

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

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VOL. XL., No. 20. [NEW SERIES.] Thirty-fifth Year.

NEW YORK, SATURDAY, MAY 17, 1879.

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A NEW ESTIMATE OF THE WORLD'S AGE.

Geologists, astronomers, and physicists alike have hitherto been baffled in their attempts to set up any satisfactory kind of chronometers which will approximately measure geological time, and thus afford us some clew to the antiquity of our globe. Mr. Millard Reade, of Liverpool, has recently contributed to the Royal Society a very suggestive paper, in which he endeavors to grapple with the question by employing the limestone rocks of the earth's crust as an index of geological time. Limestones have been in course of formation from the earliest known geological periods, but it would appear that the later formed strata are more calcareous than the earlier, and that there has, in fact, been a gradually progressive increase of calcareous matter. The very extensive deposition of carbonate of lime over wide areas of the ocean bottom at the present day is sufficiently attested by the recent soundings of the Challenger. According to Mr. Reade's estimate, the sedimentary crust of the earth is at least one mile in average actual thickness, of which probably one tenth consists of calcareous matter. In seeking the origin of this calcareous matter, it is assumed that the primitive rocks of the original crust were of the nature of granitic or basaltic rocks. By the disintegration of such rocks, calcareous and other sedimentary deposits have been formed. The amount of lime salts in water which drain districts made of granites and basalts is found, by a comparison of analyses, to be on an average about 3.73 parts in 100,000 parts of water. It is further assumed that the exposed areas of igneous rocks, taking an average throughout all geological time, will bear to the exposures of sedimentary rocks a ratio of about one to nine. From these and other data Mr. Reade concludes that the elimination of the calcareous matter now found in all the sedimentary strata must have occupied at least 600 millions of years. This, therefore, represents the minimum age of the world. The author infers that the formation of the Laurentian, Cambrian, and Silurian strata must have occupied about 200 millions of years; the old red sandstone, the carboniferous, and all the other strata, the remaining 200 millions. Mr. Reade is, therefore, led to believe that geological time has been enormously in excess of the limits urged by certain physicists; and that it has been ample to allow for all the changes which, on the hypothesis of evolution, have occurred in the organic world.

THE LONGEST TUNNEL IN THE WORLD.

The Joseph II. mining adit, at Schemnitz, Hungary, begun in 1782 and finished last October, is now the longest tunnel in the world. Its length is 16,538 meters; that of the St. Gothard tunnel being 14,920, and the Mount Ceniz tunnel 12,233 meters.

The object of the adit is the drainage of the important gold and silver mines at Schemnitz. It furnishes a geological section more than ten miles in length, and gives not only valuable information as to the downward prolongation of the lodes known in the upper levels, but some new ones have been traversed, and the entire series of rocks, with their mutual limits as well as modifications and occasional transitions, are disclosed without interruption.

The entire cost of the tunnel was 4,599,000 florins—about \$2,300,000. Its height is 3 meters; width, 1.6 meter. By the methods of working employed during the last three years it would have taken twenty-seven years to do the entire work.

THE POWER OF VIBRATION HARNESSSED.

Mr. Keeley has made another advance, and has perfected what the *World* describes in small caps as "AN INVENTION WHICH SENSIBLE MEN BELIEVE MUST ERE LONG REVOLUTIONIZE THE GREAT INDUSTRIES OF MANKIND."

Mr. Keeley's former generator, which cost him \$60,000, was found to be inadequate, and has been broken up and sold for old iron; but this expenditure is regretted by none of those interested, for they know—so we read in the *World's* three column report—that through it Mr. Keeley has been enabled to accomplish what he set out to do; which is a fortunate circumstance for Mr. Keeley. By replacing the old generator with a new and perfect one, we are told, Mr. Keeley has done away with the necessity for storing in any large quantities the "vapor," formerly so called; and all idea of utilizing the power on a pressure engine has been discarded, and an engine has been made entirely new as to its principle. The engine is called a "vibratory engine;" and the whatever it is that runs the engine has been rechristened, receiving the expressive name "intermolecular etheric substance." This, as our readers will readily perceive, is quite a different thing from "cold vapor," and open to none of the scientific objections to which the latter was amenable.

