DENTAL EXHIBITION & REFERENCE COLLECTION AT THE SMITHSONIAN INSTITUTION

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The great advances in the profession of dentistry in the third quarter of this century can best be appreciated from a historical perspective. Anyone comparing present scientific knowledge and practices with those of past generations cannot but be overwhelmed by the remarkable achievements. Professional services, advanced therapy, and technology add to the patient's comfort and confidence and assure adequate treatment. New drugs reduce pain and inconvenience. New tools facilitate the dentist's work and enable him to achieve the best of performances. Day by day, dental education and scientific research are taking advantage of an ever-advancing technology.

The Smithsonian's reference collection and exhibits portray the past of the dental profession by showing history-making events, inventions, and documents which throw light on pioneer dentists, their ideas, equipment, and the environment in which they lived and practiced. Together with scientific and technical advances, one now also finds an emphasis on strict ethical standards in the teaching, research, and practice of dentistry (*1*).

During the past decade, curators in the Smithsonian's Division of Medical Sciences have enjoyed a close and rewarding association with the past and present chairmen and members of the Advisory Committee of the American Academy of the History of Dentistry to the Smithsonian, as well as with deans and faculties of the dental colleges of the Universities of Columbia, Maryland, Northwestern, and Pennsylvania (*2*). Through this assistance and cooperation, the division's collection has been greatly enriched until it has become the largest and most comprehensive of its kind in the Western Hemisphere (*3*). An attempt was therefore made to prepare a general display that would present various aspects of the history and practice of dentistry. This exhibition includes not only general themes such as dental prosthetics, operative and mechanical dentistry, and orthodontics, but also personal memorabilia and relics of pioneer dentists.

Figure 1. Busts, portraits, and personal memorabilia of two American dentists who pioneered in anesthetic surgery. On the left, Horace Wells (1815-48), who used nitrous oxide for tooth extraction as early as 1844. On the right, William T. G. Morton (1819-68), who was the first person (1846) to use ether successfully in a public demonstration. Donors: Dr. W. H. Archer, National Library of Medicine (through Army Medical Museum), and Dr. William J. Morton

Doctors Who Helped With the Exhibits

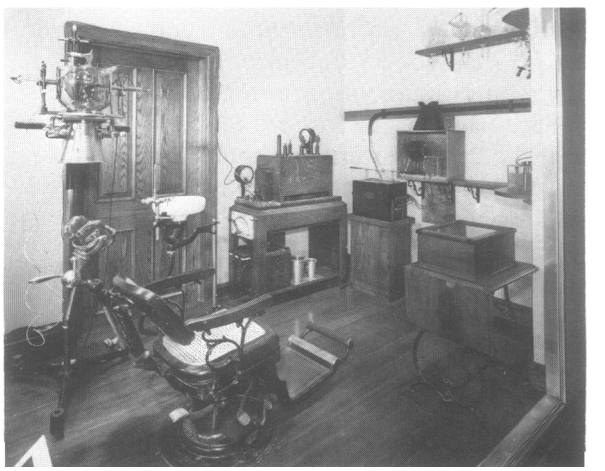
Past and present members of the Advisory Committee of the American Academy of the History of Dentistry to the Smithsonian National Museum of History and Technology and friends who helped in obtaining artifacts and preparing them for the exhibition at the Smithsonian included these doctors of dental surgery: C. Willard Camalier and Francis J. Fabrizio of Washington, D. C.; Alfred M. Chandler of Chevy Chase, Md.; Robert J. Nelsen of Rockville, Md.; Robert M. Stephan of Bethesda, Md.; J. Ben Robinson of Baltimore, Md.; Jacob Sharp of New Haven, Conn.; Donald A. Washburn and Allan G. Brodie of Chicago, Ill.; Otto W. Brandhorst of St. Louis, Mo.; James E. Aiguier of Philadelphia, Pa.; and Francis M. Blauston of White Plains, N. Y. Alfred R. Henderson, M.D., of Bethesda, Md., served as a special consultant in organizing the exhibits.

Anesthesia and Roentgen Rays

Since ancient times, practitioners have used several methods and drugs (such as opium, mandrake root, and henbane) for anesthesia, but with limited success. One of America's greatest single contributions to 19th century medicine was effective surgical anesthesia, and dentists played a leading role in its development, application, and propagation (*4*). An exhibit therefore is devoted to this achievement. In this exhibit is a bust of the dentist Horace Wells (1815–48) by J. Scott Hartley (fig. 1). Wells used nitrous oxide (known as laughing gas) for tooth extraction in 1844 and tried to interest others in his work. Born in Vermont, Wells practiced in Connecticut and died in New York City. Besides the bust, the only other surviving memorabilia of Wells are also on exhibit—an engraved portrait of him, two hand-colored miniature paintings of him and his wife, and a brass stencil bearing his name, all donated by Prof. W. Harry Archer, D.D.S., of the University of Pittsburgh (*5*).

Shown also in figure 1 is a bust, a watch, and a miniature painting of William T. G. Morton (1819–68), as well as an early inhaler based on one Morton devised. Morton, a native of Massachusetts, was the first dentist to use ether successfully as an anesthetic in a public demonstration (*6*). The year was 1846. Crawford W. Long (1815–78) of Georgia is also represented in this exhibit. A doctor of medicine, Long performed surgical operations with ether from 1842 to 1849, when he published his results. Figure 1 also includes a pencil sketch of him in profile and his memorandum case and watch as they appear in the exhibit. In 1903, an Ohio dentist, Charles K. Teter, introduced one of the earliest apparatuses for administering anesthetic nitrous oxide combined with oxygen in measured proportions (an apparatus on exhibit). It was the second such machine brought to the United States from Europe.

Figure 2. Partially reconstructed office of C. Edmund Kells (1856-1928), with his dental chair and a wooden box containing two X-ray tubes which he used. Kells was the first dentist to use X-rays in dental diagnosis and treatment. Donor: Mrs. J. O. Pierson



C. Edmund Kells (1856–1928), of New Orleans, La., was the first dentist to introduce roentgen rays in dental diagnosis (1898). He continued to apply and investigate their uses until his death from their effects (*7*). On exhibit are his first two X-ray tubes, as well as the dental chair he used (fig. 2). Kells' contemporary, the dentist and inventor Charles H. Land (1847–1922), obtained a patent in 1883 for vacuum dentures (which have been donated to the Smithsonian by his grandson, the pioneer aviator Charles A. Lindbergh). The dentures were to be held against the palate by air chambers formed between the metallic portion of the plate and the palatine arch. Land also introduced a compound hydrocarbon and muffle furnace and perfected a method for applying porcelain to restorations in artificial dentures. Later he devised a method for making all-porcelain jacket crowns (*8*).

