AN EFFICIENT CALCULATING MACHINE.

The mechanism of this machine consists of a series of adjustable toothed racks arranged in relation to a series of toothed recording wheels so as to perform the operation of addition direct, and to compound it for the performance of multiplication and division. The number to be added is set up by moving the pins in the figured slots, and then added to whatever number may be upon the opposite recording wheels when the crank is turned.

The machine is about ten inches square. All the working parts are of metal, all are positive in their operation, strong, and not liable to get out of order, making the machine able to stand up to the hard and constant use it receives.

The calculating machine bears the same relation to computation that the type writer does to correspondence. Its utility is now generally admitted.

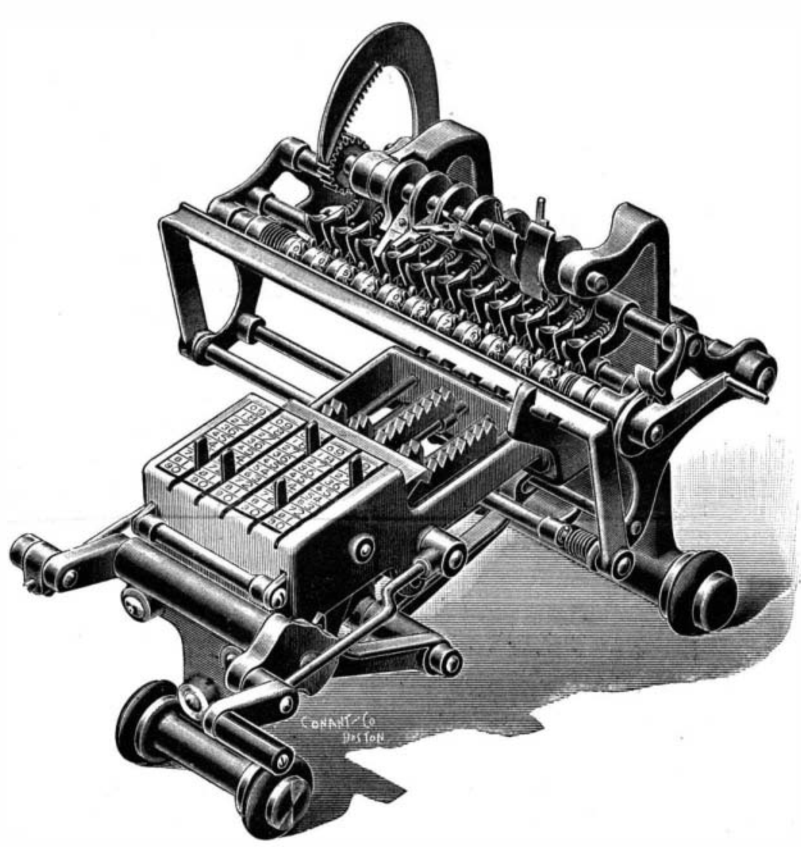
It is not claimed that the calculating machine will save time upon straight addition in column. But it is claimed that it will save time in many cases, such as, for example, adding a lot of numbers on separate slips, adding across columns, interrupted work, etc.

For multiplication and division, however, the machine has no mental competitors. The United States Lake Survey made a competitive test and reported that the machines were two and a half times faster, and that the errors, all due to the computer, were only half as numerous. The officer reporting said: "I think it safe to say that it is as much superior to logarithmic computation as the latter is superior to common multiplication and division." The method of logarithms ranks as one of the great labor-saving devices of man.

The comparison between mental and mechanical computation should not be confined to rapidity alone, for the saving of error is of the greatest importance, and the saving of brain labor comes next to accuracy as an object. The mental processes of computation, although they appear to be very simple, are, in fact, very complicated, and the chances of error are so numerous that the brain is under continual strain. The amount of labor involved in a simple computation would be astonishing if it could be measured and expressed in figures, and the machine, in avoiding all the processes of memory, transfers the greater part of it from the brain to the hand and leaves the former in better condition for work that cannot be avoided. The late President Barnard of Columbia College said: "A calculating machine offers relief from an intolerable amount of drudgery."

This machine is an improvement on the original Grant machine, which was first proposed in 1871, and which has since received the Centennial medal, the Scott medal of the Franklin Institute, and the Gold medal of the Massachusetts Mechanics' Association.

