American Adders: Circles and Bands

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Introduction

Adders are among the simplest, least powerful and least expensive computing devices known. They were not invented in the U.S., but they were the first computing devices within the price range of ordinary Americans. The advertisements used to sell them attest not only to an enduring national anxiety about arithmetic, but to a changing consumer culture.

An adder, as the term is used here, is a computing device that has parts moved to record the results of arithmetic problems but that does not actually contain a mechanism to do arithmetic. Someone adding 9 and 7 on an adder not only enters the numbers, but moves the parts of the adder to carry a one, or must supplement his effort by writing partial sums with paper and pencil. By contrast, the operator of an adding machine merely enters the numbers, may turn a crank, and leaves the machine to add. Those who made and sold adders often called them adding machines, calculating machines, or personal calculators. At the same time, some machines sold as adders were in fact adding machines. Moreover, some instruments had a carry for at least one digit, blurring the distinction between adders and adding machines. Nonetheless, in the 1920's business equipment dealers had adopted the definition of the term adder used here. Strictly speaking, the abacus is a form of adder, although both vendors and collectors have treated the devices separately, and I shall do likewise.

There are about 30 adders and patent models of adders in the collections of the National Museum of American History. The following focuses on continuous band and circular adders, drawing on the museum artifacts, devices known to us in other collections, as well as early advertisements and other references. The original version of this article included sliding bar adders and those with notched bands, but since Robert Otnes treated many of those so well in ETCetera #11, we will exclude them here.

Circular Adders

Devices such as the well-known Locke Adder used straight rods sliding next to one another to perform addition. One can do the same job in a circular fashion by rotating one disc over another one. The Smithsonian collections contain three patent model circular adders, as well as three examples actually sold. Each has two or more rings of numbers, one of which remains fixed while the other or others rotate. The rings are divided into 100 equal parts, with these parts numbered from 0 to 99. To enter numbers, one rotates the moveable ring over the fixed one. This works fine for numbers up to 99. Devices differ in the manner, if any, in which one records higher numbers.

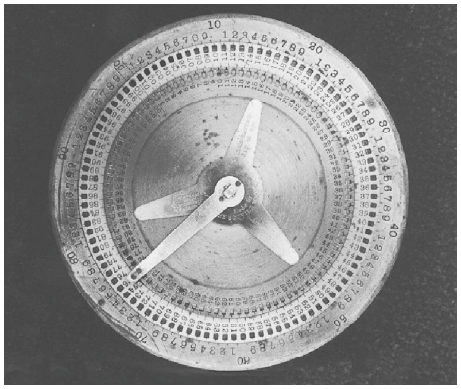
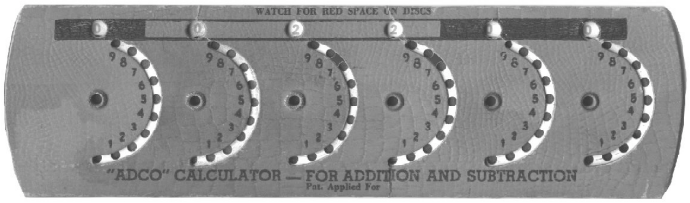


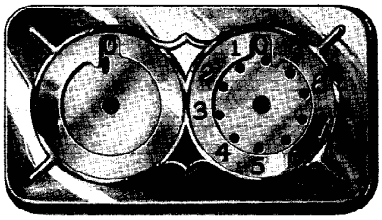
FIG. 1: "Hart's Mercantile Copmputing Machine." NMAH, from Mrs. Robert Kerr of Keokuk, Iowa Photo by Jeff Tinsley, Smithsonian

The oldest circular adder at the Smithsonian is the 1867 patent model (#67,786) for a "calculating machine" developed by A. Mendenhall of Cerro Gordo, Indiana. Mendenhall proposed two methods for recording numbers over 99. The first was a set of 9 holes around the edge of the fixed disc, into which one could place a pin. Whenever the rotating disc moved a full turn, one moved the pin up to the next hundreds digit. Mendenhall suggested a mechanism which would count the number of times the upper plate rotated, and hence give the hundreds place. If one rotated especially energetically, and arrived at higher numbers, he suggested a system of pins to be used to represent thousands and higher places.