Landmarks of Dental Progress

Significant landmarks of dental progress in this country are also represented by instruments, historical documents, paintings, and dental furniture (such as the revolving cabinet in figure 3), from the School of Dentistry of the University of Maryland (formerly the Baltimore College of Dental Surgery). This school, founded in 1840, was the first institution in the world to give academic training in dental surgery and confer appropriate degrees in this field. Robert Arthur and R. Covington MacKall, its first two graduates, were awarded their degrees in 1841. Arthur's diploma of dental surgery is shown in figure 4. The Latin text is signed by Horace H. Hayden (1768–1844), M.D., D.D.S., a professor of physiotherapy and pathological dentistry; H. Nillis Baxly, M.D., a professor of anatomy and physiology; Chapin A. Harris (1806–60), M.D., D.D.S., a professor of prosthetic dental surgery; and surgeon Thomas E. Bond, M.D., a professor of pathology and therapeutic specialist. In 1852, Arthur introduced the method of dental prophylaxis in which portions of the approximal surfaces of the crowns of separated teeth are filed away to prevent and arrest incipient caries. Four years later, Arthur introduced manual and automatic mallets for condensing cohesive gold foil. He later became one of the founders of the Pennsylvania College of Dental Surgery in Philadelphia and its first dean.

One historical object on display which has dra-

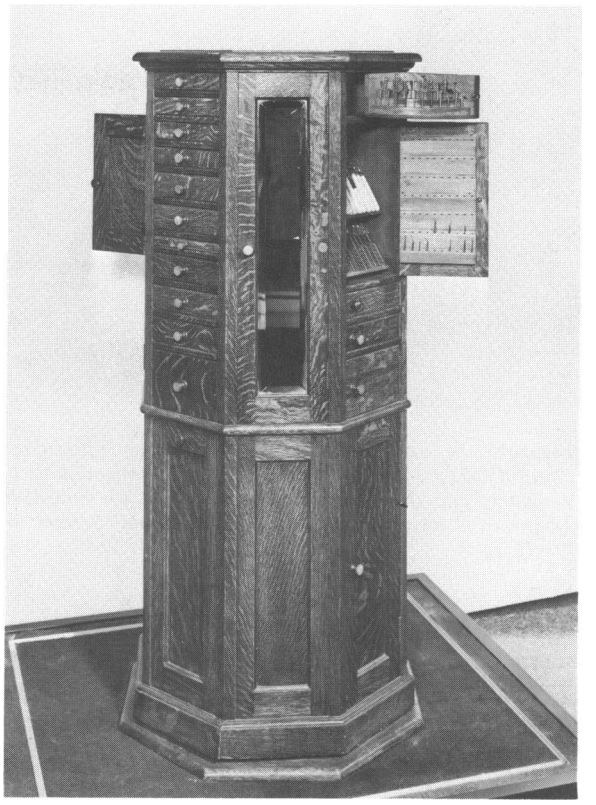
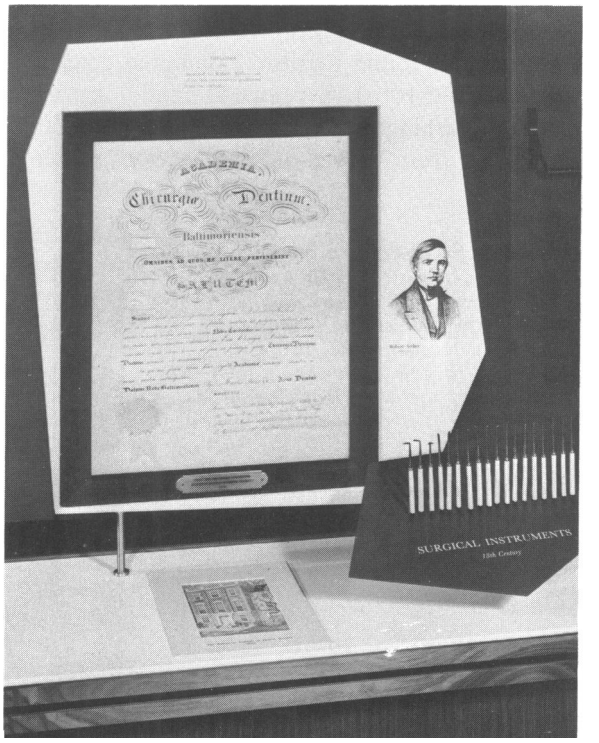


Figure 3. A revolving dental cabinet made in 1905 by A. C. Clarke Dental Manufacturing Company, Chicago, Ill. Donor: University of Maryland School of Dentistry

Figure 4. Doctor of Dental Surgery diploma of Robert Arthur (1819-80), who received one of the first two academic degrees conferred by a college of dentistry (1841). Donor: University of Maryland School of Dentistry



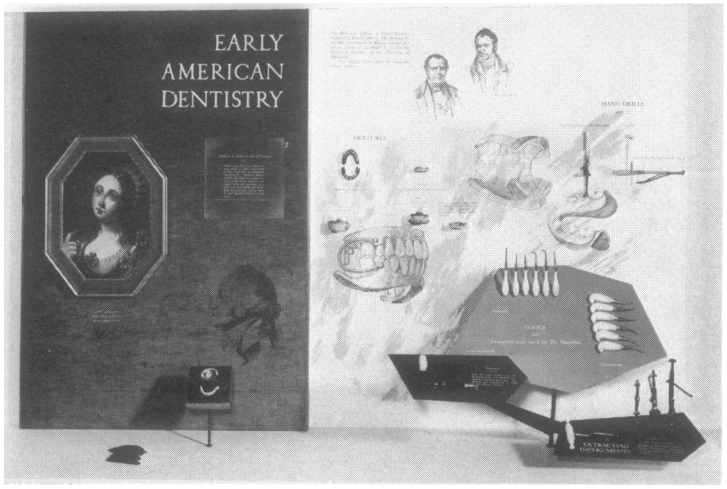


Figure 5. Set of dentures worn by George Washington about 1795, a painting of St. Apollonia, patron saint of dentistry, and dental instruments of the 18th and 19th centuries. Donor: University of Maryland School of Dentistry

matic appeal is the set of gold and ivory dentures worn by George Washington between 1795 and 1798. It was made by his New York dentist, John Greenwood (1760–1819), with modifications Washington had suggested. These dentures (fig. 5), the most complete of four surviving sets used by Washington, were given to the School of Dentistry of the University of Maryland by the Greenwood family. The upper denture was constructed in two parts. The first part consisted of a swagged gold plate, which had been hammered in a mold. The second part consisted of the upper teeth, made of hippopotamus dentine; these teeth were riveted to the gold plate. (In 1971, Dr. Reidar F. Sognnaes, professor of oral biology and anatomy at the University of California, Los Angeles, tried to make an exact replica of a set of Washington's dentures. He found that the hammered gold plate cost about $100.) Greenwood made the lower part of Washington's dentures of ivory; the anterior teeth were carved in two sections, each of which was joined to a bar by two wooden dowels. Two spring wires, secured to gold posts—a common practice until the first decade of the present century—kept the dentures in place (*9*).