The Grant Calculating Machine Company, of 145 Fletcher Street, Lexington, Mass., are manufacturers of this machine.



GRANT'S CALCULATING MACHINE.

The Bulrush Caterpillar.

We are indebted to Mr. H. L. McFadjen, of Rotura, New Zealand, for several interesting specimens of the above object. An engraving of the aweto will be found in the SCIENTIFIC AMERICAN of September 27, 1890. Our correspondent also sends the following:

The following is a description of the bulrush caterpillar (*Sphoeria Robertsia*)—native name aweto.

This singular plant, which is a native of New Zealand, may be classed among the most remarkable productions of the vegetable kingdom. There are birds which dispossess others of their nests, and marine animals which take up their abode in deserted shells; but this plant surpasses all, in killing and taking possession, making the body of an insect—and that too very probably a living one—the foundation from whence it rears its stem, and the source from which it derives its support. It certainly forms one of the most surprising links between the animal and vegetable kingdom yet noticed, and as such merits as circumstantial a description as our present imperfect acquaintance with it will allow.

The aweto is chiefly found at the root of the rata (*Metrosideres robusta*). The plant in every instance exactly fills the body of the caterpillar. In the finest specimens it attains the length of 3½ inches, and the stem which germinates from this metamorphosed body is from six to ten inches high; its apex, when in a state of fructification, resembles the club-headed bulrush in miniature. There are no leaves; a solitary stem comprises the entire plant, and if any accident breaks it off, a second arises from the same spot. The body is found buried, and the greater portion of the stalk as well. When the plant has attained its maturity, it soon dies away. These curious plants, when fresh, have the flavor of a nut. The natives eat them, and likewise use them when burnt as coloring matter for their tattooing, rubbing the powder into the wounds, in which state it has a strong animal smell. When newly dug up the substance of the caterpillar is soft, and being divided longitudinally, the intestine channel is distinctly seen. Most specimens possess the legs entire, with the horny part of the head, the mandibles and claws. The vegetating process invariably proceeds from the nape of the neck, from which it may be inferred that the insect, in crawling to the place where it inhumes itself prior to its metamorphosis, while burrowing in the vegetable soil, gets some of the minute seeds of this fungus between the scales of its neck, from which in its sickening state it is unable to free itself, and consequently, being nourished by the warmth and moisture of the insect's body, then lying in a motionless state, they vegetate, and not only impede the progress of change into the chrysalis, but likewise occasion the death of the insect. That this vegetating process thus commences during the lifetime of the insect appears certain from the fact of the caterpillar, when converted into a plant, always preserving its perfect form. In no one instance has decomposition appeared to have commenced, or the skin to have contracted or expanded beyond its natural size.

In a Ferryboat Pilot House.

I shall stop you a moment and ask you to step on the upper deck of a New York ferryboat. You must not expect me to ask you into the pilot house, as, unless you have a pilot's license, the law forbids it, and if we should have a collision the court may think that you "rattled" the pilot, and mulct our boat in damages. Now look around and see the everyday life of the lower Hudson. There to the southward you will see an ocean tramp threading his way along. Astern are a steam lighter and a tug with a car float in tow, while a couple more tugs are hunting around for jobs, like beagles searching for a trail. The giant Campania is backing out of her berth, her monster stacks witnessing the industry of her stokers, who are now beginning to shovel coal to again lower the eastbound record. A Sound steamer is making her pier further down, while one of the steamboats bound for Coney Island is rushing down stream and an excursion tow is heading slowly for Glen Island. In between them all, steadily and surely, a dozen ferryboats are carrying their human freight to do the daily work of the great metropolis. All this is crowded into a square mile of water, which itself is moving to or from the sea at two and a half miles an hour.

Now, think of the problem set to the ferryman. He must carry, in safety, across this crowded harbor, with its rapid and changing currents, a large portion of the business population of one of the world's great centers of business. It is estimated that the yearly passenger trips between New Jersey and New York number 70,000,000; that the total for all New York ferries will exceed 170,000,000; that the number of boat trips equals 1,800,000, and the number of teams carried 5,000,000. All this immense traffic is carried on with remarkable safety. The lamentable accident to a Staten Island ferryboat, some twenty years ago, and a single collision afford the only cases of death from accident on record among North River ferry passengers. There have been other cases of death, but they are such as are not directly connected with the risks of the business, such as falling down companionways, being run over by teams, etc.—*Col. E. A. Stevens, in Cassier's Magazine.*

Accidents with Explosives.

