The History and Development of the Dental Surveyor—Part III

Robert L. Engelmeier, DMD, MS

The third and final installment of this series reviews noteworthy instruments that have not enjoyed the commercial success of those discussed in Parts I and II.

J Prosthodont 2004;13:195-202. Copyright © 2004 by The American College of Prosthodontists.

INDEX WORDS: surveyor, dental surveyor, paralleling instrument, clasp surveyor, parallelometer

THE FINAL installment of this three-part series includes additional instruments that did not enjoy the commercial success achieved by those featured in Parts I[1] and II.[2] These designs do, however, further illustrate the intense interest in and importance placed upon cast surveying as an essential element in diagnosis and treatment planning. They also make it clear that designers tried to accessorize the dental surveyor from its infancy to expand its capabilities and improve its ease of use.

Although Dr. A.J. Fortunati did not design a dental surveyor per se, he is credited as the first to describe the principle and technique of cast surveying.[3-6] In 1918, he demonstrated the advantages of using a mechanical device to "map" the contours of abutment teeth. He replaced the steel-analyzing rod of a paralleling instrument of the day with a graphite rod and traced the greatest convexities of the teeth on a dental cast. The Bridge Parallelometer he used was originally designed for precision attachment work.

Simultaneous with, but independent of, Dr. Fortunati, the Philadelphia Dental Clinic Club actually developed the first instrument that could be classified as a dental surveyor.[7] The Robinson Surveyor has been recognized as the first instrument designed and built specifically for dental cast surveying. No patent was issued for this surveyor. No references have been found in the dental literature concerning its commercial production.

Applegate,[6] Cummer,[7] and Schwartz[8] all credited Weinstein and Roth of New York City, designers of the original Ney Surveyor, as the first to design a dental surveyor for successful commercial production. The J.M. Ney Company introduced this benchmark of surveyor design to the dental community in 1923 (Figs 1*A* and *B*).[9,10]

Recently, a Robinson Surveyor surfaced in the instrument collection at the University of Texas—Houston Health Science Center Dental Branch (Fig 2*A*). Curiously, it had been stamped with the S.S. White Company trademark without any patent references. A search of old S.S. White catalogs has revealed that, at least in 1935,[11] these inexpensive clasp surveyors were commercially available (Fig 2*B*).[12] This little surveyor enjoyed only a short production run in the mid-1930s. It was not available as early as 1923 when the Ney Surveyor made its debut. The reason for such a short production period for this instrument might be that by the time of its offering by the S.S. White Company, the solid and finely built Ney Surveyor had captured the lion's share of the market. The S.S. White Surveyor simply could not compete and so was soon discontinued.

The first half of the twentieth century was a prolific time for surveyor development in the United States. The interesting collection of designs presented here was gleaned from the U. S. Patent Data Base. Though most of these instruments did not enjoy commercial success, they nonetheless contributed significantly to the evolution of the dental surveyor. Many design idiosyncrasies of these instruments showed up in

Accepted October 21, 2003.

Correspondence to: Robert L. Engelmeier, DMD, MS, Director, Graduate Prosthodontic Program, The University of Texas—Houston Health Science Center Dental Branch. 6516 M. D. Anderson Boulevard, Room 422, Houston, TX 77030. E-mail: Robert.L.Engelmeier@uth.tmc.edu