Reconstructed Dental Offices

Reconstructions of dental offices show, in retrospect, the development of dental practice; two such displays are on exhibit (*10*). One is a representation of the office of Dr. Greene V. Black (1836–1915) and includes the original fixtures and appliances he used in his Illinois office.

Black became one of the most renowned Americans of his time in operative and pathological dentistry. He held four doctoral degrees (M.D., D.D.S., Sc.D., and L.L.D.) and was dean and professor of operative dentistry, dental pathology, and bacteriology at the Northwestern University Dental School in Chicago from 1891 until his death in 1915. He was a well-known educator and author. A 2-volume treatise on operative dentistry (*11*) which he wrote ran into several editions and was widely circulated here and abroad. In this work, he discussed the pathological changes that can occur in the hard tissues of the teeth and described technical procedures in preparing fillings.

Black, through his teaching and research, introduced new techniques in operative and restorative dentistry. He contributed notably to the advancement of dental terminology, the treatment of caries, the preparation of fillings, and the use of gold foil and amalgam for restoring teeth. He designed an improved dental foot engine soon after Sandy Morrison, in 1872, invented the first treadle engine. Black's engine, which is in the exhibit, has a metal flywheel; the foot pedal is secured to a wooden base. It drills with the aid of a string cord (fig. 6). The dental chair in the simulated office is

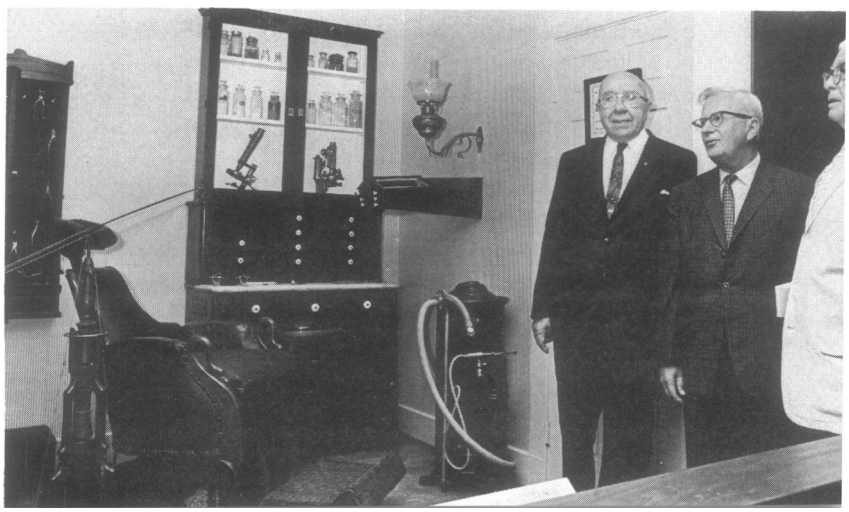


Figure 6. Reconstructed office of Dr. G. V. Black (1836-1915) being observed by (left to right) C. Willard Camalier, chairman of the Advisory Committee of the American Academy of the History of Dentistry to the Smithsonian and past president of the American Dental Association, and two other committee members who are prominent dentists—Dr. Henry A. Swanson and Rear Admiral Alfred W. Chandler. Donors: Northwestern University School of Dentistry and children of Carl E. Black, M.D.

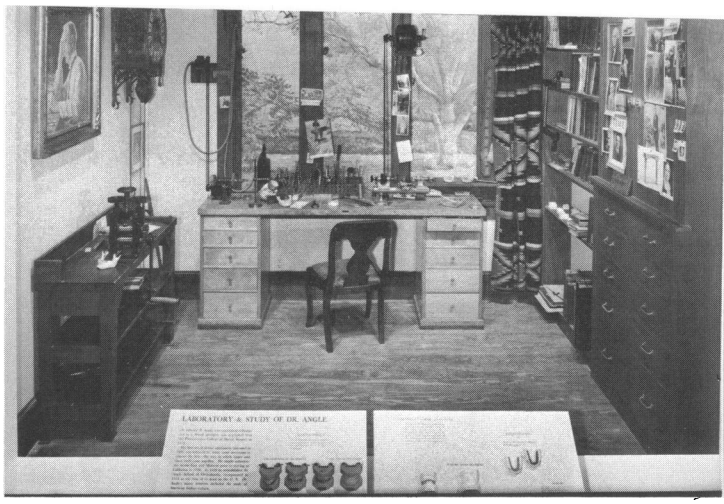


Figure 7. Furniture, equipment, tools, and personal memorabilia from the original laboratory and study of Dr. Edward H. Angle (1855-1930). Donors: University of Illinois College of Dentistry (through Prof. Allan G. Brodie and Prof. Cecil C. Steiner); Spencer R. Atkinson and Carlotta A. Hawley, orthodontists

of the type that G. W. Archer, a dentist of Rochester, N.Y., patented in 1874. Black added a footrest—a forerunner of footrests on later models. Also on display is a binocular, achromatic R. & J. Beck microscope (No. 5949, London, about 1865) with a triangular brass base. In his private research, he used this microscope and a Bausch & Lomb model given to him in March 1899 by the Alumni Association (class of 1898) of the Northwestern University Dental School.

The second reconstructed room in the exhibition is the laboratory and study of the dentist and educator, Edward H. Angle (1855–1930) as it looked about 1916; it includes personal memorabilia and dental implements which Angle invented or developed (fig. 7). Angle established orthodontics as a medical specialty in the United States and for more than four decades contributed to its systematization. He also founded the first American school of orthodontics (in California).

Angle's first set of dental appliances, patented in 1889, was followed by many more inventions designed to correct dental irregularities and the bite and to bring the teeth into normal occlusion (*12*). On display are an improved model of a ligature-typing device, a set of retaining pipes, an experimental model of one-handed forming pliers with clamps for holding the band, a steel clamp-band positioning instrument (developed from tools that Angle had designed earlier), a variety of patterns of band-forming pliers, and cards that show various types of brackets and arches and the use of spurs on bands for rotating teeth. On the wall hangs an iron clock from Angle's office, with four small wrought-iron side pieces (legs), a steel pendulum, and ornate grillwork (*13a*). Angle's many interests included the study of American Indian cultures, as can be seen from the Indian skulls, baskets, and a rug on display, as well as from Angle's books and clippings about Indians and related subjects (*10*).

While a great number of today's orthodontic appliances have been derived from Angle's inventions, new techniques for correcting dental irregularities have been introduced which depart from his system in that, with these techniques, teeth are removed to provide more space in the dental arch. Angle's former student, the orthodontist P. Raymond Begg of Australia, for example, in the 1940's introduced a method for correcting one kind of malocclusion. It was based on removal of the first bicuspids while the orthodontic appliances were in place, followed by the removal at intervals of the adjacent teeth. At the end of the treatment, the dental arches were closed. Begg also introduced the technique of using a light, resilient arch wire in orthodontic treatment (*13b*). In contrast, in about 1930, Spencer R. Atkinson, a dentist of California, devised the universal appliances method, which is based on Angle's technique but embodies modifications designed to minimize injurious stresses on the surrounding tissues of the teeth. Along with a wire for the lingual arch to control the molars, Atkinson used smaller arch wires for the remaining teeth. Charles A. Hawley, a dentist of Washington, D.C., in 1919, introduced the tooth retainers that have since been named "Hawley retainers" (*14*).