James A. Loomis and Alonzo Johnson of Springfield, Massachusetts obtained a patent (#73,732) for a circular adder with carry — termed an "Improvement in Calculating Machines"—in 1868, and they assigned their patent to Charles Gifford of Gardner, Maine. The Smithsonian has an "Improved Calculator" that closely resembles the Loomis and Johnson patent. A green paper sticker glued to the back of the instrument reads "IMPROVED CALCULATOR / PATENT PENDING / CONKEY & LOOMIS, Manufacturers / SPRINGFIELD, MASS." The tag also gives printed directions. The instrument has two discs numbered from 0 to 99. When the total exceeds 99, a hand like the short hand of a watch automatically advances one to indicate the hundreds value (once again, the adder has a single carry). Sums of up to 9999 can be indicated.

Inventors of two circular adders from the 1870's suggested that their customers break up large numbers into two-digit pairs, and add these parts in turn. For example, to add 6472 and 2754, one should add 72 and 54, obtaining 126. Writing down the 26, one then added 64, 27, and 1 to obtain the thousands and hundreds values. Both of these inventors introduced a mechanism that carried the results of the sums of 2-digit groupings to a third digit.





G. N. MINDLING
Manufacturer of
THE VEST POCKET ADDING MACHINE FOR ONLY $1.25
1418 N. St. Clair Street,
PITTSBURGH, PA.

FIG. 2 (above): ADCO Calculator, showing red carrying marks in middle two columns. FIG. 3 (right): Stephenson-type adder sold under G.N. Mindling name (ad from "Who Makes it and Where, 1929 Edition").

Hence, like Mendenhall and Conkey and Loomis, they combined aspects of adders and adding machines. The first of these circular adders was patented by E.W. Taylor of Franklin, Indiana in 1874 (#155,772). The patent model for this "Improvement in Adding-Machines" is at the Smithsonian.

The second circular instrument was patented by William Hart of Kirksville, Missouri in 1878 (#199,289). The Smithsonian example (fig. 1) is marked "HART'S PATENT / JAN. 15, 1878", "Made by THE SCOVILL MANUFACTURING CO. / Waterbury, Conn." and "J.W. STRANGE /Steel / LETTERCUTTER / BANGOR, ME." The box identifies the instrument as "HART'S / MERCANTILE / MERCANTILE / Computing Machine." The instrument has two discs numbered from 0 to 99. There is a long hand with a pointer coming down from its end which rotates the upper disc over the lower one to add numbers up to 99. When the total exceeds 99, a hand like the short hand of a watch automatically advances one to indicate the hundreds value (once again, the adder has a single carry). Sums of up to 9999 can be indicated.

A third adder of this type is the "Quick and Sure Reckoner" patented by William M. Briggs of Stoughton, Massachusetts in 1879 (#222,126). Like earlier inventors of circular adders, Briggs used a rotating disc with 100 holes around its edge to enter numbers against a fixed disc. His instrument had a small stellated wheel with ten teeth. When the large rotating disc made a full turn, the stellated wheel advanced one to indicate hundreds. Briggs suggested that further wheels could be introduced to indicate thousands, ten thousands, etc., but did not include these wheels on the simple wooden and paper model he sent to the Patent Office. The patent model was acquired by Leland Locke, who in turn gave it to the Smithsonian.

Finally, and more humbly, there is an aluminum instrument called the "Prewett Addograf" that consists of two fixed discs which enclose a rotating disc. This small object has the numbers from 1 to 20 stamped clockwise around the edge of one side of the rotating disc and those from 21 to 40 clockwise around the edge of the other side. Three digits from either disc are visible at any one time (e.g., 6, 8, and 10 on one side and 30, 32, and 34 on the other). The function of the instrument is unclear - it is not a straightforward adder. It was made in Los Angeles, California and is marked "PAT. PEND.," but as yet I have found no patent. The Addograf came to the Smithsonian in 1940 from the collection of Leland Locke. I would guess from the spelling of "Addograf" and the use of aluminum that the object dates from the first half of the 20th century, but have no definite evidence.

All of the circular adders in the Smithsonian collections have only one or two concentric rotating discs. It is possible to use several adjacent rotating discs, just as one uses several rods in a rod-type adder. One such device is the ADCO Calculator in the editor's collection. This cheap paper adder relies upon red marks between every 10 holes on the adding wheels. When adding a number *above* a red mark, the user must remember to carry 1 into the adjacent left column.

There is also the familiar "Stephenson" adder, a two-wheeled device sold under a number of different names. Archibald M. Stephenson of Manteno, Illinois received a U.S. patent in 1872 (#137,107) for a four-wheeled adding machine with automatic carry. The two-wheeled production version is somewhat different, since the user may enter only single digits in the right wheel. There is an automatic carry to the left wheel, which registers up to 19, so that the maximum sum is 199. The Stephenson seems to have been an aid for people adding long columns of figures using paper and pencil.

