

# DENTAL INSTRUMENTATION

## The History of Articulators: The Appearance and Early Use of the Incisal-pin and Guide

Edgar N. Starcke, DDS

AS EARLY AS the 1840s, some form of “vertical stop” was a common component of mechanical articulators. Clearly, some early inventors recognized the importance of preserving the vertical relationship of the casts in the articulator and provided this feature. A notable “holdout” was William G.A. Bonwill, who believed that such a device would interfere with the accurate function of an articulator\* (Fig 1).

Just as in many present-day simple articulator designs, the “vertical stop” feature frequently involved a short, vertical pin or screw contacting a fixed or adjustable horizontal plate and was centrally located just anterior or posterior to the condylar axis. The *Evens*, *Hayes*, and *Bonwill* (post-1899) are early examples of articulators with this type of “vertical stop.”<sup>1</sup>

Not until the first decade of the 20th century, however, did the incisal pin appear as an integral part of articulator design, functioning as a mechanism for anterior guidance rather than simply as a means for preserving the vertical relationship of the casts.

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Correspondence to: Edgar N. Starcke, DDS, Clinical Professor, Department of Prosthodontics, The University of Texas Health Science Center at Houston Dental Branch, 6516 John Freeman Avenue, P.O. Box 20068, Houston, TX 77225. E-mail: [estarcke@mail.db.uth.tmc.edu](mailto:estarcke@mail.db.uth.tmc.edu)

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\*In a paper published in the month of his death (Sept 1899),<sup>5</sup> Bonwill remarked that his articulator “had never been changed in design since it was invented in 1858.” He believed that “a prop to keep the jaws apart” was unnecessary and would interfere with lateral movements. Therefore, it can be concluded that Bonwill articulator models with “vertical stops,” such as those modified by The S.S. White Dental Mfg Co<sup>6</sup> and The Consolidated Dental Mfg Co,<sup>7</sup> were produced after 1899.

The history of the incisal-pin and guide feature is not without its share of controversy and contradiction. Obviously, there was little consensus among early inventors regarding the concept of incisal guidance. It was generally held that the incisal guide could be controlled and adjusted by the dentist. Because the character of the incisal guide table was largely determined by the inventor’s interpretation of its intent, it is not surprising that many variations in the design of these tables came into use. A flat horizontal surface was the most common, but incisal tables were also designed with various protrusive inclinations, some in combination with fixed or adjustable lateral wings. Similarly, concave, convex, parabolic, or cup-shaped



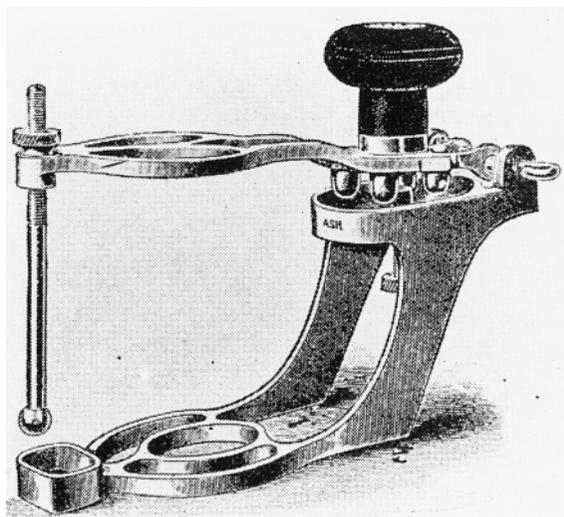
Figure 1. William G.A. Bonwill (1838-1899). (Reprinted from *Dent Cosmos* 1899;41: facing page-p 1081.<sup>30</sup>)

incisal guide tables were used, seemingly without regard for other features of the articulator.

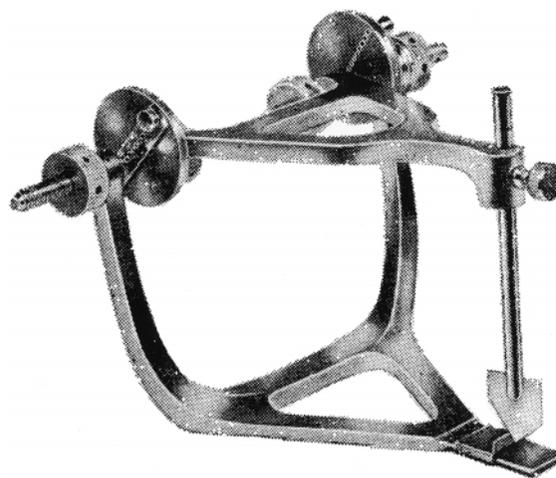
### The First Articulators Patented With an Incisal-pin and Guide Assembly

