The Integrating Machine.

At a recent meeting of the American Institute of Electrical Engineers, in this city, Mr. B. Abdank said:

There is one of these machines constructed in Zurich by the celebrated constructor, Coradi. To perform the integration it is sufficient to follow with the tracing point the given curve. The integral curve is then mechanically traced by the instrument. The integration of differential equations is a problem that we meet continuously in the physical sciences. We perform an integration in determining the area of a given figure, also in determining the static moments and the moments of inertia, in calculating the shape of the elastic curve.

The planimeter, as you know, gives mechanically the area and the moments. The instrument that you see before you gives much more. It traces a curve that indicates how the integral increases. The curve is the integral curve, the applications of which are extremely numerous. You have seen one of these applications for the determination of the magnetic curve.

I am glad to have had the opportunity to present it to this electrical society, and, as it were, smuggle into your presence a mathematical instrument under the cover of an electrical application. And I do so because the apparatus interests me personally, being myself the inventor of it.

I must also crave your pardon for having addressed you in English, of which language I am not at all a complete master, and I am ashamed because that lack of knowledge is entirely contrary to my principles. I am of the opinion that every electrician ought to be able to speak English. He cannot be a good electrician without being a complete master of that language. Without an intimate acquaintance with the works of Faraday, he is not able to draw conclusions in a simple and logical manner from experiments. He cannot, without being in direct communication with the legion of workers in electricity who speak the English language and who have advanced electricity in this country to a point where it is fifty years ahead of that in Europe, I say, that without knowing it intimately, he cannot keep track of what can be done with that power of nature which we are all attempting to harness.

Mr. Wolcott.—Having been for some time interested in the study of integrating machines of various kinds, and having invented some myself, I can say that I never have seen anything which will approach this instrument. The ordinary type of integrating machine which Mr. Abdank has spoken of will simply give a reading at the end of a given time—simply a single reading of the integral available. All who have given any study to the subject are familiar with the apparatus of Prof. James Thomson, Sir William Thomson's brother, which will integrate any expression involving a single variable. It is simply a disk and a sphere in a cylinder. The distance of the point of contact of the sphere from the center of the disk will represent the variable quantity, that is the function, and if this distance can be made to follow any required law of motion, and that point of contact of the disk is transmitted to the circumference of the cylinder, which is uniform the whole length, it is evident that the motion of the cylinder is proportional to the distance of the sphere from the center of the disk. This apparatus, in combination with others, will also integrate differential equations. I do not think there is any apparatus like this which will trace one curve, the ordinates in which are integrals of the ordinates in the other curve.

Carl Hering.—I would like to say in behalf of Mr. Abdank that one of the features of that instrument besides tracing the integral curve is that it can be used for solving numerical equations which, I understand, cannot be solved algebraically—equations of a high degree, fourth, fifth, and sixth degree. The instrument will trace out a curve the dimension of which will give the values of equations of high degree, and give all the real roots in one curve.

Prof. Mayer.—If the machine will do that, it is a marvelous production of ingenuity and science. Charles Babbage, of England, gave his whole life to making a calculating engine. After he had perfected his differential engine, and the British government would not supply him with means of bringing it out, he invented an analytical engine, of which you will find a description by the only daughter of Lord Byron, Lady Lovelace, which did just what this does. The construction of it would be so difficult that Babbage had not the means of bringing it out. If a machine so simple in its construction will do that, I can see that it is the most marvelous production of this age. I would like very much to understand it. Of course I only see it there and I know nothing of its principle.

The Chairman, Capt. Michaelis.—I understand, Mr. Abdank, to put it in plain language, in solving any equation of the second degree the instrument would describe a conic section, and higher curves according to the nature of the equation.

FOR BRASSING SMALL ARTICLES.—To 1 quart water add half an ounce each of sulphate copper and protochloride of tin. Stir the articles in the solution until the desired color is obtained.

Correspondence.

White and Sugar Maple.

To the Editor of the Scientific American:

Your answer to query No. 21, page 331, to correspondent, that "white and sugar maple are the same," is not correct. White maple is *Acer dasycarpum*. Sugar maple is *Acer saccharinum*. Their resemblances and their differences are stated in all the botanies.