1059-941X/04

doi: 10.1111/j.1532-849X.2004.04033.x

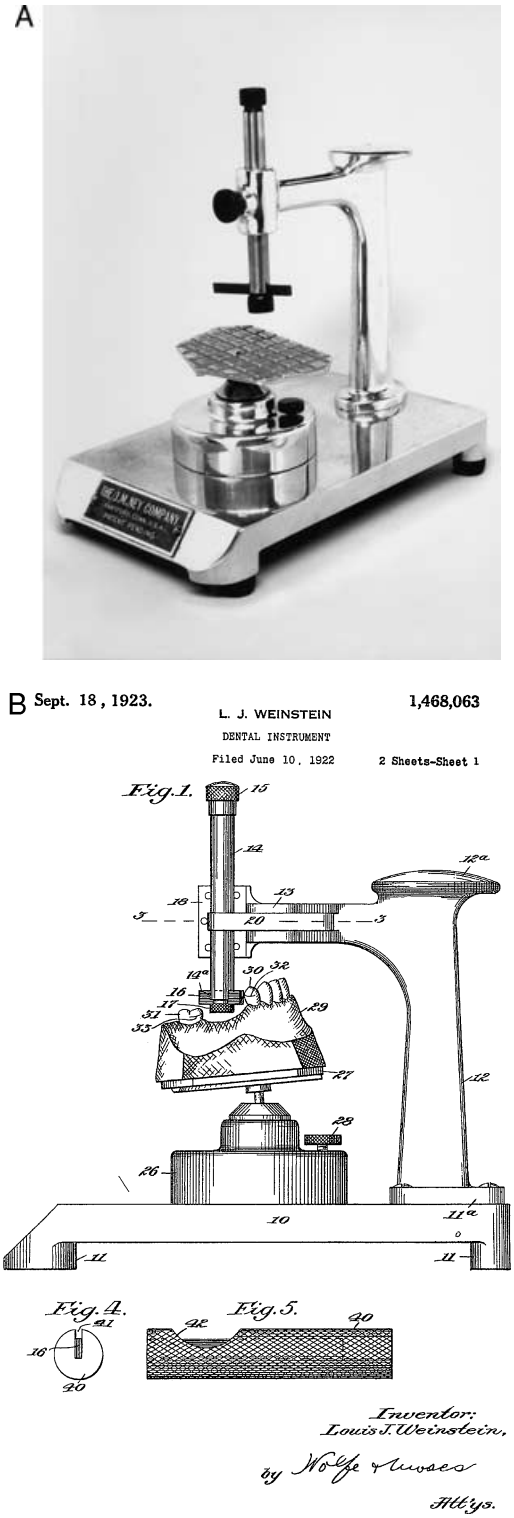

Figure 1. (*A*) The original Ney Surveyor (courtesy author's collection). (*B*) A U.S. Patent was granted to Dr. Lewis J. Weinstein of New York City for this instrument in 1923.

later designs, which were commercially successful. Presurveyor paralleling instruments were actually intended for precision attachment work; however, many of them established standards for surveyor and cast holder design. After 1918 many were designed to be both surveyors and paralleling instruments.

Paralleling Instruments—Progenitors of the Dental Surveyor

By the 1920s, some designers had produced instruments that were no less than outrageous mechanical fantasy, as evidenced by John C. Corcoran's patent of 1910 (Fig 3).[12] This bizarre marriage of a parallelometer and Bonwill articulator must have been as expensive to manufacture as it was complicated to use.

Victor Stoll of Brooklyn was granted a U.S. Patent in 1917 for a paralleling instrument that

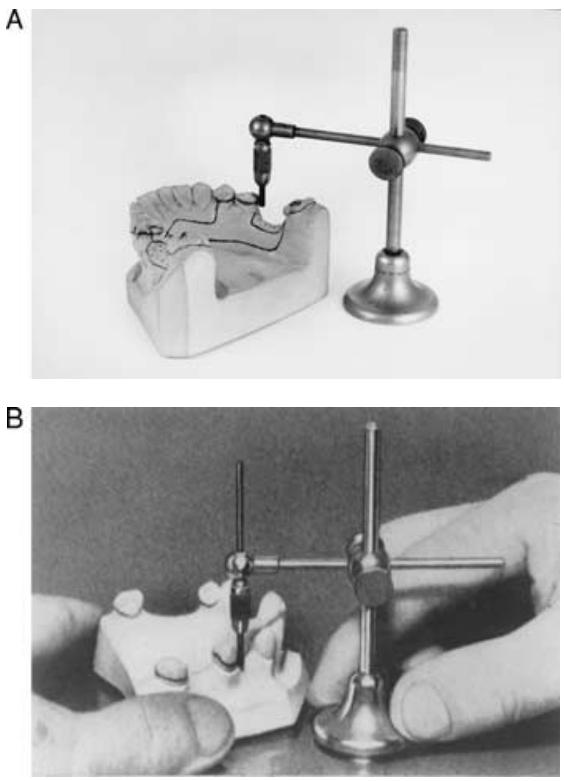

Figure 2. (*A*) The Robinson Surveyor, designed in 1918, was briefly marketed by the S.S. White Company in the mid 1930s (courtesy UTDB collection). (*B*) S.S. White Company Catalog illustration from 1937.

would have been an excellent cast surveyor, if only it had occurred to him to place a pencil lead into the mandrel chuck holder (Fig 4*A*).[13] He received a second patent later that same year for another paralleling instrument that sported a pivoting chuck holding arm, as well as a cast holder that undoubtedly inspired the designs of many that followed (Fig 4*B*).[14] However, in 1952, Stoll also wandered into a mechanical fantasyland with his dental surveyor and coordinator, discussed in Part II of this series.[2] It combined a surveyor, paralleling instrument, and articulator.