There are several other American computing devices with adjacent discs, but all of those at NMAH include automatic carries making them adding machines not adders.

Continuous Band Adders

The Russian J. Diakoff suggested in 1829 that one might represent numbers on an adder by a set of continuous bands. The New York journalist and inventor Charles Henry

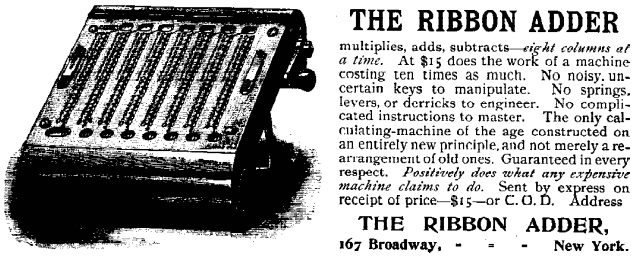


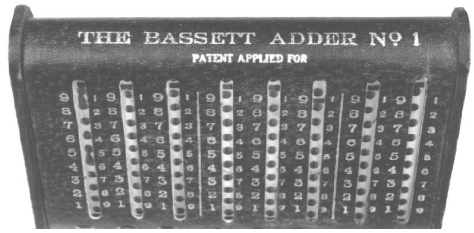
FIG. 4: Ad for Webb's Ribbon Adder from Harper's Magazine, May, 1893

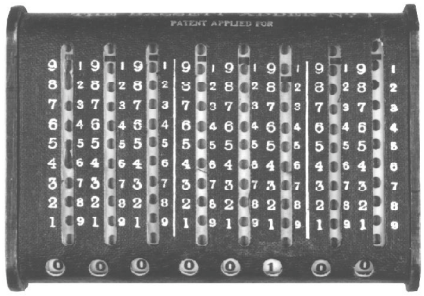
Webb picked up this idea. He applied for a patent in the U.S. in 1886, received one in England in 1888, and patented the Webb ribbon adder in America 1891 (patent #465,120). This chrome-encased instrument has 8 grooves for entering the digits of numbers with a stylus. The grooves are labeled 1-to-20 on the housing, giving a user the curious "convenience" of being able to add up to 20 in a single stroke. Inside, beneath the grooves, are long metal ribbons with regularly spaced holes. The holes are numbered to their right with the digits from 0 to 9 repeating sequentially all along the ribbon. These digits appear in windows below the grooves as amounts are entered. The same holes are also numbered to their left, with a total of 10 holes numbered 0, ten 1's, ten 2's, and so forth up to ten holes numbered on the left 29. These figures appear in windows at the top of the grooves and represent numbers to be carried. To enter a number, one pulls down the ribbons for its digits. The corresponding total appears in windows below the grooves. Digits appearing in the windows at the top must be carried into the adjacent left column. Any one strip of this adder can be used to add sums totalling 299, or to enter a 9 and carry 29.

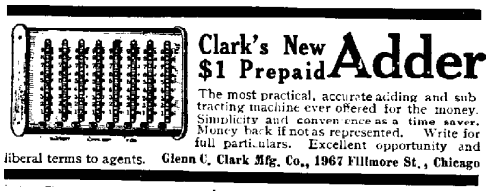
Webb had patented a small adding machine, known confusingly enough as the Webb Adder, some years earlier. That design proved moderately popular. At first, at least one of Webb's friends thought the ribbon adder would do equally well if patent problems didn't sink it. Or, as John Kedrick Bangs wrote Webb in May of 1893:

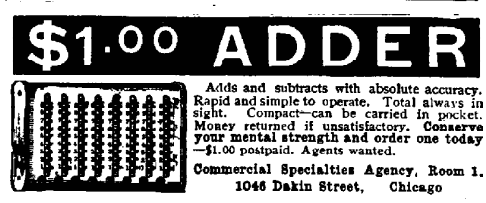
> I judge from all what I've heard said
> Your ribbon adder takes;
> But as for me - why I'm afraid
> O'them there patent snakes.

Webb overcame the delays associated with patent problems, but the depression of 1893 proved more than he could handle. He did sell the ribbon adder shown in the cover photograph to meteorologist Daniel Draper, a fellow New Yorker who had considerable enthusiasm for computing devices. However, Draper much preferred the more expensive adding machines built by Dorr E. Felt of Chicago (i.e., the Comptometer) as these actually eased the work of compiling weather statistics. Others apparently agreed. Webb's Ribbon adder soon disappeared from the market.









