

Calculating Machines.

There have been very many attempts to perform numerical calculations by mechanical means, or at least such parts of them as follow simple and rigid laws. Hitherto such instruments have failed to unite correctness in the results, combined with economy of time, and, for the most part, have been limited to the performance of the first two operations of arithmetic.

To make such instruments really useful, they must have the power of executing, by themselves, the successive operations for the solution of the problem imposed on them, when the simple data for this problem have been introduced, without trial, and without guess-work.

The best machine of this kind exhibited is that of Staffel (Russia, 148), which, on examination, seems to combine accuracy with economy of time, and works easily and directly. The mechanism is 18 inches in length, 9 inches in breadth, and 4 inches in height, and consists of three rows of vertical cylinders; the first contains 13, the second 7, and the third 7. Upon each of the cylinders in the first row are 10 notches, corresponding with the units 1 to 10. Within each of these cylinders is a small pulley, in connection with a lever, set in motion by a slider which, when the cylinder has been turned from either 9 to 0, or 0 to 9, sets in motion the lever, and communicates its action to wheels, which carry over the figures. The pulley connected with the cylinder, the furthest from the handle, is in connection with the hammer of a bell. The purpose of this bell is to give warning to the operator, on committing an error, and constitutes a most important addition to the machine, particularly in the operation of division.

Upon each of the cylinders in the second row 10 units are placed. These seven cylinders are so fixed upon their axes, that they can bodily be moved right and left, and fixed at any part, so that the cyphers in the two cylinders can be made to correspond. This cylinder is furnished with a spike, which lays hold of and works the third row of cylinders.

The internal communication of each of the parts is brought about by means of a connecting wheel, furnished with nine moveable pegs, which are set in motion by means of an eccentric incision in the dial.

The machine is capable of performing addition, subtraction, multiplication, division, and of extracting the square root.

The operation of addition is performed as follows:—

By simply placing one line of the numbers upon the second row of cylinders (the index pointing to addition), and turning the handle, till it stops, these numbers are transferred almost instantly to the first row of cylinders, and so on successively, till all the numbers to be added are transferred, and their sum is shown on the top row.

In performing subtraction, the first part of the operation is the same as in addition, but on placing the second line of figures on the second row of cylinders, the pointer being placed to subtraction, the handle is turned the opposite way, or against the motion of the sun, and the difference of the two numbers is shown on the upper line.

The operation of multiplication is performed by placing the multiplier and the multiplicand on the second and third rows of cylinders, and then, the index pointing to multiplication, the product will be found on the first cylinder.

The operation of division is very similar, excepting that the handle is turned as in subtraction.

These several operations were performed accurately, and with despatch.

In the performance of the square root, the following additional mechanism needs explanation. Between every division of the cylinder, in row 2, a small wheel is placed, and near it a projecting piece which acts upon a lever; when the projecting piece is near the word “rad” engraved on the cylinder, on turning the handle, the figures increase by 1. This, by other mechanism, is connected with the other two rows of cylinders. The operation of the square root is performed directly, without any guessing at numbers; but it is, comparatively, rather a long process.

Upon the whole it must be considered that Mr. Staffel has made an instrument possessed of considerable powers, and that great praise is due to him. The double motion of the handle as well as the warning bell are important improvements.

Mr. Staffel also exhibits a small mechanical machine for the performance of the addition and subtraction of fractions, whose denominators are 10, 12, and 15. By enlarging the machine, this number would be increased, and the power of the instrument extended. The operations were performed with quickness, and with accurate results. A Prize Medal was voted to Mr. Staffel.

THOMAS DE COLMAR (France, No. 390, p. 1196) exhibits the next best calculating machine in the Exhibition, and has combined the two essentials of economy of time and accuracy of results. It is adapted for the performance of the four first rules of arithmetic; and indirectly the square-root may be extracted by the knowledge of $a^2 + 2ab + b^2$, the results being inferred; but this is not the legitimate use of the instrument. For a description of this ingenious and useful machine, see the report of M. Benoit, “Au nom du Comité des Arts Mécaniques, Société d’Encouragement.”

The instrument is adapted for the multiplication of numbers whose product is expressed by less than 16 figures; and consists of two rows of cylinders, the one containing 16, and the second 8; the former are moveable, the operation at each step being changed tenfold.

The principle of the instrument is, that multiplication is in reality the continual addition of itself as many times as there are units in the multiplier, and division that of continued subtraction of the divisor.

On trying the machine, the number 1 was almost instantaneously taken from 10,000, giving the difference, 9,999, accurately; the performance of this operation is generally a severe test to these machines.

The number 5,321 was multiplied by 3,256 in less time than was required to perform the calculation, in the manner following:—The number 5,321 was placed on one series of cylinders, and the number 6 was placed on one of the cylinders of the second row, and on the handle being turned (in one direction always) the number 31,926 appeared; the upper row was moved through one division, the handle again turned, and so on, till in a very short time, the number 17,325,176 appeared.

The several operations to which the instrument was subjected were performed quickly and accurately.

A Prize Medal was voted to M. Thomas De Colmar.

WERTHEIM[B]ER (No. 387, p. 451) exhibits several calculating machines, adapted for the performance of addition and subtraction of numbers and moneys, of this and of other countries.

Each machine consists of a box, with a metal plate divided into nine indexes, with semicircular notches, under which are placed a succession of holes. Round the indexes, numbers are engraved, and the semicircular notches are furnished with teeth, and a pointer to insert between the notches, for the purpose of bringing the notch opposite any particular figure, from right to left. This operation is dangerous, for the notch is liable to slip and not go home.

The instruments are ingenious, but they are much wanting in the essentials of such machines, viz., economy of time and unerring accuracy. The Jury, however, voted Honourable Mention to them.

SCHILT (Switzerland, No. 59, p. 1270) exhibits a simple calculating machine, but which can perform the first operation of arithmetic only. Honourable Mention was voted to Mr. Schilt.