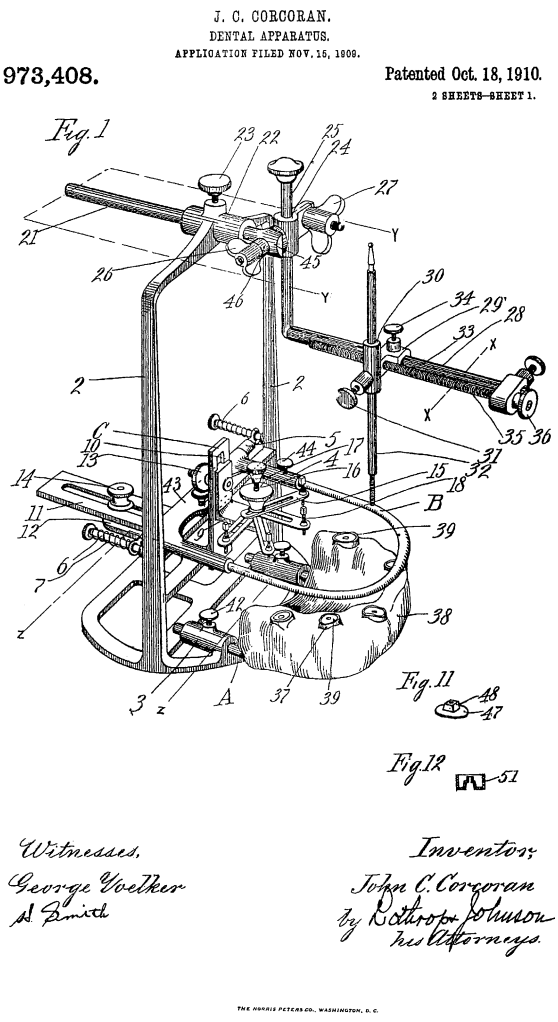
J. C. CORCORAN.
DENTAL APPARATUS.
APPLICATION FILED NOV. 15, 1909.
973,408. Patented Oct. 18, 1910.
2 SHEETS—SHEET 1.
Fig. 1
Fig. 11
Fig. 12
Witnesses,
George Voelker
A. Smith
Inventor,
John C. Corcoran
by Dettrop & Johnson
his Attorneys.

Figure 3. John C. Corcoran of St. Paul, Minnesota received a U.S. Patent in 1910 for this combination paralleling instrument/Bonwill articulator.

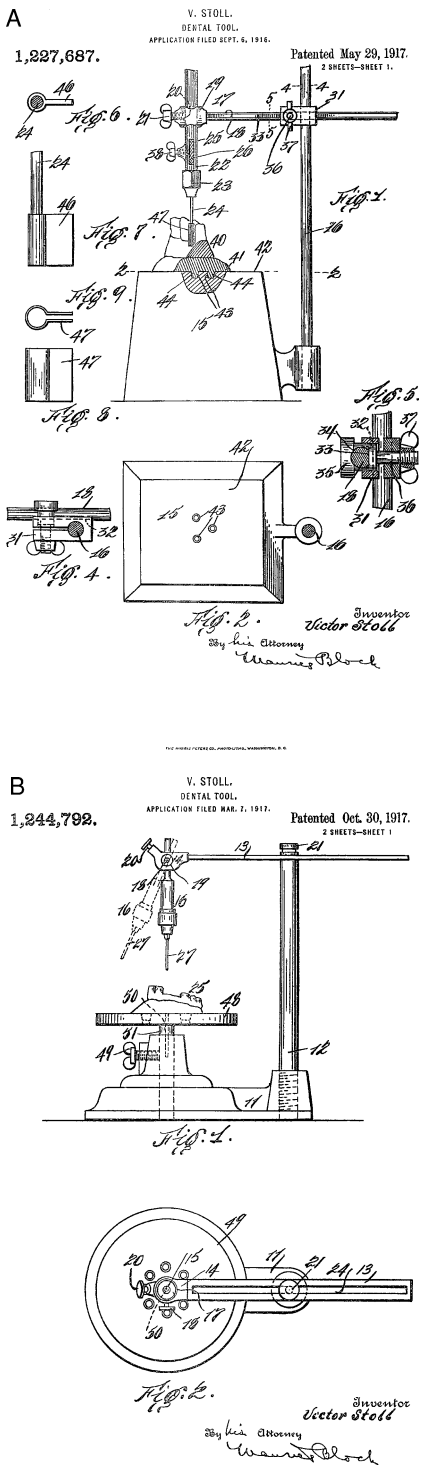
A
V. STOLL.
DENTAL TOOL.
APPLICATION FILED SEPT. 6, 1916.
1,227,687. Patented May 29, 1917.
2 SHEETS—SHEET 1.
Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.
Fig. 6.
Fig. 7.
Fig. 8.
Fig. 9.
Inventor
Victor Stoll
By his Attorney
B
V. STOLL.
DENTAL TOOL.
APPLICATION FILED MAR. 7, 1917.
1,244,792. Patented Oct. 30, 1917.
2 SHEETS—SHEET 1
Fig. 1.
Fig. 2.
Inventor
Victor Stoll
By his Attorney

Figure 4. (*A*) Victor Stoll received a patent in 1917 for this straightforward parallelometer design. (*B*) Victor Stoll received another patent later in 1917 for this paralleling instrument with a pivoting chuck holder.