Dental Appliances and Dentures

In displaying dental implements of various periods, it seemed desirable to classify them according to subject matter and in categories which would elucidate their functions, uses, and historical significance. The card catalog and reference collection of the Smithsonian's Division of Medical Sciences are therefore arranged and classified under such titles as mechanical, prosthetic, and operative dentistry, oral hygiene and surgery, and orthodontia. Thus, a few dental exhibits in the division's gallery were devoted to specific themes emphasizing the beginning of professional dentistry, such as dentures, mouth hygiene, or operative dentistry, as the case might be (*10*).

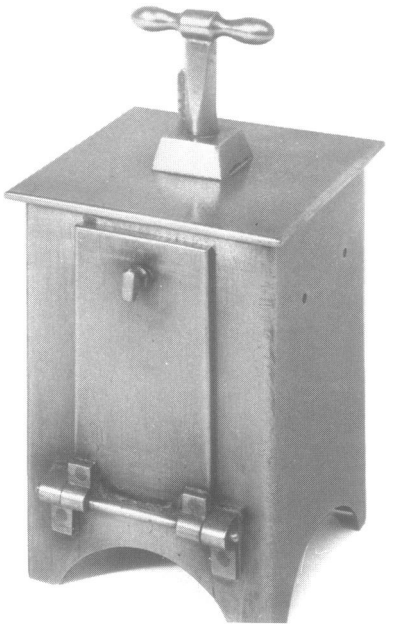


Figure 8. Model of a dental vulcanizer patented (No. 165 328) by F. Heindsmann of New York City in 1875. Smithsonian collection

The remains of early man, as well as documentary evidence, show that tooth care and mouth hygiene have been practiced since ancient times. Early man exerted much effort to replace missing teeth, both to preserve his appearance and to enhance his ability to chew. The practice of dentistry as a profession and advanced dental technology and science, of course, did not come until much later.

In the West, the first climax in dentistry was reached in the pioneering scientific work of Pierre Fauchard (1678–1761) of France. In 1728, he drew one of the first known illustrations of full dentures (*15*). Up to Fauchard's time, and also much later, the individual dentist carved artificial teeth for his patients from hippopotamus ivory, bone, wood, and other available materials, such as human or animal teeth. This arduous task, although it often took long weeks of hard work, produced few satisfactory results for several reasons. Dentures made from the substances mentioned tended to decay and to give off disagreeable odors. Many serious efforts were therefore made to find better materials for artificial teeth (*16*).

A breakthrough came in 1788, when Nicholas Dubois de Chemant, also of France, made "mineral-paste teeth." Interestingly enough, a pharmacist had much to do with this remarkable achievement. It was the French apothecary, M. Duchateau of St. Germain en Laye, who had the idea of using porcelain in dental prosthetics (1774). His friend, de Chemant, succeeded in manufacturing porcelain dentures and presented a set of teeth made of what he called "his" new composition to the Royal Academy of Sciences in Paris in 1789; he gave no credit to Duchateau. In 1808, Giuseppangelo Fonzi of Italy, a practicing dentist in Paris at the time, made "terra-metallic teeth," also from porcelain. This dentist introduced the use of a single porcelain tooth, which was soldered with platinum pins to bases made of metal, such as silver or gold. Later on, the manufacture of porcelain teeth expanded greatly, with excellent results in terms of good, durable dentures (*17*).

The introduction and successful use of nitrous oxide and ether as anesthetics ushered in a new and great era in dentistry in the United States in the 1840's. It also gradually, although dramatically, increased the demand for artificial teeth. The S. S. White Dental Manufacturing Company of Philadelphia and other dental manufacturing companies here and abroad greatly improved the appearance and durability of artificial teeth, making them available to dentists everywhere (*18*). During this period, several significant events took place in dentistry. Between 1846 and 1851, an Ohio dentist, John Allen, introduced a new kind of dentures, the "continuous-gum" type. The teeth in these dentures were built up with porcelain body, were soldered to platinum bases, and were then fired.

Three years later, the dentist and inventor Mahlon Loomis of Massachusetts (1826–86) devised the all-porcelain dentures included in the exhibit. In the same year, molds for making artificial teeth were also introduced. Models for such molds were filed with the U.S. Patent Office in 1864, 1868, and later years and patented. Moreover, during this same period, the mass production of vulcanized hard-rubber base plates and of dentures with porcelain teeth met with great success. This production made it possible for a dentist to prepare dentures in a few hours instead of in weeks of tedious work. In the late 19th century the demand for this type of dentures thus increased, but competition was strong, and prices fell so low that a complete set of dentures sold for only $5 (*18*).

In 1866, a dentist of Philadelphia, Eli T. Starr, invented a special flask for holding teeth molds during vulcanization. In the following decade, several vulcanizers were also devised and patented, including one in the exhibit, for which a patent was granted to John R. B. Ransom, D.D.S., of

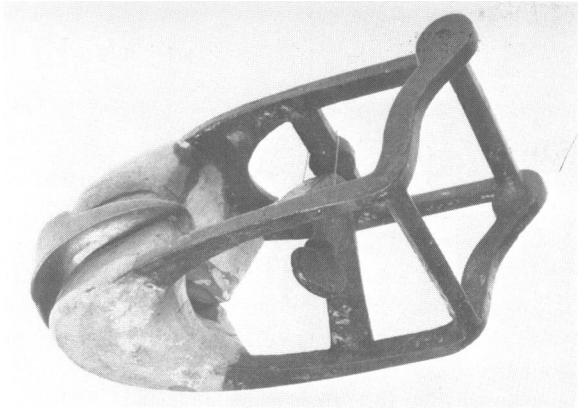


Figure 9. Model of an articulator patented (No. 90 706) by C. Von Bonhorst, Lancaster, Ohio, in 1869. Smithsonian collection

Ohio in 1874. One year later, F. Heindsmann patented the vulcanizer shown in figure 8. A heating apparatus for making celluloid dentures was also introduced in 1874 (*19*).

The invention of articulators for holding the casts of artificial teeth is attributed to a French dentist, J. B. Gariot. Gariot designed his first model in 1805 from impressions of the gum in a lifelike position. This invention allowed artificial teeth to be properly arranged. Some 35 years passed, however, before certain essential improvements on articulators were introduced that made them more practical and useful.

The dentist Daniel T. Evans of Philadelphia, in 1840, invented the first articulator with which dentists could reproduce the movement of the human jaw and make casts of the teeth and gums. With his articulator, which was two-dimensional and of the Gothic-arch type, Evans was able to demonstrate the movement of the condyles in a horizontal plane. Eighteen years later, W. G. A. Bonwill, a Delaware dentist, invented the first anatomical articulator, which became widely used after some modifications (see example in figure 9). Other models of articulators were subsequently patented—C. D. Chesney's in 1875, H. C. F. Oehlecker's (fig. 10) in 1878, J. B. McPherson's in 1879, and Matthew M. Kerr's in 1902.