Although articulator patents contain valuable information, they provide historical data from only one perspective. Inventors' research reports in the early literature suggest these patents may not reflect the actual historical sequence of events. Even as late as the 1930s, Alfred Gysi and Rupert Hall, whose published debates have become legendary, each claimed credit for the incisal-pin and guide although, in fact, the first patents incorporating these features were granted to others.<sup>2-4</sup>

C.E. Luce, of Stuttgart, Germany, received the first patent for an articulator with an incisal-pin and guide assembly on November 28, 1911.<sup>8</sup> Luce, formerly of Boston, MA, was also one of the first investigators to describe the downward and forward movements of the condyles (1889).<sup>9</sup> Luce's articulator was the first "scribing" type; ie, it had poste-



**Figure 2.** The *Luce* Articulator, 1911. The first "scribing" type articulator will be discussed more fully in a future article. (Reprinted with permission from Smith ES: *Advancements in full denture construction*. Journal of the American Dental Association, vol 21, pp 12-32, Copyright © 1934 American Dental Association.<sup>28</sup> Reprinted by permission of ADA Publishing, a Division of ADA Business Enterprises, Inc.)



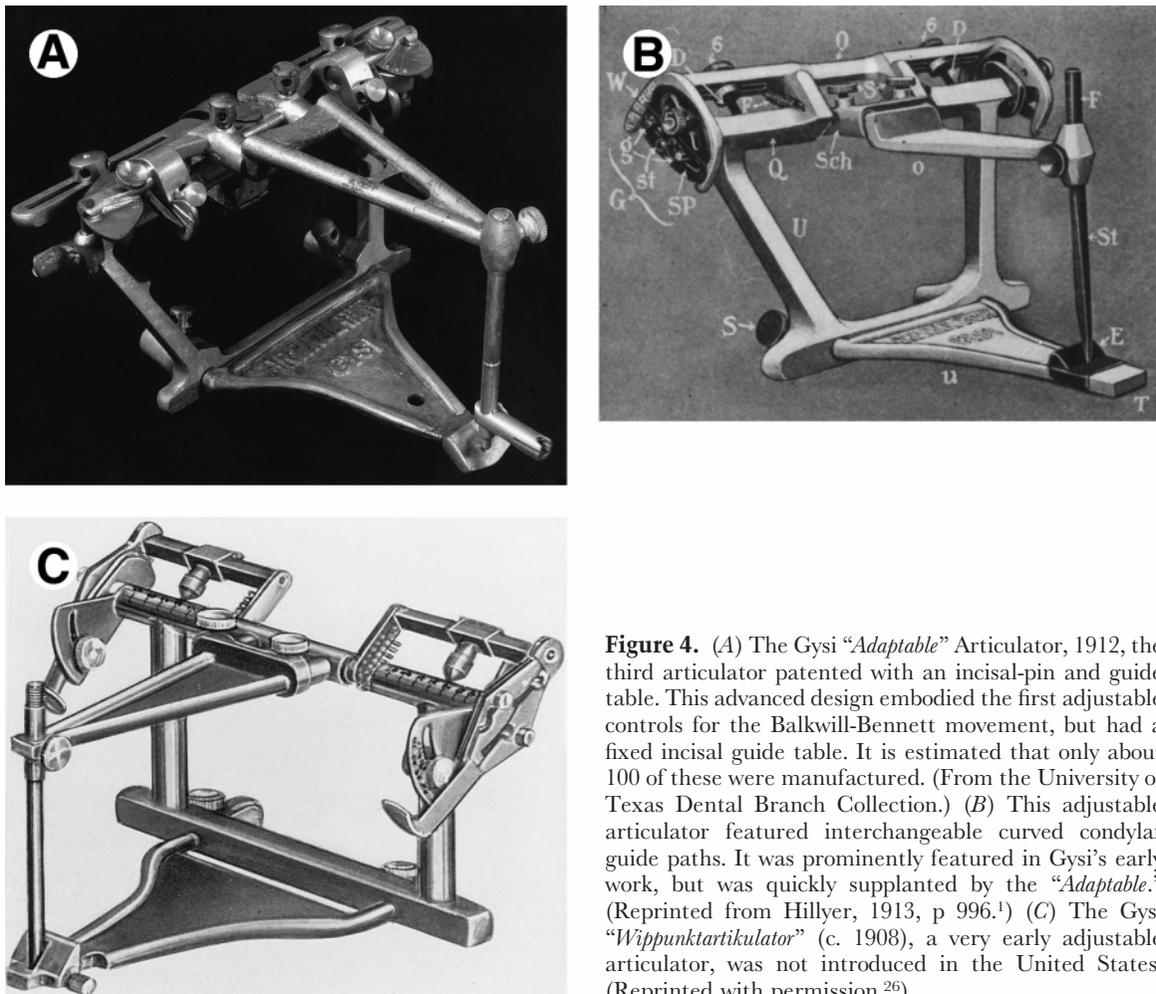
**Figure 3.** The *Eltner* Articulator, 1912. The second articulator patented with an incisal-pin and guide table. Eltner's articulator was constructed on the theory that the temporomandibular joints have 2 horizontal axes, one running through the condyles and the other through the articulator eminences. (Reprinted with permission from Posselt U (ed): *The Physiology of Occlusion and Rehabilitation* (ed 1). New York, NY, Oxford University Prss, 1962, p 103.<sup>25</sup>)

rior and incisal path controls that were functionally generated (in modeling plastic; Fig 2).