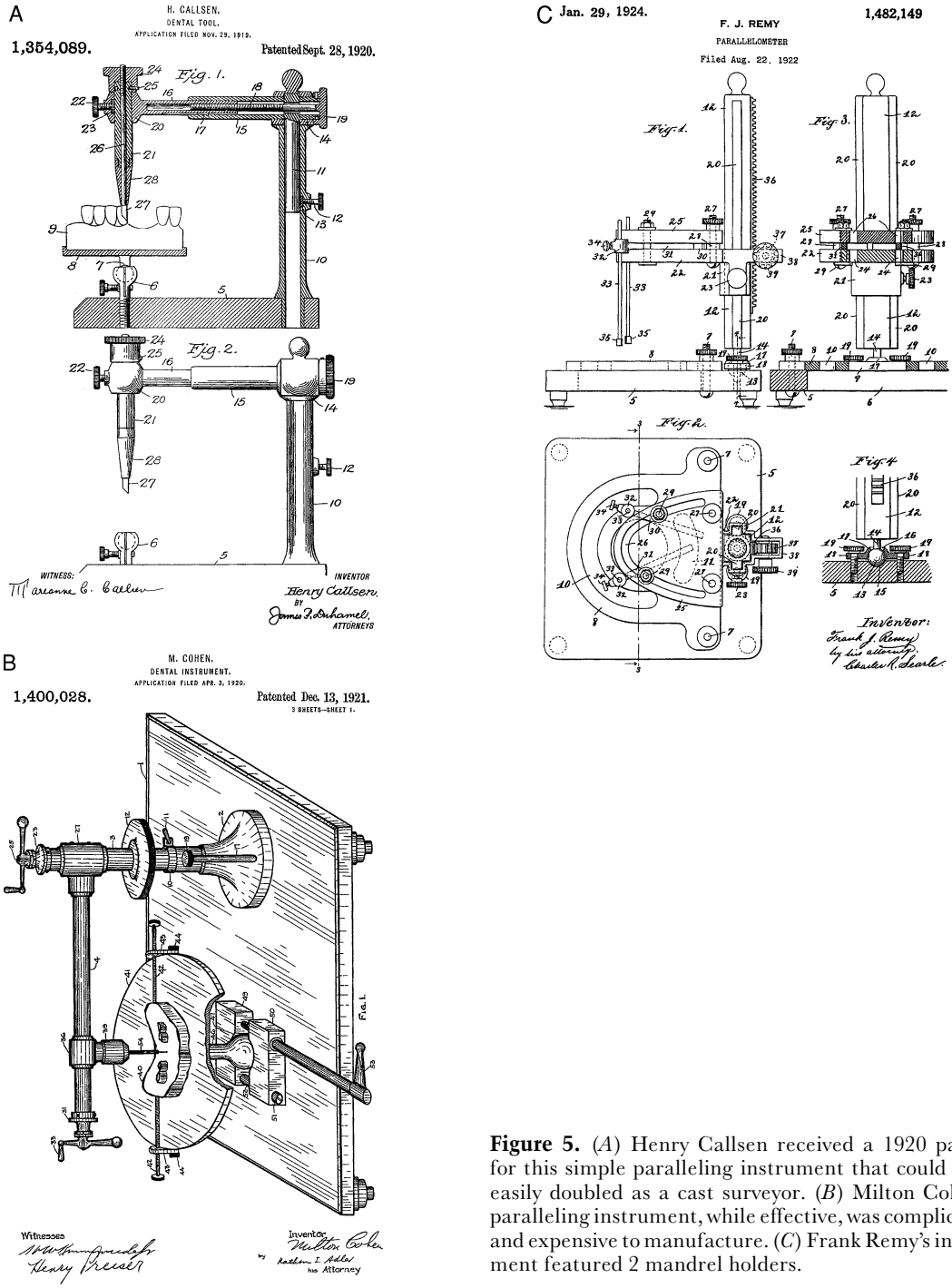

Figure 5. (*A*) Henry Callsen received a 1920 patent for this simple paralleling instrument that could have easily doubled as a cast surveyor. (*B*) Milton Cohen's paralleling instrument, while effective, was complicated and expensive to manufacture. (*C*) Frank Remy's instrument featured 2 mandrel holders.