Then, in 1910, a remarkable breakthrough took place as a result of the work and researches of a Swiss dentist, Alfred Gysi (1865–1957). Gysi invented an adjustable articulator in that year, which was the most ingeniously constructed of any articulator introduced up to the first quarter of this century. A graduate of the old Pennsylvania College of Dental Surgery, Gysi became a professor of prosthetic dentistry at the University of Zurich and assisted greatly in advancing a better understanding of the uses and applications of articulators (*20*).

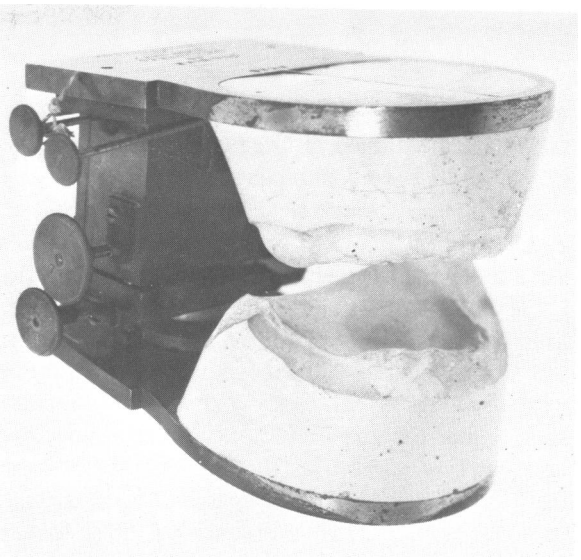


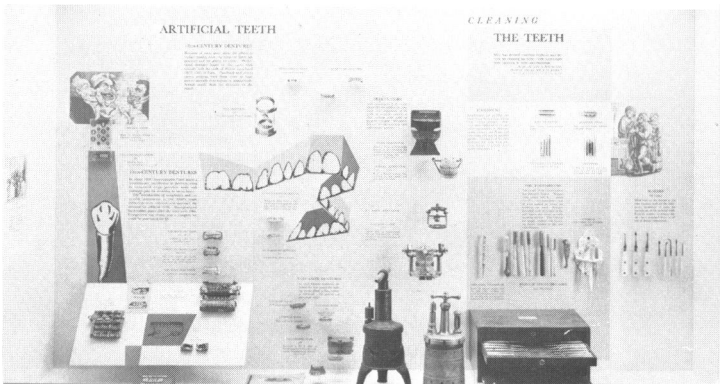
Figure 10. Model of an articulator patented (No. 198 853) by H. C. F. Oehlecker of New York City, in 1878. Smithsonian collection

Oral Hygiene and Surgery

In the less technical aspects of oral hygiene, the exhibit features implements for cleaning teeth (fig. 11)—19th century highly ornamented gold and silver toothpicks with inlaid mother-of-pearl handles, elegant Victorian toothbrush holders, fiber-stick toothbrushes with bristles of quill, wood, horn, ebony, and ivory, and handles of steel and gold inlaid with semi-precious stones; also, metal scalers assembled in ornate cases that often denoted the dentist's prestige (*21*).

Since tooth decay is as old as recorded history, instruments for extraction were devised long ago to help in pulling decayed teeth with the aim of relieving distress (*22*). A motif on a Greco-Scythian vase dating from about 300 B.C. appears

Figure 11. Dentures, articulators, and other implements used in making artificial teeth and for mouth hygiene. Donors: Columbia University School of Dentistry, University of Pennsylvania School of Dentistry, James E. Aiguier, F. M. Blauston, Gen. Charles A. Lindbergh, and Robert Meibauer



to portray a tooth extraction. Extractions, furthermore, are mentioned in Greco-Roman medical literature up to the seventh century of our era.

Almost one thousand years ago, Abulcasis al-Zahrawi of Moorish Spain (deceased about 1013), devoted a portion of his medical encyclopedia "al-Tasrif" to oral surgery (*23*). The exhibit includes a photograph of a sample page from this work (fig. 12). The encyclopedia is illustrated with drawings by al-Zahrawi that show in detail such dental tools as extractors, forceps, elevators, and scrapers, as well as the stabilization of loose teeth by means of fixed bridges and crowns made of gold. In his practice and teaching, this Moorish physician recommended the use of the tools he so meticulously described in the encyclopedia (*24*). This work, of which numerous copies are extant in the original Arabic, as well as in Latin translation, contains the first known independent surgical treatise with illustrations. The purpose of the illustrations was to instruct his students in the manufacture and use of dental implements. The treatise influenced later surgeons and makers of surgical instruments, both in the East and West. Even as late as the European Renaissance, surgical manuals in Latin contained illustrations of implements similar to those in the encyclopedia, or slightly modified (*25*).

Soon, however, improved dental instruments were introduced that provided the dentist with a better grasp of the teeth. In the 14th century, new and powerful instruments for extraction came into use which were called pelicans. These instruments were fashioned, seemingly, after the tools used by coopers in constructing barrels. The earliest pelican on display is 16th century French. In the late 17th century, the German-manufactured ueberwurf, an instrument for extractions which had a large bolster, came into wide use. (German authors of that century seem to distinguish between the pelican and the ueberwurf.) In the early 18th century, the German surgeon Lorenz Heister (1683–1738) designed an adjustable pelican. Little change has been made in the pelican over the years, as can be seen in the example in figure 13 of a model made about 1800. Heister's model was soon followed by a double-ended one and by the models of the Italian C. Vernetti (*26*), which are shown in figure 14.

Upon looking at these displays, one cannot help feeling relieved to be living in the second half of the 20th century with its high professional standards in oral hygiene and its advancing dental science and technology. Today's visits to the dentist's office are no longer the painful and terrifying experiences our forebears faced in the "good old

Figure 12. Page from Abulcasis al-Zahrawi's surgical treatise (completed about 1,000 A.D.), which contains illustrated sections on dental surgery. This Arabian author was the first to describe treatment of deformities of the mouth. He recommended and described in detail methods for removing hardened tartar with scalers and other tools. Photo courtesy of Khuda Bakhsh Oriental Library, Patna, India

