being more obtrusive, is not so satisfactory. In some tables the increase of the last figure is only marked when the figure is in­creased to a 5, and then a Roman five (v) is used in place of the Arabic figure. Hereditary errors in logarithmic tables are con­sidered in two papers “ On the Progress to Accuracy of Logarithmic Tables” and “On Logarithmic Tables,” in *Monthly Notices of Roy. Ast. Soc.* for 1873. See also the *Monthly Notices* for 1874, p. 248 ; and a paper by Gernerth, *Ztsch. f. d. österr. Gymn.,* Heft vi. p. 407.

Passing now to the logarithmic trigonometrical canon, the first great advance after the publication of the *Trigonometria Artificialis* in 1633 was made by Michael Taylor, *Tables of Logarithms* (London, 1792), which gives log sines and tangents to every second of the quadrant to 7 places. This table contains about 450 pages with an average number of 7750 figures to the page, so that there are altogether nearly three millions and a half of figures. The change in the leading figures, when it occurs in a column, is not marked at all ; and the table must be used with very great caution. In fact it is advisable to go through the whole of it, and fill in with ink the first 0 after the change, as well as make some mark that will catcli the eye at the head of every column containing a change. The table was calculated by interpolation from the *Trigonometria Artificialis* to 10 places and then reduced to 7, so that the last figure should always be correct. Partly on account of the absence of a mark to denote the change of figure in the column and partly on account of the size of the table and a somewhat inconvenient arrangement, the work seems never to have come into very general use. Computers have always preferred Bagay’s *Nouvelles Tables Astronomiques et Hydrographiques* (Paris, 1829), which also contains a complete logarithmic canon to every second. The change in the column is very clearly marked by a large black nucleus, surrounded by a circle, printed instead of zero. Bagay’s work has now become very rare. The only other canon to every second that has been published is contained in Shortrede’s *Logarithmic Tables* (Edin­burgh). This work was originally issued in 1844 in one volume, but being dissatisfied with it Shortrede issued a new edition in 1849 in two volumes. The first volume contains logarithms of numbers, antilogarithms, &c., and the second the trigonometrical canon to every second. The volumes are sold separately, and may be regarded as independent works ; they are not even described on their title-pages as vol. i. and vol. ii. The trigonometrical canon is very complete in every respect, the arguments being given in time as well as in arc, full proportional parts being added, &c. The change of figure in the column is denoted by a nokta, printed instead of 0 where the change occurs.

Of tables in which the quadrant is divided centesimally, the principal are Hobert and Ideler, *Nouvelles Tables Trigonométriqucs* (Berlin, 1799), and Borda and Delambre, *Tables Trigonométriqucs Décimales* (Paris, 1801). The former give, among other tables, natural and log sines, cosines, tangents, and cotangents, to 7 places, the arguments proceeding to 3o at intervals of 10" and thence to 50o at intervals of 1' (centesimal), and also natural sines and tangents for the first hundred ten-thousandths of a right angle to 10 places. The latter gives log sines, cosines, tangents, cotangents, secants, and cosecants from 0° to 3° at intervals of 10" (with full proportional parts for every second), and thence to 50o at intervals of 1' (centesi­mal) to 7 places. There is also a table of log sines, cosines, tangents, and cotangents from 0' to 10' at intervals of 10" and from 0o to 50o at intervals of 10' (centesimal) to ll places. Hobert and Ideler give a natural as well as a logarithmic canon ; but Borda and Delambre give only the latter. Borda and Delambre give seven­figure logarithms of numbers to 10,000, the line being broken when a change of figure takes place in it.

In Briggs’s *Trigonometria Britannica* of 1633 the degree is divided centesimally, and but for the appearance in the same year of Vlacq’s *Trigonometria Artificialis,* in which the degree is divided sexagesimally, this reform might have been effected. It is clear that the most suitable time for effecting such a change was when the natural canon was replaced by the logarithmic canon, and Briggs took advantage of this opportunity. He left the degree unaltered, but divided it centesimally instead of sexagesimally, thus ensuring the advantages of decimal division (a saving of work in interpolations, multiplications, &c.) with the minimum of change. The French mathematicians at the end of the 18th century divided the right angle centesimally, completely changing the whole system, with no appreciable advantages over Briggs’s system. In fact the centesimal degree is as arbitrary a unit as the nonagesimal, and it is only the non-centesimal subdivision of the degree that gives rise to inconvenience. Briggs’s example was followed by Roe, Oughtred, and other 17th-century writers ; but the centesimal divi­sion of the degree seems to have entirely passed out of use, till it was recently revived by Bremiker in his *Logarithmisch-trigono­metrische Tafeln mit fünf Decimalstellen* (Berlin, 1872). This little book of 158 pages gives a five-figure canon to every hundredth of a degree with proportional parts, besides logarithms of numbers, addition and subtraction logarithms, &c.