Three more circa 1920 paralleling instruments are illustrated in Figures 5*A*, *B*, and *C*.[15-17] All three were designed for the same purpose—the placement of precision attachments; however, Henry Callsen's instrument is infinitely simpler than that of Milton Cohen, and it could have easily doubled as a cast surveyor. Frank Remy of Brooklyn designed a very solid parallelometer featuring two parallel mandrel arms. Henry A. Adler of New York designed a paralleling instrument,

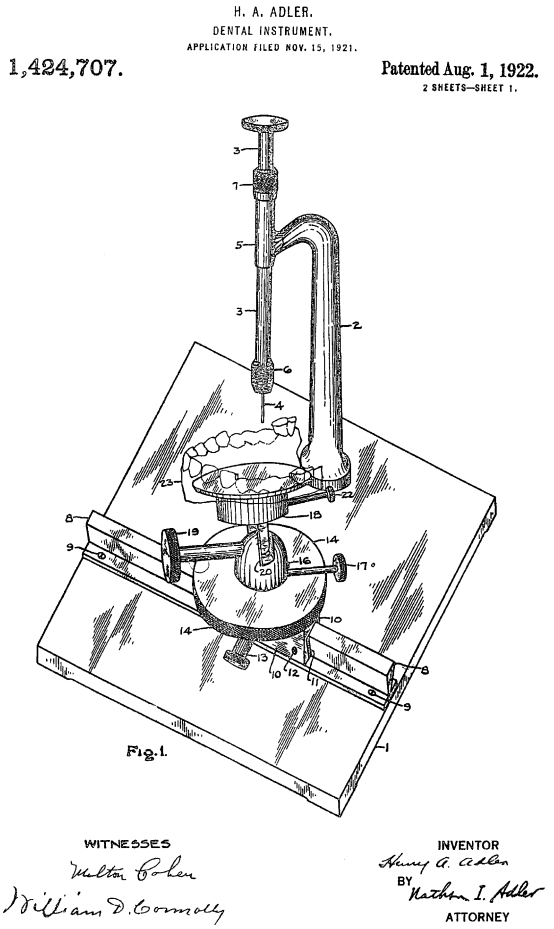

Figure 6. Henry Adler's parallelometer would have made a great surveyor if only he had thought to replace the analyzing rod with a pencil lead.

which predated the Ney Surveyor but had the look and all the qualities of a good dental cast surveyor (Fig 6).[18]

Patents for instruments designed specifically for cast surveying began to appear by the mid-1920s. Some were simple and easy to use while others were complicated by accessories and/or incorporation into an articulator design. But, as always, the complicated, expensive instruments could not survive the marketplace and quickly slipped into oblivion.

Frank L. Williams of Denver received two patents in 1925 for complicated but interesting instruments. Both were articulator/surveyors. Of particular note is that they were both plasterless and could be clamped to a bench top (Figs 7*A* and *B*).[19,20]

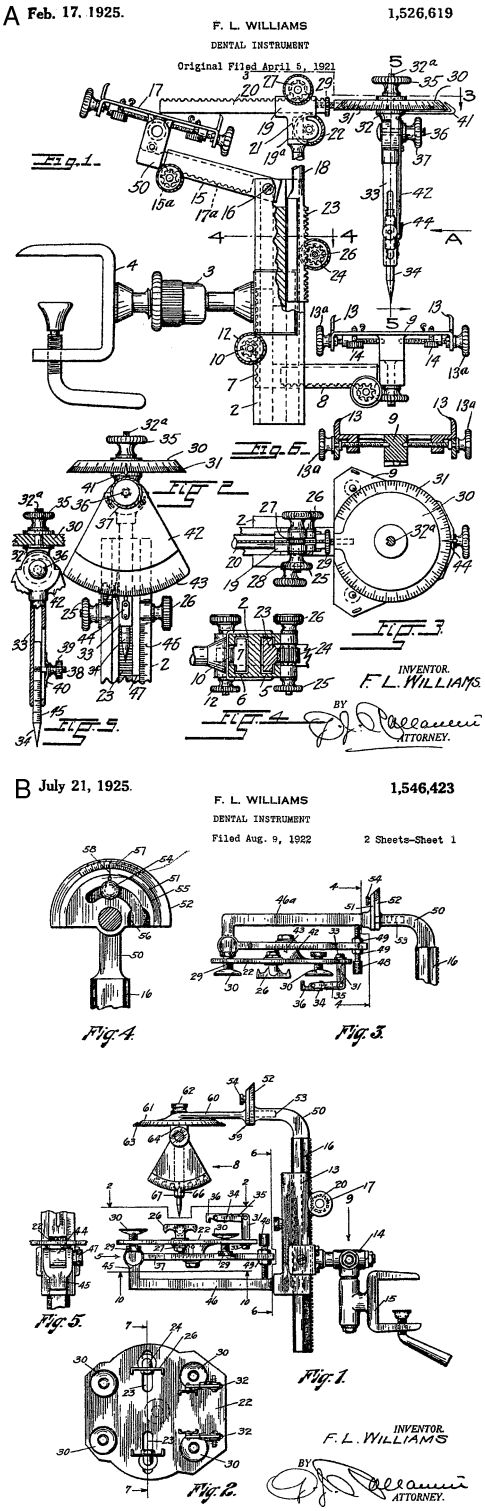

Figure 7. (*A, B*) These 2 articulator/surveyors, designed by Frank L. Williams in 1925 were plasterless and could be clamped to a bench top.