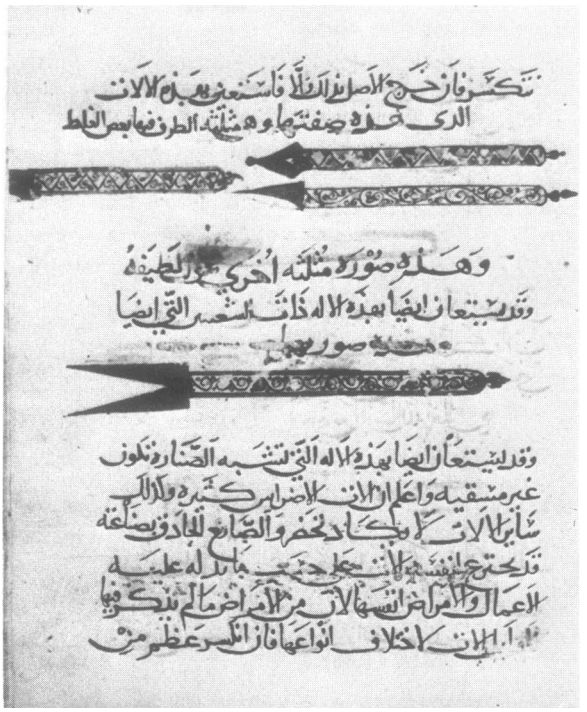


Figure 13. A double-ended dental pelican, made around 1800. This tool for extracting teeth has changed little over the years. Smithsonian collection

days" when dentists had only crude instruments and inadequate medications. Moreover, before the middle of the 19th century, no effective anesthetics for general and oral surgery were available. We cannot fail, therefore, to recognize and appreciate the humorous implications of such works of artists of the 16th and 17th centuries as "The Dentist" by Gerard van Honthorst (1599–1656), "The Tooth Drawer" by Gerrit Dou (1613–75), and "The Tooth Master" by Jan Steen (1626–79), reproductions of which appear in "The Dentist in Art" (*27*). A similar sense of humor and anticipation, mixed with religious beliefs and aspirations, can also be seen in paintings representing St. Appolonia of Alexandria, Egypt, the patron saint of the art of dentistry and patients suffering from dental diseases (*28*).

During the 18th century, new instruments to use in extracting teeth were introduced into the practice of dentistry. These instruments were powerful levers, known as "keys" because of their shape (fig. 15). During the extraction, unfortunately, these levers occasionally broke the bone as well as the tooth. Nevertheless, because of the convenience they afforded in quick and easy extraction of teeth, their popularity extended almost to the close of the 19th century. Various types of keys were invented—with shift claws from right to left, straight claws, perpendicular claws, bent claws, and claws in different sizes for the young and old. Because of the dangers in using the keys, however, forceps, in a variety of shapes and styles, gradually became the principal instrument for extractions, and they have been used continuously from the Renaissance (fig. 16). Around 1900, one U.S. manufacturer alone offered more than 100 styles, including a model with an adjustable handle, interchangeable blades, and jaws that could be adjusted and reversed (*29*).

Drills and Filling Material

Drilling, another phase of operative dentistry, is also represented by the implements and engines used for it over the years. From medieval times, if not earlier, dentists prepared cavities by digging out the decay with excavators or by filing down the teeth if the decay was not too deep. Files, file

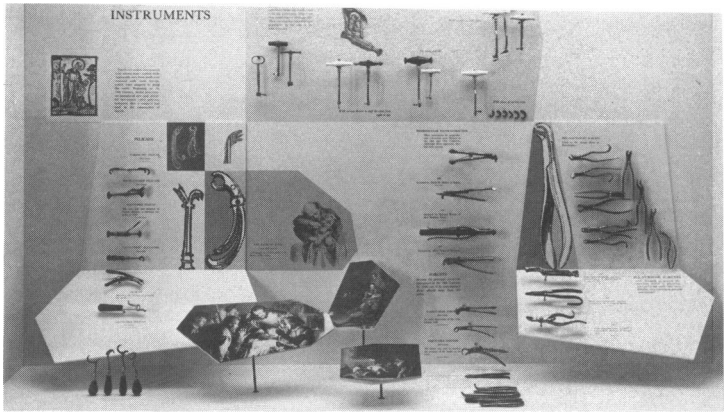
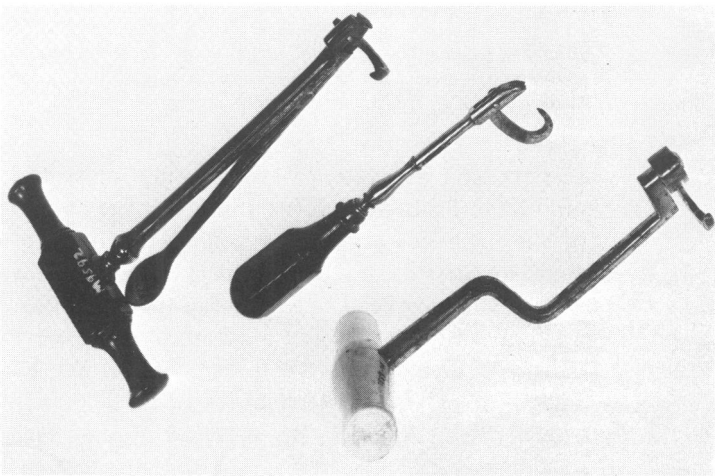


Figure 14. Tools used in extractions—extractors, pelicans, keys, and forceps; also reproductions of artists' depictions of dentistry. Smithsonian collection

Figure 15. Dental extraction keys: Vernetti-type from Milano, Italy, made in late 1790's; pelican type, known as Douglas lever, made in early 19th century; ebony-handled key with rectangular wrought-iron arm and bent shift, also made in early 19th century. Smithsonian collection



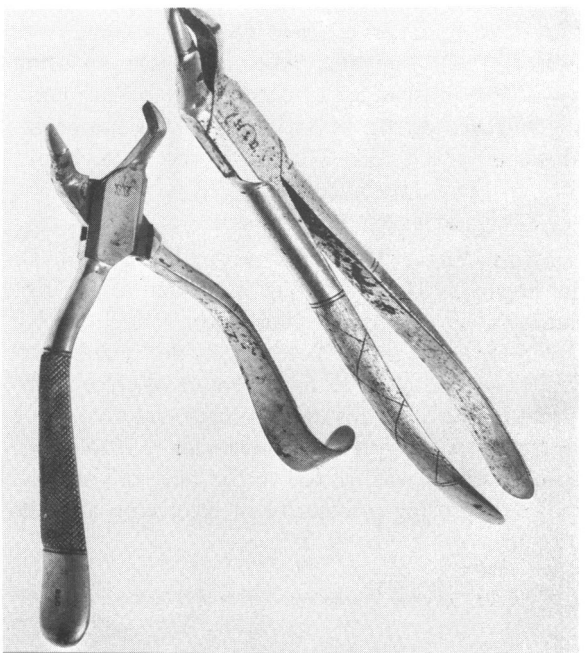


Figure 16. Dental alveola forceps with bayonet-shaped beaks, made in Chicago, Ill., in late 1890's; forceps for extracting upper third molar, made in the same period in Philadelphia. Smithsonian collection

Figure 17. Model of dental drill with electromagnetic plugger patented (No. 166 843) by Joaquin Bishop of Sugartown, Pa., 1875. Smithsonian collection

carriers, and excavators were the only tools used until hand drills were devised in about the middle of the 19th century. For reaching the parts of teeth inaccessible to the ordinary straight drills with a revolving head socket and to the bow drills, a variety of hand-powered mechanical drills, were invented, such as the 1850 drill of W. W. H. Thackston, a Virginia dentist.