*Collections of Tables.—*For a computer who requires in one volume logarithms of numbers and a ten-second logarithmic canon, perhaps the two best books are Schrön, *Seven-Figure Logarithms* (London, 1865, stereotyped, an English edition of the German work published at Brunswick), and Bruhns, *A New Manual of Logarithms to Seven Places of Decimals* (Leipsic, 1870). Both give logarithms of numbers and a complete ten-second canon to 7 places ; Bruhns also gives log sines, cosines, tangents, and cotangents to every second up to 6° with proportional parts. Schrön contains an inter­polation table, of 75 pages, giving the first 100 multiples of all numbers from 40 to 420. The logarithms of numbers extend to 108,000 in Schrön and to 100,000 in Bruhns. Almost equally convenient is Bremiker’s edition of Vega’s *Logarithmic Tables* (Berlin, stereotyped ; the English edition was translated from the fortieth edition of Dr Bremiker’s by W. L. F. Fischer). This book gives a canon to every ten seconds, and for the first five degrees to every second, with logarithms of numbers to 100,000. All these works give the proportional parts for all tho differences in the logarithms of numbers. In Babbage’s, Callet’s, and many other tables only every other table of proportional parts is given near the beginning for want of space. Schrön, Bruhns, and most modern tables published in Germany have title-pages and introductions in different languages. Dupuis, *Tables de Logarithmes à sept Décimales* (stereotyped, third tirage, 1868, Paris), is also very convenient, containing a ten-second canon, besides logarithms of numbers to 100,000, hyperbolic logarithms of numbers to 1000, to 7 places, &c. In this work negative characteristics are printed throughout in the tables of circular functions, the minus sign being placed above the figure ; these are preferable to the ordinary char­acteristics that are increased by 10. This is the only work we know in which negative characteristics are used. The edges of the pages containing the circular functions are red, the rest being grey. Dupuis also edited Callet’s logarithms in 1862, with which this work must not be confounded. Salomon, *Logarithmische Tafeln* (Vienna, 1827), contains a ten-second canon (the intervals being one second for the first two degrees), logarithms of numbers to 108,000, squares, cubes, square roots, and cube roots to 1000, a factor table to 102,011, ten-place Briggian and hyperbolic logarithms of numbers to 1000 and of primes to 10,333, and many other useful tables. The work, which is scarce, is a well-printed small quarto volume.

Of collections of general tables the most useful and accessible arc Hutton, Callet, Vega, and Köhler. Hutton’s well-known *Mathe­matical Tables* (London) was first issued in 1785, but considerable additions were made in the fifth edition (1811). The tables contain seven-figure logarithms to 108,000, and to 1200 to 20 places, some antilogarithms to 20 places, hyperbolic logarithms from 1 to 10 at intervals of ∙01 and to 1200 at intervals of unity to 7 places, logistic logarithms, log sines and tangents to every second of the first two degrees, and natural and log sines, tangents, secants, and versed sines for every minute of the quadrant to 7 places. The natural functions occupy the left-hand pages and the logarithmic the right­hand. The first six editions, published in Hutton’s lifetime (d. 1823), contain Abraham Sharp’s 61-figure logarithms of numbers. Olinthus Gregory, who brought out the 1830 and succeeding editions, omitted these tables and Hutton’s introduction, which contains a history of logarithms, the methods of constructing them, &c. Callet’s *Tables Portatives de Logarithmes* (stereotyped, Paris) seems to have been first issued in 1783, and has since passed through a great many editions. In that of 1853 the contents are seven-figure logarithms to 108,000, Briggian and hyperbolic loga­rithms to 48 places of numbers to 100 and of primes to 1097, log sines and tangents for minutes (centesimal) throughout the quad­rant to 7 places, natural and log sines to 15 places for every ten minutes (centesimal) of the quadrant, log sines and tangents for every second of the first five degrees (sexagesimal) and for every ten seconds of the quadrant (sexagesimal) to 7 places, besides logistic logarithms, the first hundred multiples of the modulus to 24 places and the first ten to 70 places, and other tables. This is one of the most complete and practically useful collections of logarithms that have been published, and it is peculiar in giving a centesimally divided canon. The size of the page in the editions published in the 19th century is larger than that of the earlier editions, the type having been reset. Vega’s *Tabulas, Logarithmo-trigonometricæ* was first published in 1797 in two volumes. The first contains seven­figure logarithms to 101,000, log sines, &c., for every tenth of a second to 1', for every second to 1° 30', for every 10" to 6o 3', and thence at intervals of a minute, also natural sines and tangents to every minute, all to 7 places. The second volume gives simple divisors of all numbers up to 102,000, a list of primes from 102,000 to 400,313, hyperbolic logarithms of numbers to 1000 and of primes to 10,000, to 8 places, *ex* and log10*ex* to *x*=10 at intervals of ∙01 to 7 figures and 7 places respectively, the first nine powers of the numbers from 1 to 100, squares and cubes to 1000, logistic loga­rithms, binomial theorem coefficients, &c. Vega also published *Manuale Logarithmico-trigonometricum* (Leipsic, 1800), the tables in which are identical with a portion of those contained in the first volume of the *Tabulæ*

*.* The *Tabul*æ

went through many editions, a stereotyped issue being brought out by J. A. Hülsse *(Sammlung mathematischer Tafeln,* Leipsic) in one volume in 1840. The