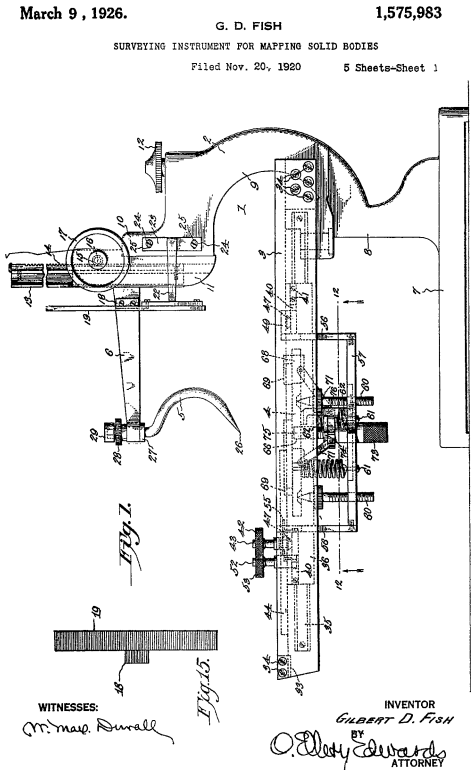

Figure 8. This elaborate surveying instrument was designed by Gilbert D. Fish to "map" solid bodies.

Gilbert D. Fish designed a surveying instrument for mapping solid bodies. Though not specifically intended to survey dental casts, it embodied many features seen in later dental surveyors (Fig 8).[21]

The best of the early designs, for the most part, were the least complicated, and their features have endured. John M. Craigo designed a dental surveyor and a milling machine more than 75 years ago. Both would be at home on a modern laboratory bench (Figs 9*A*, *B*).[22,23]

August Greth developed a rather elaborate broken arm surveyor in 1937. His patent drawings resembled a plumbing schematic. His design was obviously very expensive to manufacture, which in the end contributed to its demise (Fig 10*A*).[24]

Elmer C. Harris of Hayward, California received a 1950 patent for his dental surveyor, which doubled as a milling machine. His simple approach to double pivoting surveying arms inspired a number of blockout and milling instruments that followed (Fig 10*B*).[25]

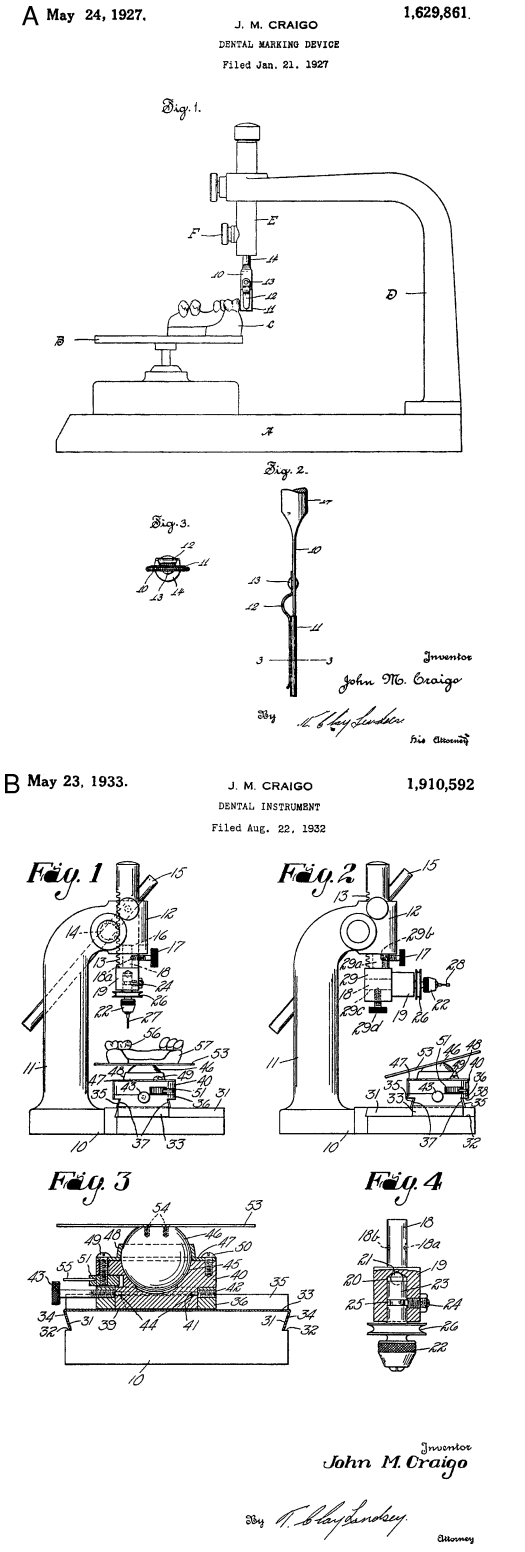

Figure 9. (*A*, *B*) John M. Craigo, of Hartford, Connecticut, invented a straightforward surveyor and a milling machine 75 years ago.