A goodly number of the drills on display have elegant ivory handles. To rotate the bur, the handles were twisted on the opposite ends, squeezed together, moved in and out, or spun by pulling out a cord. A model invented in 1850 by a New York dentist, J. D. Chevalier, exemplifies the spinning type. The most successful of the hand-powered, angled drills of this period, however, was one invented by the dentist Charles Merry of St. Louis, Mo., in 1858. His invention paved the way for the dental engine with a flexible cable.

Efforts to supplant hand power in dental drilling began in 1864 with the introduction of Harrington's spring-driven "automatic" drill, which had a separate key. The so-called "pneumatic" drill of a Michigan dentist, George F. Green, followed in 1866. In this drill, compressed air from a foot bellows provided the power for a Roots-type blower, which was geared to the bur. In response to the increasing popularity of electricity and the growing demand for its application to medical treatment, Green, in 1871, invented the first known "electric" drill (*30*). In 1870, Joaquin Bishop patented a drill with an electromagnetic plugger (fig. 17).

What vastly enhanced the dentist's ability to cut tooth structures, however, was the introduction of the dental engine (fig. 18). It also made possible the adequate preparation of cavities that is consonant with a precise knowledge of tooth hygiene. J. B. Morrison, a dentist of St. Louis, invented a foot-powered dental engine in 1871 which superseded all previous types of drills. Shortly thereafter, significant improvements were made on Morrison's foot-treadle engine by an Illinois dentist-educator, G. V. Black. The S. S. White Dental Manufacturing Company (donor of several objects in our collection) introduced other refinements (*18*). During the early part of the 20th century, electric motors gradually replaced the foot-powered engines. New dental methods and implements, including the air-abrasive technique introduced in 1945 by the dentist R. B. Black of Texas and the belt-and-gear-driven drills, permitted safe, rotational drilling at a slow speed.

There remained, however, an urgent need for dental cutting instruments that would incorporate precision along with effective high speed. This need was met in 1953 with the introduction of the turbine contra-angle handpiece by Robert J. Nelsen, D.D.S., and his associates, Carl E. Pelander and John W. Kumpula, all three of whom were then at the National Bureau of Standards. This handpiece drastically revolutionized restorative dentistry, serving as the basis for the present-day high-speed turbine dental drills in use all over the world. It practically eliminated vibration, lessening the patient's unpleasant feelings or discomfort and permitting more efficient preparation of the tooth (*31*). In 1956, Paul H. Tanner and Oscar P. Nagel of the U.S. Naval Dental School further improved dental cutting instruments by installing a handpiece driven by an air turbine (*32*).

Another phase of operative dentistry represented in the display is tooth filling. For several centuries, practitioners filled cavities with wax, noncohesive gold, or other "stoppings." Contacts between adjoining teeth, however, could not be restored with these materials. Soft, ductile metals like tin and lead were also used without much success. Although tooth restoration was usually done by men who were highly skilled, both artistically and technically, and in cooperation with ex-

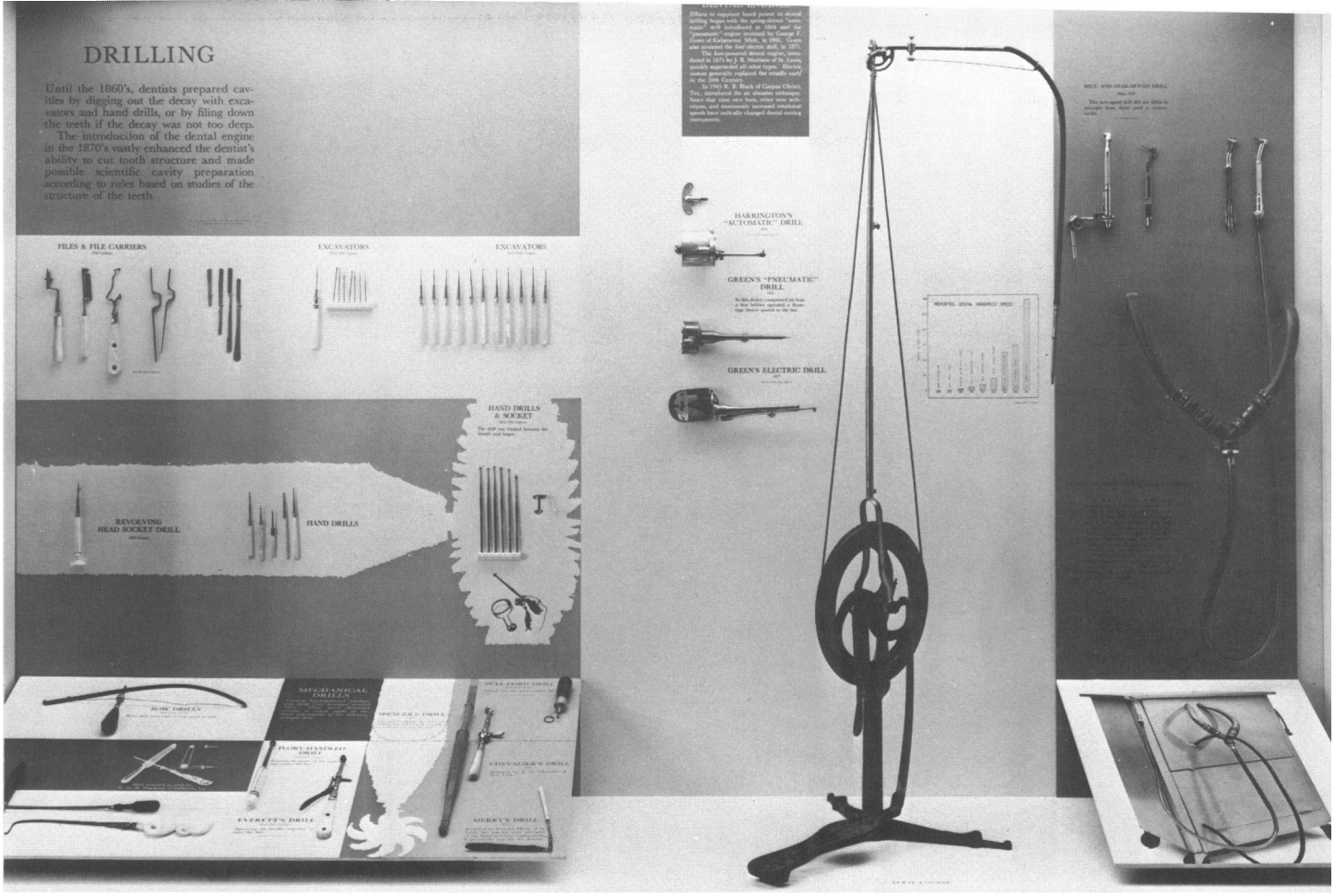


Figure 18. Files, excavators, drills, and turbine contra-angle handpiece. Donors: National Bureau of Standards, S. S. White Dental Manufacturing Company, Robert J. Nelsen, and K. L. Wilkinson

perts in gold beating, gum damage often resulted that caused unnecessary loss of teeth. Mallets and hand pluggers for packing gold into cavities, as well as shears and spatulas (with elegant mother-of-pearl handles), were used in manipulating the gold foil.