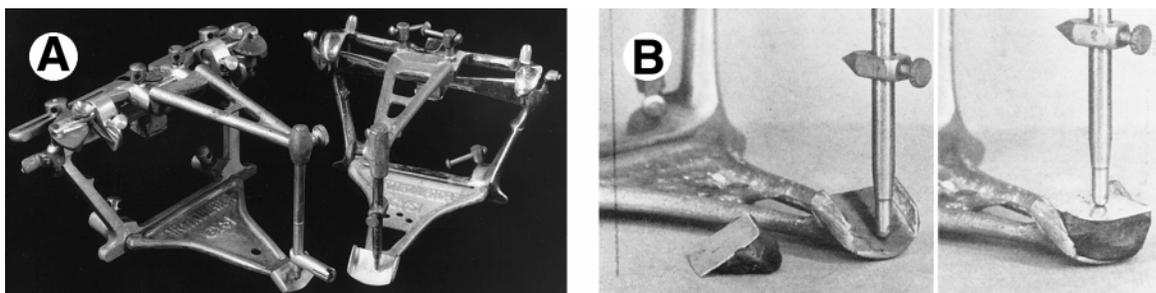
The second patent issued for an articulator with this feature was received by Ernest Eltner of Basel, Switzerland in July 1912.<sup>10</sup> Eltner's articulator featured a horizontal incisal guide table with an adjustable posterior vertical flange that limited protrusive movements. The incisal pin had a chevron-shaped blade tip. The purpose of this unusual design was not explained (Fig 3).

Alfred Gysi received a patent for his "*Adaptable*" articulator in October 1912.<sup>11</sup>† This was Gysi's first US articulator patent (Fig 4A). Although the "*Adaptable*" was highly advanced for the time, it had only a fixed, 45-degree incisal guide table. Nevertheless, the "*Adaptable*" was considered too complicated for the average practitioner and was not a commercial success. Earlier, Gysi had produced 2

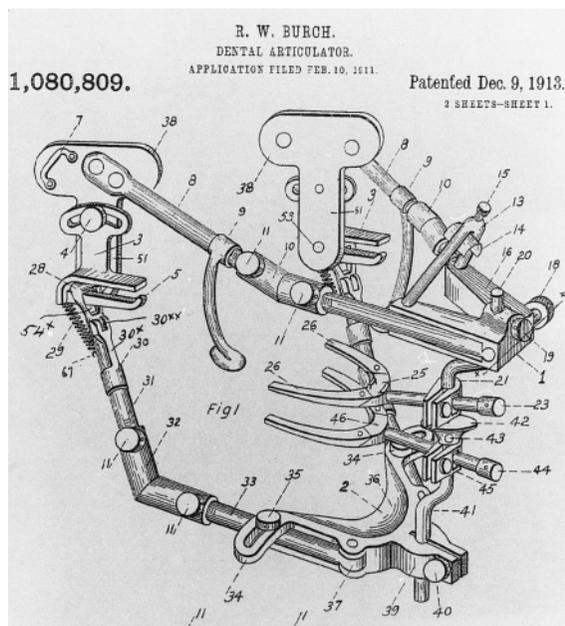
† James E. House<sup>12</sup> pointed out that the Eltner and Gysi patents illustrate a quirk in the patent system: Eltner applied for his patent (in March 1912) 9 months after Gysi (in May 1911), but received his patent 3 months before Gysi.



**Figure 4.** (A) The Gysi “Adaptable” Articulator, 1912, the third articulator patented with an incisal-pin and guide table. This advanced design embodied the first adjustable controls for the Balkwill-Bennett movement, but had a fixed incisal guide table. It is estimated that only about 100 of these were manufactured. (From the University of Texas Dental Branch Collection.) (B) This adjustable articulator featured interchangeable curved condylar guide paths. It was prominently featured in Gysi’s early work, but was quickly supplanted by the “Adaptable.” (Reprinted from Hillyer, 1913, p 996.) (C) The Gysi “Wippunktartikulator” (c. 1908), a very early adjustable articulator, was not introduced in the United States. (Reprinted with permission.<sup>26</sup>)