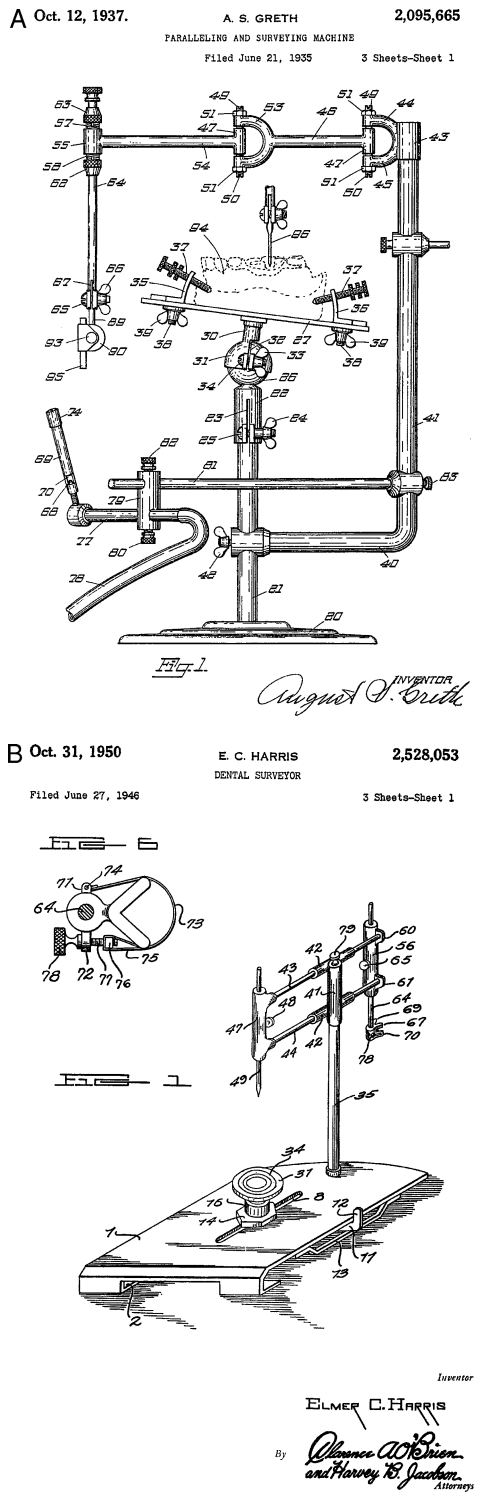

Figure 10. (*A*) August Greth's surveyor, though versatile, was overly complex and surely expensive to manufacture. (*B*) Elmer Harris designed this practical surveyor/milling machine in 1950.

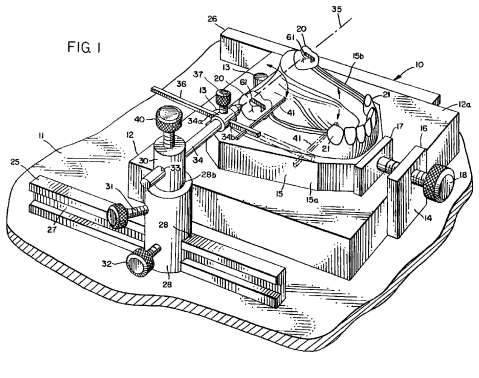

Figure 11. This unique cast holder was designed by M. Michael Salib to facilitate surveying casts for dual paths of insertion.

Late Twentieth Century Directions in Surveyor Design

Over the past 50 years, further development in surveyor design has waned in the United States. This undoubtedly has been due to increased production costs and decreased market interest. More recent innovative surveyor patents have been issued for improved methods of reorienting casts at the precise planned path of insertion. Jui-Yuan Shin of Taiwan accomplished this in 1998 with his design of the cast holder.[26] Rodney Phoenix and Robert James of San Antonio approached this problem using a 360° planar projection of light.[27] M. Michael Salib of Inverness, Illinois designed an ingenious cast holder to facilitate surveying casts for dual paths of insertion (Fig 11).[28] The Microsurveyor Compass (Denstply Sankinkk, Tokyo, Japan) from Japan is a small hand-held surveyor. It establishes the path of insertion by tilting its vertical arm rather than its cast holder. The Microsurveyor collapses for handy storage in a case that could fit into a lab coat pocket. This concept certainly makes surveying more convenient (Figs 12*A* and *B*). Continued ergonomic refinements of the dental surveyor should ensure its continued use during the treatment planning process.