In the early 19th century, the attention of dentists was turned toward finding materials that would permit easier and faster fillings. In 1818, the first fusible amalgam, the Dracet alloy, was introduced in France. Throughout the second quarter of the 19th century, silver amalgam (silver coin fillings combined with mercury) was widely used. Later, tin and gold-tin alloy replaced the unsatisfactory mercury-silver amalgam. The use of cohesive gold fillings, introduced in 1855 by Robert A. Arthur (1819–80), a dentist of Philadelphia, continued until the early 20th century. The invention of condensers to cut gold foil into strips and the increased knowledge of tooth structure and improved techniques in operative dentistry all contributed to better preparation of cavities, to restoration of the natural contours of the tooth, and to better protection of the teeth and gums (*33*). During this same period, the studies and research of Sir Charles Tomes of London (1846–1928), of his American counterpart, Black of Illinois, and of others led to the development of stable composition materials for cavity preparations and to standardized tools for cutting and fillings (*34*), some of which are shown in figure 19.

In 1897, the dentist B. F. Philbrook of Iowa described his method of casting inlays. One year later, another dentist, N. S. Jenkins, introduced low-fusing porcelain, which has the advantage of fusing on gold without requiring high temperatures (over 2100° F.) to melt the gold. Shortly afterwards, artificial enamel and other silicate cements came into use, primarily for filling front teeth. In 1907 a dentist-inventor, William H. Taggart of Chicago (1855–1933), invented a machine for making cast-gold inlays (one sample is on exhibit), in which an inverted pattern procedure

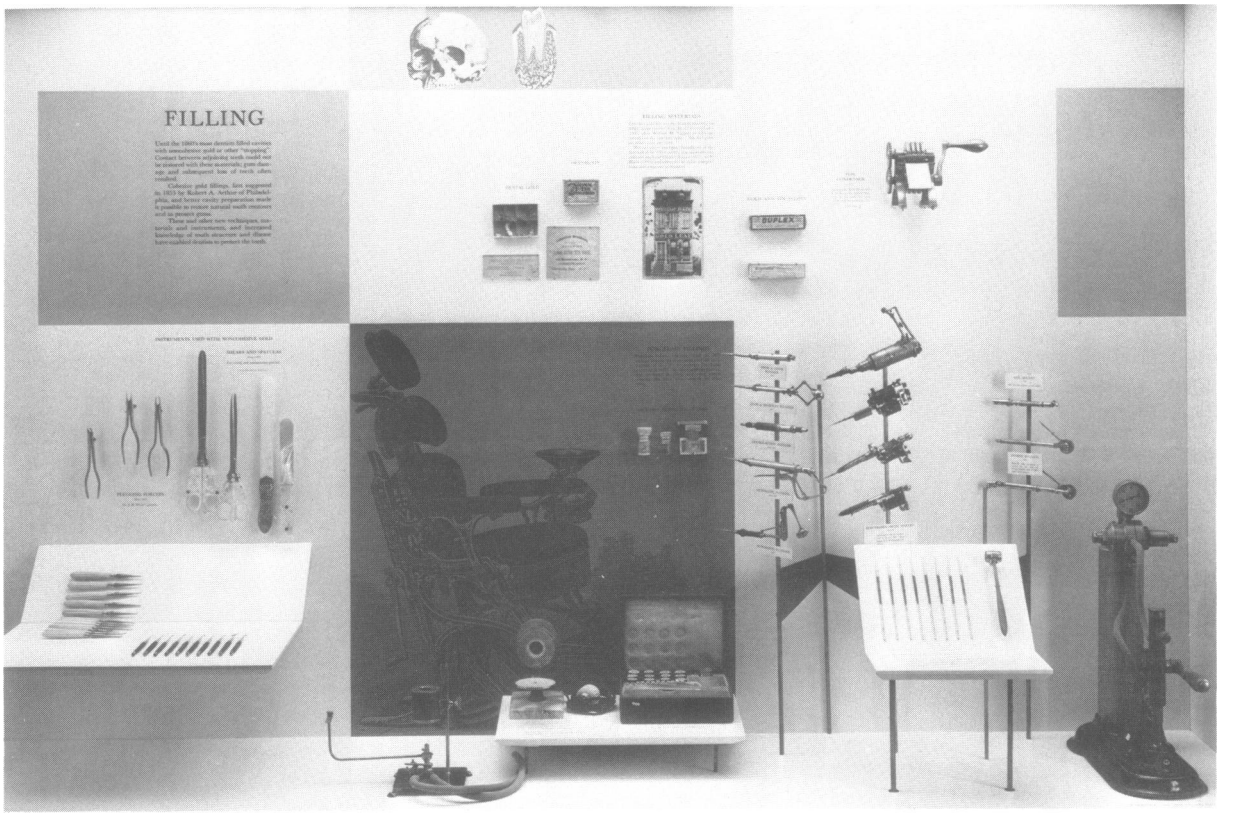


Figure 19. Tooth filling materials, condensers, and furnaces used in restorative dentistry. Donors: Hoskins Manufacturing Company, University of Pennsylvania School of Dentistry, and K. L. Wilkinson

was used. This technique revolutionized operative methods for filling cavities and for making crowns and bridge abutments. About the same time, the electric furnace began to replace platinum heating elements as the agent for fusing porcelain with chromel-alumel (*35*).

Choice and Aims of the Exhibits

The questions of choice and arrangement that arose in planning this dental exhibition were numerous. Extensive as it may seem, the exhibition contains only a small fraction of the very large and comprehensive collection of dental instruments and equipment at the Smithsonian's Division of Medical Sciences.

The exhibits are located on the first floor (northwest wing) of the National Museum of History and Technology in Washington, D.C. Most of the remaining dental collection is arranged and preserved in the reference hall of the division on the fifth floor of the same museum. The collections at both locations are available to interested researchers, dentists, scholars, and students who wish to see or examine them. A third part of the dental collection is in storage, but accessible by special arrangement with the curator in charge.

The purpose in preparing and designing this dental exhibition was threefold (*36*).

1. To present the fascinating story of the dental profession and explain its origins, development, and the salient events that have shaped its course.

2. To entertain the public and help it appreciate the remarkable advances that have occurred in dental surgery, teaching, and practice, as well as the increased scientific and technical knowledge of dentistry and mouth hygiene that have resulted from dental research and academic training in dentistry (*37*).

3. To demonstrate, through personal memorabilia, dental equipment, and artifacts, the ingenuity, professional efficiency, and skill that man has shown in tackling dental diseases and performing oral surgery.

The aesthetic and educational values reflected in the objects on display demonstrate the efforts, dedication, and achievements of the profession of dentistry through the centuries and in many different cultures.

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