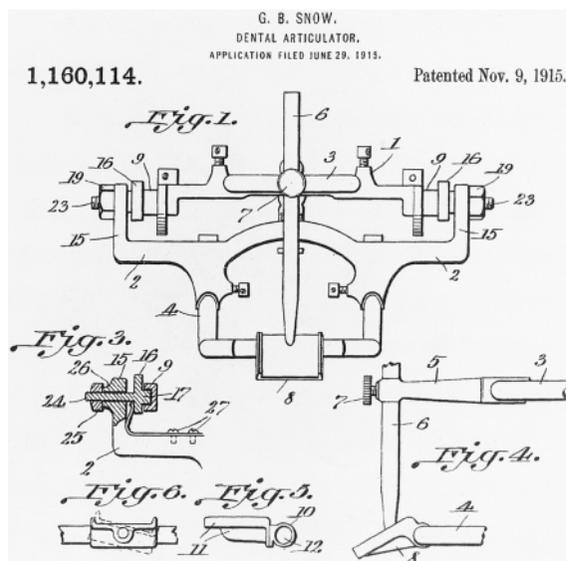
**Figure 5.** (A) The Gysi “Adaptable” and “Simplex” Articulators, 1912. The incisal guide tables for both articulators are of the same design. (From the University of Texas Dental Branch Collection.) (B) Gysi suggested that the inclination of the incisal guide table for the “Simplex” could be modified with modeling plastic and sheet metal. (Reprinted with permission from Gysi A: Practical application of research results in denture construction. Journal of the American Dental Association, vol 16, pp 199-223, Copyright © 1929 American Dental Association.<sup>27</sup> Reprinted by permission of ADA Publishing, a Division of ADA Business Enterprises, Inc.)



**Figure 6.** The Birch Articulator, 1913. Rod 20 rests on plate 42 to maintain the vertical position of this bimaxillary facebow device. (Reprinted from US patent.<sup>13</sup>)

other adjustable articulators, neither of which he patented. His “Wippunktarticulator” (Fig 4C) was never introduced in the United States. His next articulator, produced just before the “Adaptable,” had interchangeable condylar controls (Fig 4B) and was featured by Gysi in his early writings. By 1913, however, he had replaced this articulator with the “Adaptable” in both his writings and in the courses that he gave that year in the United States.

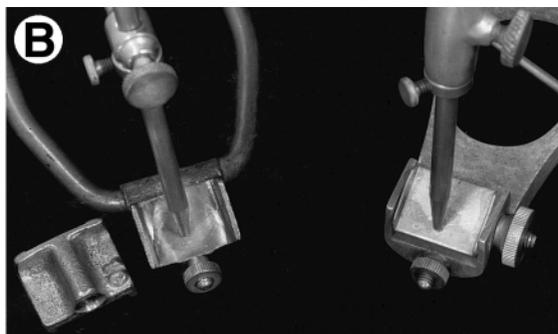
Gysi continued the exact incisal guide design in his “Simplex” articulator, an “average value” version



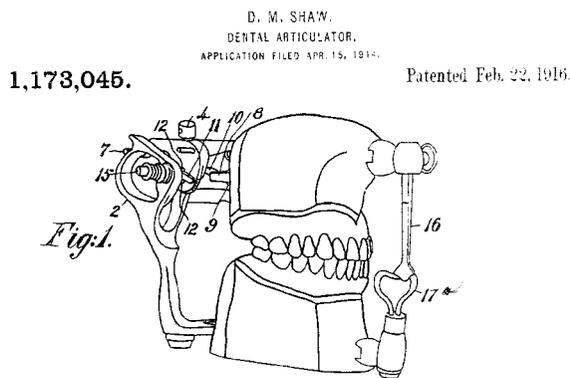
**Figure 7.** The Snow “Acme” Articulator, 1915, the first patented version of this instrument. The protrusive angle of the incisal table was adjusted by heating the solder between rod 4 and plate 8. (Reprinted from US patent.<sup>14</sup>)

of the “Adaptable.” Introduced to American dentists at essentially the same time as the “Adaptable,” the “Simplex” articulator was a decided success (Fig 5A). Up to this time, Gysi apparently had given little thought to adjustable incisal guides. Possibly because of advice or criticism, Gysi suggested that the slope of the “Simplex” incisal table could be altered with the use of a metal plate and modeling plastic (Fig 5B).

Ray W. Burch of Hart, MI received the fourth patent issued for an articulator with an incisal pin, in December 1913.<sup>13</sup> Burch was the first to employ



**Figure 8.** Snow “Acme” Articulators. These later models had, among other improvements, interchangeable incisal tables (A), and an adjustable table (B). (From the University of Texas Dental Branch Collection.)



