

pose of bending it, it should be grasped so that all weight is taken off the place to be heated. When tubing is very long, so that the outstretched arms are unable to grasp it at the proper place, one end of it is laid in the loop of a piece of rope or string hanging from the ceiling, or may be held by an assistant, who is trained to follow the motions of the operator.

A New Calculating Machine of very General Applicability.

Calculating machines are not of modern invention. From time immemorial the Chinese have employed an apparatus to facilitate their calculations, which gives results to a certain extent automatically. The Etruscans, it is recorded, also employed an apparatus of this nature. But these devices are so rudimentary as scarcely to be worthy of being dignified with the name of calculating machines. The first calculating machine constructed with wheels and pinions was that of Pascal; but this machine, as well as all that have come after it, including also the remarkable conception of Babbage, which made him famous, performed its operations by successive additions. The ingenious arithmometer of Thomas, that has received high praise, operates on the same principle.

In a word, all the calculating machines discovered thus far have been based on the differential method. For example, if it be given to find the product of 756.48 by 98.7, it would be necessary to add successively 7 times, 8 times, and 9 times the number 756.48, which represents a total of 24 operations.

The picture shown herewith represents the appearance of a calculating machine designed by Leon Bollée, a French inventor, which has attracted the attention of the scientific world. It is practicable with this to solve the above-named problem in three operations, which is evidence that the apparatus is capable of effecting an immense saving of time in performing the work of multiplication, and conversely of division, over others of its class. The essential feature in its operation, in which it is said to differ from all its predecessors, lies in the fact that the Bollée machine proceeds by direct multiplication. There are other advantageous features which it possesses, notably in the manner its results are exhibited, which are said to add considerably to its practical value.

The intelligible description of the operating mechanism would obviously be impossible without the aid of sectional drawings, and we shall have to content ourselves with the statement of the operations which the machine is able to perform. It is possible with its aid to make additions, subtractions, computations in progressions, calculations of problems in interest, to make multiplications and divisions, extract square roots, etc. The magnitude of the results that can be treated by the machine, permits of its use in all the operations of practice. It is possible, for example, to have quintillions in a product, or, reciprocally, to divide quintillions by billions. The rapidity with which the results may be reached, is said to represent a saving in time of

ninety-five per cent, comparing its work with that of a skillful calculator.

The Stahlberg Time-Dating Stamp.

This ingenious apparatus, of which we gave a lengthy description in our impression of March, 1890 (page 49), has lately been examined by the Committee on Science and the Arts of the Franklin Institute, of Philadelphia. We give in what follows, an abstract of the Committee's report, covering the more important points of the same:

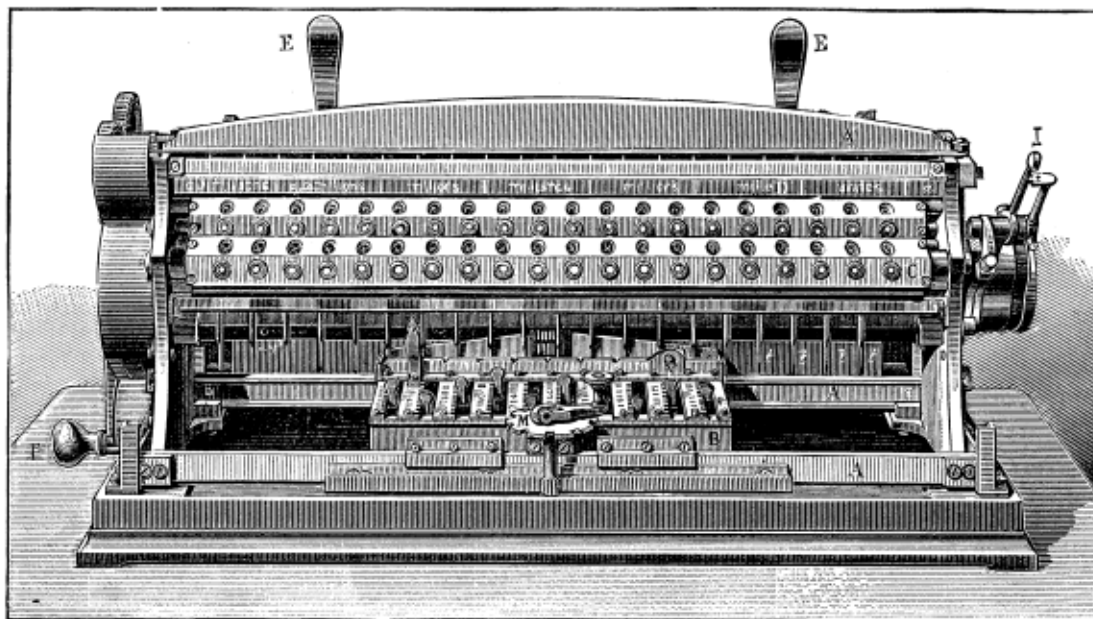
The apparatus consists of a rectangular box or cube, upon the top of which is an instrument resembling an ordinary hand stamp. Within the box is a clock movement, and a series of movable type wheels which are operated by the clock movement. The type wheels indicate the year, month, day, hour and minute. The actuating force is furnished by two large springs coiled in barrels similar to the usual propelling springs of marine and carriage clocks. The time movement by which the escapement is operated, which controls and regulates the measurement of time, and determines the moment of motion