TOP TO BOTTOM: Fig. 5 & 6–two views of Bassett Adder No. 1. Fig. 7–Clark's Adder (ad from "System" April 1909). Fig. 8–$1.00 Adder (ad from "System" Sept., 1910)

The Bassett Adder is another continuous band machine which appeared on the scene some years later. There were at least two models of the Bassett, examples of which are in the Robert Otnes collection in Palo Alto, California.

The Bassett Adder No. 1 (figs. 5&6) is made entirely of wood, paper and celluloid. On this simple device, numbers are entered with a stylus by pulling down the perforated bands in each column. The user must pay attention, however. Every band has a black mark between each tenth hole. When pulling down a band using a hole ab*ove* a black mark, one must remember to add one to the adjacent left column for the carry. The device in the Otnes collection indicates a "Patent Applied For."

The second Bassett in the Otnes collection is labeled simply "The Bassett Adder / Patents Pending," but is

FIGS. 9 & 10 (above) top and reverse of The Bassett Adder, showing product logos.

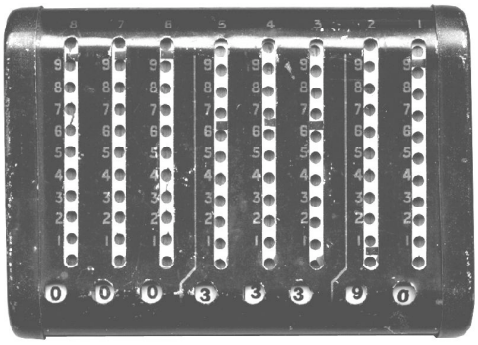


FIG. 11 (top right) front view of The Bassett Adder showing 33390 sum.

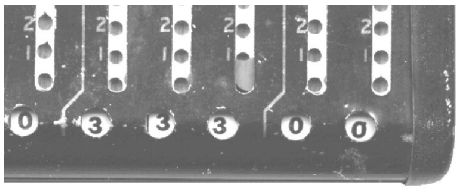


FIG. 12 (middle right) Ten added to amount before carrying. Note flag at bottom of hundreds column

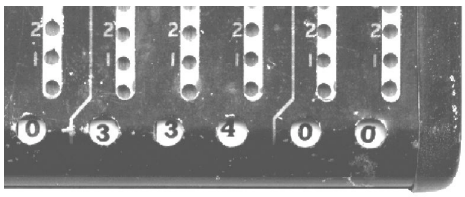


FIG. 13 (bottom right) Carry performed in hundreds column, bringing total to 33400, and removing flag in theprocess.

apparently later than the "No. 1" and certainly a measure more complex. The Bassett Adder has a wooden core with celluloid number bands, but it is encased in tin. This device has an automatic feature to remind users to carry their tens.

The Bassett Adder (figs. 9&10) has celluloid bands with the same sort of black markers every ten holes as seen on the Bassett No. 1, but next to each black marker is a tiny raised button. When this button reaches the bottom, it engages a red "flag" which appears in the adjacent left column. A demonstration is illustrated in figs. 11-13.

The full history of the Bassett Adder is not yet clear. In *System* for April, 1909 it was advertised as "Clark's New Adder," a product of the Glenn C. Clark Manufacturing Co. of Chicago. In 1910, another *System* ad described it as the "$1.00 ADDER," sold by Commercial Specialities Agency of Chicago. On Feb. 18, 1911, the same device was advertised in *Scientific American* as the "Bassett $1.00 adder" sold by J.H. Bassett & Co., of Chicago. We have also seen ads for the Basset adder in the 1925 and 1938 novelty catalogues of Johnson Smith & Co. of Racine, Wisconsin. It probably appeared in many other years as well. J.H. Bassett & Co. seems to have been in the business of selling adding devices far into the 1930's.

Summary and Conclusion

Since the mid-19th century, Americans have used simple devices to assist in arithmetic. These adders took a variety of forms. From the 1890's, as more expensive and sophisticated machines became commonplace, lightweight, portable, inexpensive adders were regularly sold by an expanding number of office equipment makers and dealers.

Adders were portrayed not only as tools of business but, as an increasing proportion of the American population paid income taxes, managed checking accounts, and had a bit of extra money, as aids for individuals. In the postwar years, adders from Germany and Japan came to dominate the American market.

From museum collections, publications, trade literature and advertisements, it is possible to piece together a history of the adder and to assign rough dates to many instruments. Further details, information about the manufacture and distribution of adders, and accounts of how they actually have been used, would be welcome.

Peggy Kidwell watches over the Mathematics Collections at the Smithsonian's National Museum of American History. This article is excerpted from "Rittenhouse," 1994, 8:78-98, with material on the ADCO and the Bassett adder appended by the editor.