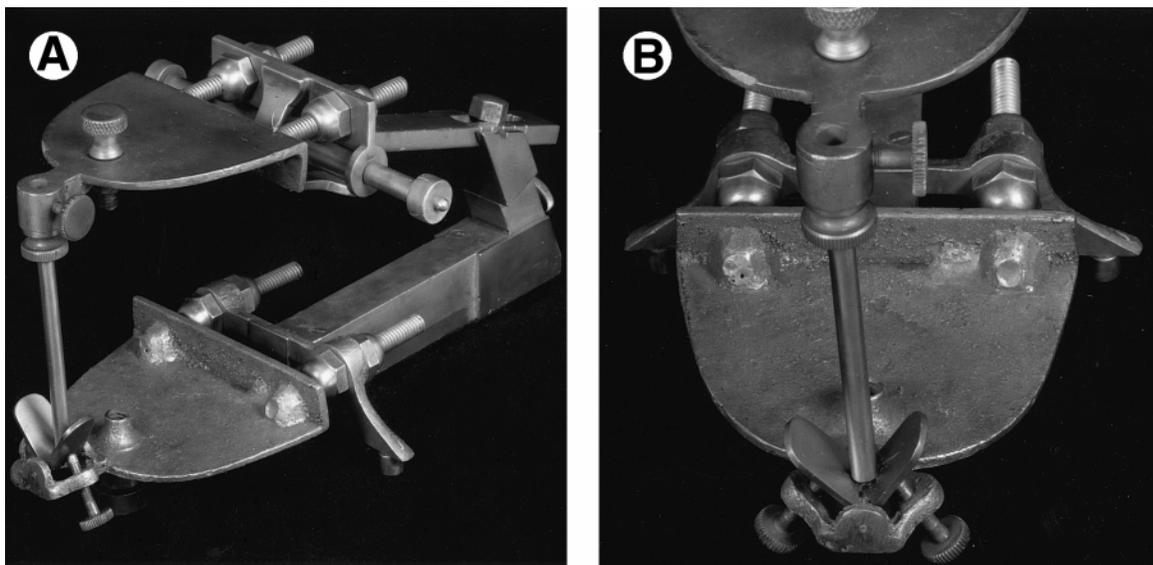
**Figure 9.** The Shaw Articulator, 1916. This is an early example of an articulator with an incisal pin assembly, and an unusual design. It has adjustable condylar paths, but the function of the incisal pin is not clearly stated in the patent letter. The Dental Manufacturing Company Limited produced the Shaw articulator in London, England. (Reprinted from the US patent.<sup>15</sup>)

the innovation of converting maxillary and mandibular facebows into an articulator. The facebow devices were connected by condylar slot assemblies and were adjusted while being worn by the patient. The incisal pin was used simply to maintain the anterior vertical position (Fig 6).

After the Burch articulator, George B. Snow patented the “Acme” articulator (November 1915),<sup>14</sup> Snow’s third articulator patent and the first with an incisal-pin and guide. In the earliest model (Fig 7), the protrusive angle of the incisal table was adjusted by heating the solder between the components identified by the numbers 4 and 8, and moving the table up or down. Later models featured interchangeable tables (Fig 8A), and finally, an adjustable table with a setscrew (Fig 8B).

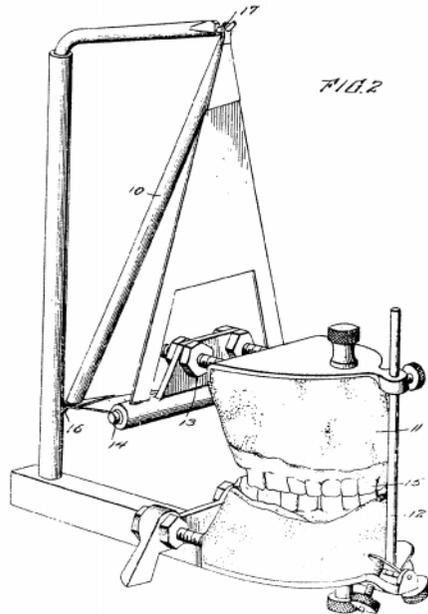
David M. Shaw of Eltham, England patented an articulator in February 1916 (Fig 9). This device has been largely overlooked, but deserves mention because of the notable design of the incisal pin assembly, apparently intended to affect protrusive and lateral motion with the curved incisal chevron-shaped tip functioning on the curved wire “guide.”<sup>15</sup>

In November 1916, Rupert E. Hall received his first patent for an articulator,<sup>16</sup> a device that has been unceremoniously nicknamed the “Alligator” (Fig 10). According to House,<sup>12</sup> “Alligator” was the least offensive of its nicknames. It was patented as a “single rotation center” device, but Hall provided no instructions for its use. This instrument predated his later model based on his “conical” theory



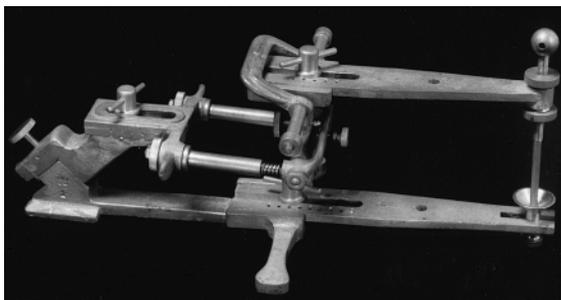
**Figure 10.** The “Alligator” Articulator, Hall’s first patented articulator, was not well received. (A) Complete view of articulator. (B) Anterior close-up of incisal-pin and guide table. The adjustable lateral wings incorporated into the horizontal incisal guide table were an innovation. (From the author’s collection.)