The annual report by her Majesty's inspectors on the working of the Explosives Act for the past year gives evidence, says *The Chemist and Druggist*, not only of the efficiency of the act, but also of the rigid manner in which the various safeguards are enforced by the inspectors. Fatal accidents by fire or explosion in manufacture, so far as these come under the control of the act, numbered 6 in 1893, which is a slight increase on the ten years' average, which was 5·9. Considering that 127 factories are reported upon, exclusive of those where small and toy fireworks are produced, this does not seem high in so risky a business. It is very much lower than was the case before the act came into operation, when the output was nothing like so large. A large proportion of the accidents reported are due either to spontaneous combustion or to the sensitiveness of the sulphur-chlorate mixtures to friction and percussion. So great indeed has the danger of the sulphur-chlorate mixture been found to be in the manufacture of fireworks, that the inspectors intimate that an order under the act will shortly be issued by the Secretary of State prohibiting the manufacture or importation or sale of any fireworks containing the mixture, except with the express authority of a government inspector.

Among the accidents recorded in the report several may be quoted as of special interest to pharmaceutical readers. A striking instance of sensitiveness occurred at Nobel's Stirling factory, when about five ounces of "priming composition," consisting of sulphide of copper, phosphide of copper and chlorate of potash, was exploded through friction from a hardened drop of shellac varnish which had dropped on the table. An explosion of peroxide of sodium suggested a series of experiments which proved that peroxide of sodium is in itself a perfectly stable body. When, however, the peroxide is mixed, or even in contact, with any combustible substance it becomes at once highly dangerous, the addition of water causing instantaneously either an outbreak of fire or an explosion. An accident in the City Road was due to the fumes of ether and alcohol coming into contact with a gas jet. It was found on examination that a bottle containing about one-half pound of ether and alcohol had burst, owing to the high temperature of the day and the proximity of the gas. The vapors came in contact with the gas jet, which was burning at a distance of about thirty inches from the bottle, igniting the contents. A serious fire was avoided by the gas being promptly turned off. The manufacture of xylonite, or, as it was originally called, celluloid, was the origin of another fire. The following is an occurrence which should be noted by amateur manufacturers of colored fires. A Manchester professor of chemistry was carrying with him on the Manchester, Sheffield and Lincolnshire Railway a mixture for producing a colored fire, "Bengal fire," on the occasion of the Duke of York's wedding. The mixture was in a bottle placed in a leather bag, on the middle seat of compartment of a first-class carriage, when just as the train was being pulled up the explosion occurred, and the three passengers in the compartment, including the professor himself, were injured. The composition, it appeared, contained unwashed flowers of sulphur and chlorate of potash. This was an undoubted and very interesting case of spontaneous ignition, the risk from which, in the case of mixtures of this sort, has long been recognized and frequently called attention to by the chemical adviser of the department. Although the whole case was attended with various illegalities, the railway authorities consented, under the circumstances, to withdraw proceedings.

Increase of Strength in Metals at Low Temperature.

When the earth shall have cooled until the air is condensed as a liquid sea above the land and the frozen oceans, the non-crystalline metals, as Prof. Dewar has shown in one of his latest lectures, will be much stronger than they are now. Small bars of the metals, cooled by liquid oxygen or air, were stretched in a cement-testing machine until they broke with the strain. At about 290° below zero Fahrenheit, the breaking strain of copper, which is 22·3 tons per square inch at ordinary temperatures, was increased to 30 tons; that of iron rose from 34 to 62·7 tons; of brass, from 25·1 to 31·4; of German silver, from 38·3 to 47 tons; and of steel from 35·4 to 60 tons. Frozen quicksilver broke at 32 pounds. Of two equal rods of the same metal, suspended at the ends, the one at 290° below zero was unaffected by a weight that at once bent the warmer one. The vibration of the metals was affected, as was proved by two tuning forks, which were in unison under equal conditions, but became dissonant when one was cooled.