a ratchet resting upon the rim of one printing wheel to fall out at intervals, and engage in the notches of the adjacent printing wheel of the next higher denomination of time divisions, the movement of said wheels is regulated so that with a given number of movements of one wheel the proper movement of the next will take place in the same manner as in a numbering machine or paging machine, or in a calendar clock. Cams are introduced, which turn at regular intervals, and vary the position of the notch which permits the engagement of the pawl resting on the day wheel from dropping, so as to engage the month wheel at the proper time for the different months of the calendar in the four years, including leap year, and the patentee has even provided for correction to conform to the Gregorian calendar in omitting a leap year at the proper intervals of centuries.

The impression of the type-printing wheels is produced by pressing the card, paper or document to be stamped by the usual guided platen commonly used in hand stamps upon an inking ribbon placed upon the type wheels, operating in the same manner as a type-writing machine. The clock movement is ac-

tuated at intervals of one minute, or such other intervals as may be determined upon, being stationary during intervals. The shaft which performs this work is preferably the one rotated hourly, and bearing the minute hand.

This motion is provided for by the introduction of the spring which transmits the motion, as already stated, to the escapement, and makes the winding of the clock, so far as the time indicator is concerned and the motion of the escapement, once every minute. The waste motion and release of the lower train, so as



BOLLEE'S CALCULATING MACHINE.

of the printing wheels as they change from one indication to another, is propelled by an intermediate spring, which is wound up at intervals, and has practically uniform force, and the time-keeping is therefore unaffected by the changes of tension incident to the unwinding of the powerful springs requisite to run the time-printing type mechanism of the apparatus.

The general construction of the machine is as follows: There are two barrels containing springs, which are actuated by means of toothed wheels attached thereto and turn an intermediate pinion, the shaft of which pinion bears a larger toothed wheel propelling at a higher velocity a wheel rotated once per minute. Turning loosely upon an arbor of this wheel is a second wheel, which, by a suitable toothed gearing, is connected with the escapement of the usual lever or anchor-shaped construction. The connection between the pinion on the minute wheel, and the escapement propelling wheel, is made by a helical spring, so that although the pinion propelling the wheel moves intermittently, the motion of the train, imparting motion movement to the balance wheel, is continuous. The rotation of the parts connected with the time-measuring train in immediate control of the escapement, is merely to liberate the printing wheels so that they may move to give the proper indications of time, the propulsion of these wheels being from the pinion shaft below the minute shaft. By a series of notches, which permit

to produce its intermittent motion at the proper intervals, is controlled by a wheel having toothed prominences like the escapement wheel, which is detained by a shaft, rotating with a second hand once per minute; and whenever a notch comes to the position of the tooth, a single tooth of the above-named wheel can pass, so that at intervals of one minute the wheel moves through one-sixteenth of the circle, and transmits a corresponding motion to the minute-printing type wheel. Devices embodying an arrangement for variably propelling the date wheels in calendar clocks, to conform to the variations of the lengths of the calendar months, have been used heretofore, resembling the devices here employed, but have not been applied to dating-stamps, and it appears from examination of preceding inventions, that the intermittent motions of all previous automatic time-dating stamps have been made with such direct connection with the time-measuring train of the clock as to impart incorrect measurement of time.

In order that the intermittent action by which transmission of motion from the pawls to the ratchets of the different printing wheels may easily be understood, a ticket-numbering stamp of usual construction is produced before the committee, in which these parts are exposed to observation, and the general method of transmission previously known, which occurs in engine registers, or counters, and in ticket-numbering machines, can more readily be under-