1,187,523.  
 H. E. HALL.  
 DENTAL ARTICULATOR.  
 APPLICATION FILED JULY 2, 1914. Patented June 20, 1916.  
 3 SHEETS—SHEET 2.

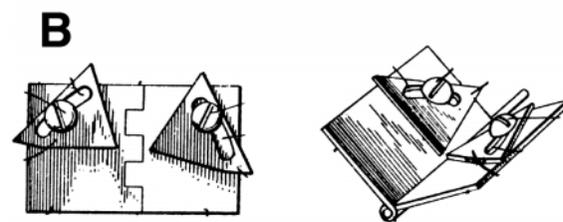
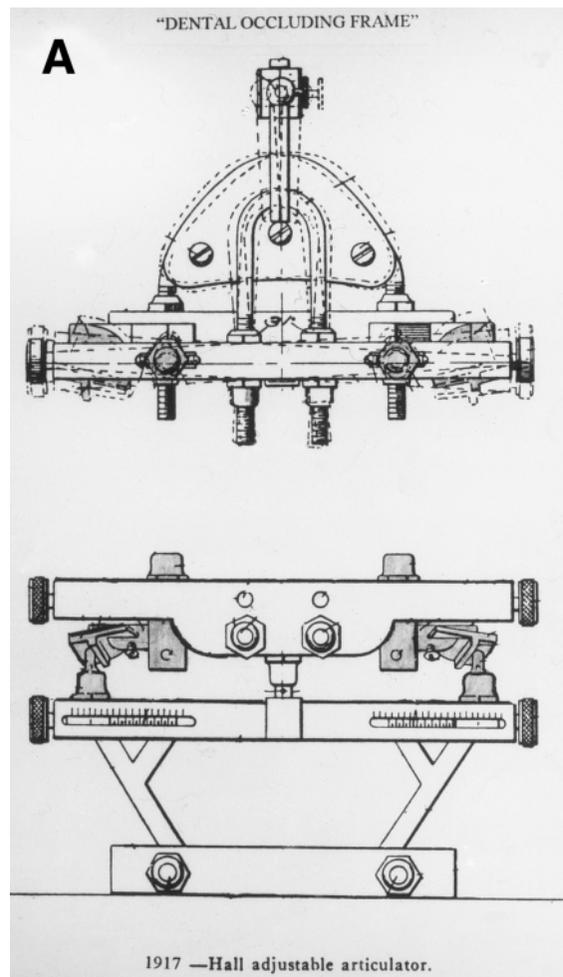


Witnesses  
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 Inventor  
 Rupert E. Hall.  
 By *[Signature]*  
 Attorney

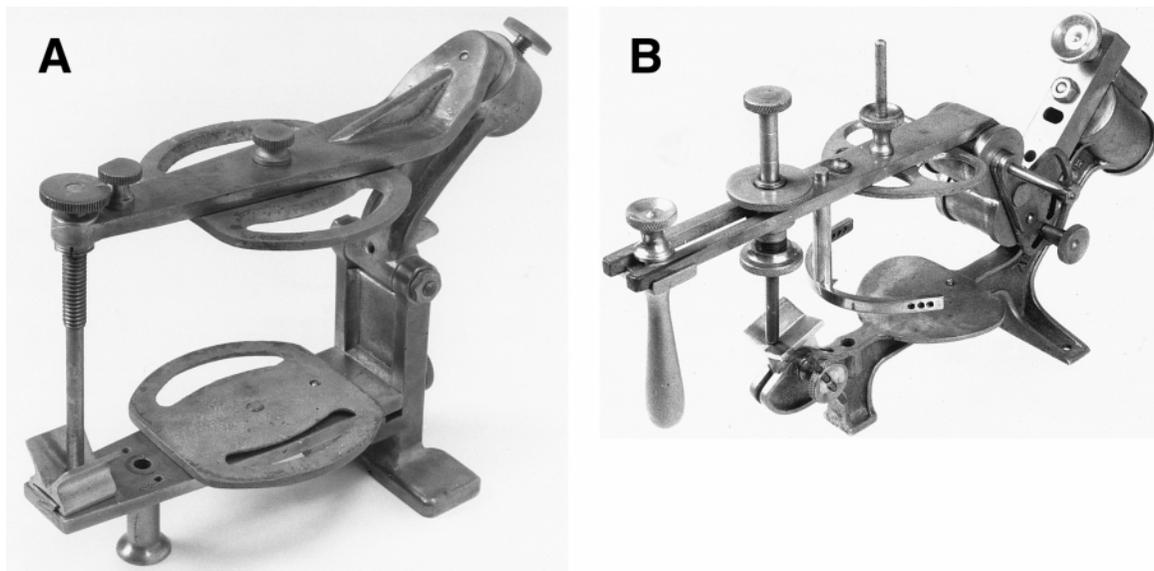
**Figure 11.** From the Hall patent, this is a conceptual drawing of an articulator that Hall used to explain the theory on which the articulator in Fig 10 is based.<sup>16</sup>