W. C. PECKHAM.

New York, N. Y.

The Highest Peak in the World.

To the Editor of the Scientific American:

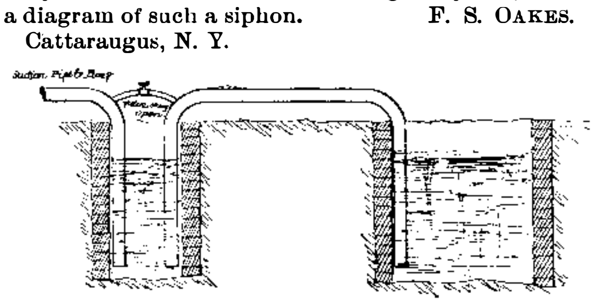
In issue of SCIENTIFIC AMERICAN November 24, 1888, in answer to query No. 21, by O. S., you give Mount Everest, of the Himalaya Range, as the highest mountain in the world. According to Gaskell's New Family Atlas, Mount Hercules, in New Guinea, now claims that honor. Its height is given as 32,768 feet. The same authority gives Mount Everest 29,002 feet, so that Mount Hercules leads the world as the highest mountain by 3,766 feet. THOS. D. GILLESPIE.

Pittsburg, Pa., December 6, 1888.

SELF-CHARGING SIPHON.

In your issue of November 17, page 307, you describe a siphon used by East Orange Water Works. I do not fully understand it, and should be greatly obliged for a diagram of such a siphon. F. S. OAKES.

Cattaraugus, N. Y.



[We give the diagram above as requested. It is self-explanatory.]

Periflora Graeca.

To the Editor of the Scientific American:

I wish to call attention to this curious vine, that has not been much noticed. It is rarely found in the nurseries and seldom seen as a climber in ornamental grounds.

Its flowers are not showy, but curious—greenish yellow below and brownish purple above and singularly formed. Leaves few and opposite, about the size and shape of a peach leaf, but not recurved like the peach leaf. It has a slight inclination to twine, but generally grows straight and of great length, and is about as thick at its extreme point as at the root. The vine is generally about from one-fourth to one-half inch thick from end to end. One of its most striking features is its toughness. It may be tied and untied and used as a rope without breaking. It would not be difficult to grow it 30 or 40 feet long in one season, several vines from the same root, of even size, straight and smooth. We should suppose in basket making or such work it would be quite an acquisition. As to its propagation from cuttings, we have no experience, but it grows readily from roots. J. H. CREIGHTON.

Lithopolis, Ohio.

A New "Strong" Locomotive.

A recent number of the Providence *Journal* describes as follows the new monster locomotive built by the Hinkley Locomotive Company, Boston. She is designed and constructed for the Strong Locomotive Company, New York, for the Atchison, Topeka, and Santa Fe Railroad. It is the latest built of the "Strong" locomotives. The improvements are the invention of Mr. George S. Strong, at one time mechanical superintendent of the Lehigh Valley road.

The peculiarity in the construction of the Strong locomotive is in her furnaces and combustion chamber, her cylinder valves and valve gears, and in the arrangement of her wheels and running gear. The boiler has two furnaces, each one being a welded and corrugated steel cylinder 42 inches in diameter and 7 feet long. These two furnaces are joined by a flanged and corrugated junction piece, a corrugated cylindrical combustion chamber, making the grate area of 50 square feet, with a combustion chamber 9 feet from the face of the bridge wall to the tube sheet, and 16 feet from the fire door to the tube sheet. The total heating surface is 1,650 feet. By this construction all braces and stay bolts and crown bars are done away with, the gases being all consumed and all the smoke prevented. The sparks are not drawn from the fire box, and no spark arrester is required, the engine running without smoke or sparks. The original Strong engine would even burn culm, the refuse of the pit mouth, and this engine will use anthracite or bituminous coal with good results.