References

1. Engelmeier RL: The history and development of the dental surveyor: Part I. J Prosthodont 2002;11:11-18
2. Engelmeier RL: The history and development of the dental surveyor: Part II. J Prosthodont 2002;11:122-130

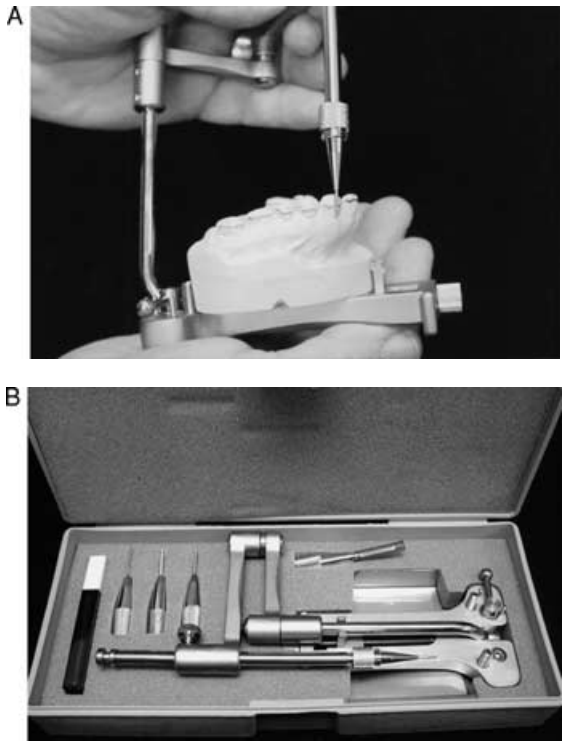

Figure 12. (*A, B*) The Microsurveyor Compass (Dentsply Sankinkk, Tokyo, Japan) controls the path of insertion by tilting the vertical arm rather than the cast holder. Its size allows it to be handheld during the surveying process. It also collapses for storage.

3. Nichols IG: Prosthetic Dentistry–An Encyclopedia of Full and Partial Denture Prosthesis. St. Louis, MO, Mosby, 1930, pp 587-590
4. Kennedy E: Partial Denture Construction. Brooklyn, NY, Dental Items of Interest, 1928, p 232
5. Applegate OC: Essentials of Removable Partial Denture Prosthesis (ed 3). Philadelphia, PA, Saunders, 1965, pp. 98-111
6. Applegate OC: Use of the paralleling surveyor in modern partial denture construction. J Am Dent Assoc 1940;27:205-215
7. Cummer WE: Partial denture services, in Anthony LP (ed.): The American Textbook of Prosthetic Dentistry in Contributions by Eminent Authorities (ed 7). Philadelphia, PA, Lea & Febiger, 1942, pp 670-840
8. Schwartz JR: Modern Methods of Tooth Replacement. Brooklyn, NY, Dental Items of Interest, 1948, pp 637-649
9. The Ney Surveyor Manual. Bloomfield, CT, Ney Dental International, 1995, pp 1-4
10. Weinstein LJ: Dental Instrument. US Patent No. 1,468,063, September 18, 1923
11. S. S. White General Catalog of Dental Supplies. Philadelphia, PA, The S. S. White Dental Manufacturing Company, 1935, p 87
12. Corcoran JC: Dental Apparatus. US Patent No. 973,408, October 18, 1920
13. Stoll V: Dental Tool. US Patent No. 1,227,687, May 29, 1917
14. Stoll V: Dental Tool. US Patent No. 1,244,792, October 30, 1917
15. Callsen H: Dental Tool. US Patent No. 1,354,089, September 28, 1920
16. Cohen M: Dental Instrument. US Patent No. 1,400,028, December 13, 1921
17. Remy FJ: Parallelmometer. US Patent No. 1,482,149, January 29, 1924
18. Adler HA: Dental Instrument. US Patent No. 1,424,707, August 1, 1922
19. Williams FL: Dental Instrument. US Patent No. 1,526,619, February 17, 1925
20. Williams FL: Dental Instrument. US Patent No. 1,546,423, July 21, 1925
21. Fish GD: Surveying Instrument for Mapping Solid Bodies. US Patent No. 1,575,983, March 9, 1926
22. Craigo JM: Dental Marking Device. US Patent No. 1,629,861, May 24, 1927
23. Craigo JM: Dental Instrument. US Patent No. 1,910,592, May 23, 1933
24. Greth AS: Paralleling and Surveying Machine. US Patent No. 2,095,665, October 12, 1937
25. Harris EC: Dental Surveyor. US Patent No. 2,528,053, October 31, 1950
26. Shin JY: Method and Apparatus of Recording and Reproducing the Path of Insertion of a Cast on Surveyors. US Patent No. 5,720,612, February 24, 1998
27. Phoenix RD, Jones RE: Planar Light Beam Orientation Device. US Patent No. 6,050,816, April 18, 2000
28. Salib MM: Surveying Instrument and Method for Dual-Path Insertion Dentures. US Patent No. 4,722,686, February 2, 1988