**Figure 12.** Hall's second articulator patent and the new and improved "Alligator." The incisal guide is a 45-degree cup.<sup>17</sup> (From the University of Texas Dental Branch Collection.)



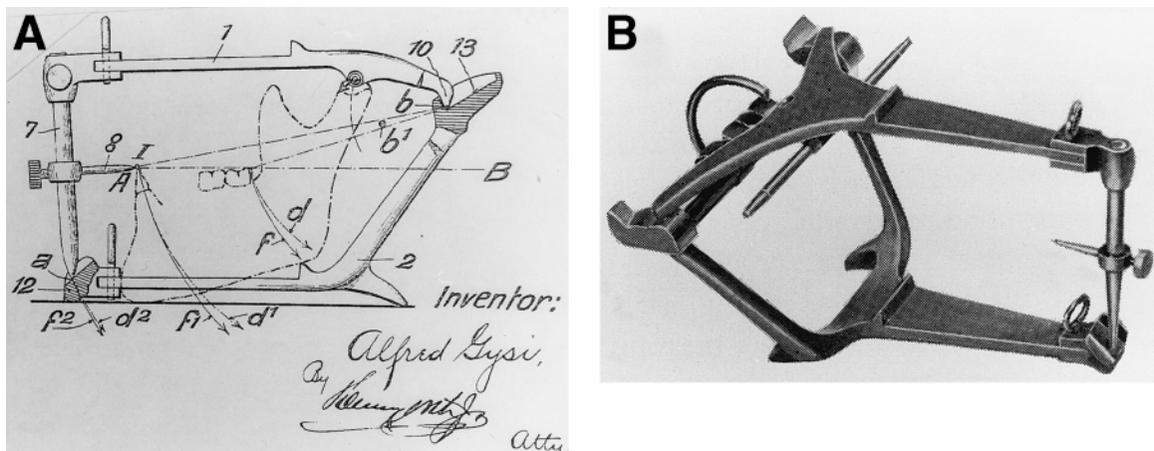
**Figure 13.** The Hall "Dental Occluding Frame" Articulator, 1917. (A) Many advanced features were incorporated into this arcon articulator design. (B) The new feature to be patented was the "gothic arch" triangular guiding edges on the lateral wings of the incisal guide table. (Hall remarked that this was his "first endeavor in articulator building."<sup>2</sup> If true, he must have had little interest in this design at the time because it was his third articulator patent.) (Modified and reprinted from US patent.<sup>18</sup>)



**Figure 14.** Hall “Automatic Anatomic” Articulators, 1918. (A) The original patented version<sup>19</sup> had a horizontal incisal guide table with 45-degree fixed lateral wings. (From the author’s collection.) (B) The updated version (not patented) had an adjustable incisal guide table with fixed lateral wings. (From the University of Texas Dental Branch Collection.)

of occlusion. The “Alligator” was the first articulator to include an incisal guide table with adjustable lateral wings. The illustration appearing in this patent (Fig 11) has been misinterpreted as the first version of the “Alligator.” In fact, it is a “perspective

view of an articulator. . . showing diagrammatically the principles upon which the articulator is based.”<sup>16</sup> On Hall’s second articulator (March 1917), a revised version of the “Alligator,” the incisal pin was designed to function within a 45-degree cup<sup>17</sup> (Fig 12).



**Figure 15.** The Gysi “Dreipunkt” Articulator, 1917. (A) This illustration is from the 1917 US patent. The device had fixed cup-shaped condylar guides and a fixed 40-degree incisal guide. It resembles a “tripod” articulator, but Gysi did not describe it as such.<sup>20</sup> (B) In this later version, the condylar guides have been modified, leaving its other features unchanged. (Reprinted with permission from Posselt U (ed): *The Physiology of Occlusion and Rehabilitation* (ed 1). New York, NY, Oxford University Press, 1962, p 103.<sup>25</sup>)

### Hall's "Dental Occluding Frame": The First Patented "Gothic Arch" Incisal Guide Table

Rupert Hall's third articulator patent, issued for the "Dental Occluding Frame" (April 1917), was groundbreaking, although it is doubtful that the articulator itself was ever put into commercial use.<sup>18</sup> It was an arcon instrument that featured adjustable, curved condylar paths, including settings for the Balkwill-Bennett angle, and a mechanism for adjusting the intercondylar distance (Fig 13A). It also included a horizontal incisal table with adjustable lateral wings, as well as a new feature—a triangular guiding edge on each lateral wing that could be set to follow a "gothic arch" tracing (Fig 13B). Although Hall placed no special emphasis on it, this design represents the first patented "controlling" incisal guide mechanism. Although neither Hall nor Gysi can be credited with being the originator of this new feature in articulator design, it would become a subject of controversy between the 2 men in ensuing years.

