his life of accomplishments in both fields was without precedent. At an 1886 dinner in his honor at New York's Delmonico's, he re-

minded his audience that artists of the past sometimes had been scientists and inventors, "including Leonardo da Vinci. . . and our own Robert Fulton, a painter whose scientific studies resulted in steam navigation."

The telecommunications industry spawned by Morse's 30-mile Washington-to-Baltimore loop is now probing the cosmos. And there has been much recent interest in his paintings. ■