The other radical departures in the build of this locomotive are in the cylinders, valves, and valve gear, there being no steam chests on top of the cylinders, as in ordinary engines. There are four valves interposed in the passages back of the cylinders—one for steam and one for exhaust at each end, every valve being a gridiron plain slide. There are nine ports 4¼ inches long on each valve, making 38¼ inches the length of port on each valve. This large valve area admits the steam at very nearly boiler pressure on the piston, and the steam valve cuts it off at the will of the engineer at any place from 4 to 22 inches, the exhaust valve holding on to the steam until the last inch of the piston travels, when it opens wide, letting the steam go freely with very little back pressure. This peculiarity enables the engine, at high speed, to develop about double the horse power that an ordinary locomotive, with equal sized cylinders, 19 × 24 inches, at an equal cut-off, would be able to do, an engine similar to this one having shown the enormous strength of 1,810 horse power while pulling a train of twelve Pullman coaches on the Northern Pacific road at a speed exceeding sixty miles an hour. The same engine has pulled a train of ten cars 148 miles in 148 minutes running time. This was done on a five-foot wheel six-coupled engine.

Returning to a description of the valve gear, the valves are operated by a single eccentric for each cylinder, the eccentric being keyed fast to the shaft or axle.

This eccentric runs the engine both ways, and imparts an independent motion to the steam and exhaust valves, so that the engineer has perfect control over the point of cut-off without altering the travel of the exhaust, and can alter the compression without changing the travel of the steam. In this manner the engine makes the same card or gives the same distribution of steam as a nicely adjusted Corliss or Greene engine would do at a given high piston speed. This enables her to do her work with from 20 to 33 per cent less water, and consequently less steam. Her large grate area enables her to burn her coal so as to give an evaporation from 25 to 33 per cent higher than ordinary locomotive boilers doing the same work, so that the combined action of boiler and valve gear is to make a very economical engine, and one that is capable, it is claimed, of taking an extremely heavy train of from ten to fifteen cars and making 60 miles an hour with ease.

The locomotive has four wheels, swing truck, under her front end, like an ordinary machine. Her drivers, 68 inches in diameter, are midway between the front and rear ends of the boiler. Back of the drivers is a two-wheel pony truck, 42 inch wheel, which is equalized with the drivers, making ten wheels under the engine. The tender is carried on a four-wheel truck forward and a six-wheel truck back, making ten wheels in all under the tender. The total weight is over sixty tons. The engineer's cab is over the hind driver, forward of the double fire box. He has a very extended view of the track on both sides, and is entirely away from the dirt and dust of the tender, and his cab rides as nicely and as cleanly as a parlor car. The fireman has a cab on the back end of the fire box entirely to himself. They have communication by a passage over the top of the fire box between the two cabs, the engineer having a call bell with which to summon the stoker if he wishes to speak with him. The locomotive wheel base is 28 feet; the wheel base of engine and tender, 48 feet; total length over all, about 55 feet. The highest point of the engineer's cab is 13 feet 7 inches from the ground. Her fireman's cab, which, like the driver's, is very roomy, is built of heavy iron plate. The engine has no extended front arch or netting or device for spark arrester, as they are not required.

Pyrotechnic Photography.

A curious photographic apparatus, in which a camera is raised by a rocket and lowered by a parachute, is being developed by a French inventor, M. Amedee Denisse. In its experimental form, the cylindrical camera has twelve lenses round its circumference with a sensitive plate in its center, and is provided with a shutter which opens and instantly closes as the apparatus commences to fall. The descent is eased by the opening of the attached parachute, which is drawn back to the operator by a cord attached before the firing of the rocket. For securing bird's-eye views, the photo-rocket offers several important advantages over balloon photography, such as comparative cheapness in operating and freedom from risk in case of use for military reconnoitering.

Walking on the Water.

C. W. Oldreive lately accomplished the task of walking on the water of the Hudson River from Albany to New York. Distance about 150 miles, wager $500. His average progress was twenty-four miles a day. He always went with the tide.

The shoes he wore are made of cedar, lined with brass. They are five feet long and a foot wide. Each is air tight, with a space in the center for the foot. On the bottom are three fins so arranged that when the shoe moves forward they are pressed up against the bottom, and when the shoe is at rest they hang downward, like paddle wheel buckets.