In 1918, Hall patented the "Automatic Anatomic" articulator, based on his "Conical" (single rotation center) theory of occlusion.<sup>19</sup> He returned to the use of a horizontal incisal guide table with fixed 45-degree lateral wings (Fig 14A). Hall later believed that this design was a mistake, and in the next version, he included an incisal guide table with an adjustable protrusive angle but retaining the fixed lateral wings (Fig 14B). This version of the "Automatic Anatomic" articulator was never patented.

Gysi's "Dreipunkt" articulator, patented in June 1917,<sup>20</sup> was a departure in design (Fig 15A and B). Similar to the "tripod" or "positional" articulator, it had fixed 33-degree condylar cups to accommodate mandibular styli. Gysi retained the same fixed 40-degree protrusive incisal guide table that he had used in previous articulator designs.

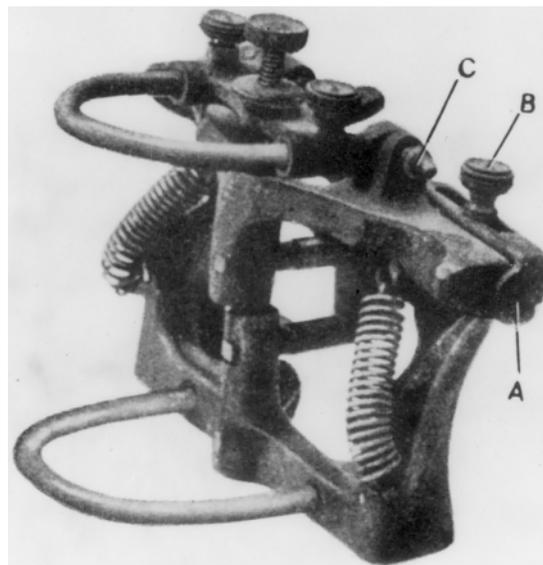
### Alfred Gysi: First Recognition of the Importance of the Incisal-pin and Guide

Much of what we know about Alfred Gysi's early work is based on his 1908 book, *Beitrag zum Articulationsproblem*, published by Hirschwald (Berlin, Germany). The book was translated into English by

Oscar T. Wayne, DDS of Zurich, and published as a series of 4 articles in the *Dental Cosmos* in 1910.<sup>21-24</sup>

It has been generally accepted that Gysi coined the term "Gothic arch" to describe the character of incisor point movements in the horizontal plane. Gysi undoubtedly was the first investigator to design and study the incisal-pin and guide assembly and to report on its significance for reproducing mandibular movement.

Gysi related that he and Eugene Muller of Zurich worked from 1896 to 1899 to construct an articulator that "exactly imitated the form of the condyle and glenoid fossae."<sup>21</sup> From Gysi's description and from this illustration of what may be his first articulator, it is an "average value" instrument with the exception of lateral "rotation center" controls (Fig 16). It is apparent that in the 1890s, neither W.E. Walker nor Gysi had considered the anterior guidance. Later, Gysi would be more concerned with the ability of an articulator to produce



**Figure 16.** The Gysi-E. Muller Articulator, 1896-1899. If this is not the first articulator that Gysi produced, it is surely one of the earliest that is mentioned in his writings. Although some of the details are obscured in this illustration, (A) identifies the condyle (pin) that functions in a fixed condylar slot; (B) is one of the controls for the adjustable lateral rotation centers; (C) is the position of the vertical hinge. This instrument has 2 springs to hold centric position, and 2 posts that are centrally located just anterior to the condylar axis to function as a "vertical stop." The incisal-pin and guide had not yet appeared in articulator design. (Reprinted with permission.<sup>31</sup>)

mechanical equivalents of mandibular movement rather than with the anatomic accuracy of its design.

As early as 1901, Gysi recognized the relationship between the angle of the lateral movements of the incisal point (“gothic arch”) and the distance between the posterior vertical rotational axes. He called these “pivoting points.” Nevertheless, he did not provide an adjustable incisal guide table until much later. Gysi’s change of controls to the incisal table on the “*Trubyte*,”<sup>29</sup> an articulator that he referred to as his new and modified “*Adaptable*,” generated new controversy in the 1930s.

More on the history of articulators/the incisal pin and guide in the next issue of the *Journal of Prosthodontics*.

### Acknowledgment

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