This intermolecular etheric substance has never before been isolated either by chemical or mechanical means; and this achievement alone is sufficient to make Mr. Keeley the greatest discoverer of this age; indeed of all ages. And, curiously, the intermolecular etheric substance appears to be not more remarkable for its enormous expansive power than for the vast quantity of it, which is held in unresisting subjection by a little water. The force locked up in nitro-glycerine is as nothing to it. Another astounding feature is the ease with which intermolecular etheric substance is evolved and annihilated at will by Mr. Keeley. A pressure of 20,000 lb. to the square inch is generated simply by moving a lever about twelve inches long, so as to open and close a four-way valve placed within the "cross bar" of the generator, a

small quantity of water having been previously ejected into the generator by means of a small rubber bulb. Another notable circumstance is recorded by Mr. Keeley's reporter, namely, that when the intermolecular etheric substance is evolved and discharged, "neither heat nor cold is generated, and the elastic force is to the touch, when allowed to escape in substantial form, perfectly dry." One does not need to be a man of scientific education to appreciate a marvel like this. Even the common every-day experience of uneducated people will tell them how unusual it is for elastic force in substantial form, escaping under a pressure of 20,000 lb. to the square inch, to feel perfectly dry and neither hot nor cold. We can account for it only by supposing the intermolecular etheric substance, this solid elastic force, to possess a texture so fine that it passes through the hand intermolecularly without impinging on the gross matter through which the senses operate.

It would not be fair, the *World* writer observes considerably, to tell all he knows about Mr. Keeley's discovery; but he ventures to disclose the fact, for which we cannot be too grateful, that "the force so produced by Mr. Keeley, and having the wonderful energy stated, can be at once condensed so as to give a resulting vacuum." This discovery cannot fail to be of vast advantage to Professor Crookes in his researches upon the trajectory of molecules *in vacuo*.

To utilize the enormous energy of the intermolecular etheric substance Mr. Keeley, as already stated, has abandoned the idea of a pressure engine, and has invented a novel machine, which he calls a vibratory engine, and which after much labor he has succeeded in "focalizing." For a description of this engine we are again indebted to the *World*. The writer says:

"Its main part consists of a steel disk, about 30 inches in diameter, having a shaft passing through it. The disk is intended to revolve in a vertical plane. Projecting from the disk at right angles to it and near its periphery are a series of 288 steel pins about one eighth of an inch in diameter and varying in length from about five inches to two and one half inches, these pins being highly vibratory. This disk is surrounded with a cast iron casing resting on a cast iron bed-plate, underneath which are some steel disks that are also highly vibratory. I venture to say that any engineer seeing this invention at rest would say that it could not be propelled."

But it does go wonderfully, running for hours at a time, having been started and being kept running by the intermolecular etheric substance generated in a second. The function of the steel pins is, according to Mr. Keeley's explanation, to intensify the vibration of the intermolecular etheric substance, producing "a rotary or vertical circle of vibration," which circle of vibration runs the engine. By this device Mr. Keeley says he has succeeded in harnessing the power of vibration, hitherto, except in music, known only as a destructive power, against which engineers had to guard with the greatest care. To illustrate the terrible power of vibration and the great importance of harnessing it, the *World* writer says:

"Long ago I read of a man who said he could fiddle a bridge down, and being jeered at for his presumption, set his fiddle to accord with the key of the bridge, and came so dangerously near succeeding in his work of destruction as to convince the scoffers of his ability to do what he said. Mr. Keeley's motor and engine recalled this story to me, and also convinced me that the fiddler was theoretically correct in his boast. Indeed, Mr. Keeley says that it is theoretically possible to shake down a house with a violin."

In this statement Mr. Keeley is, as usual, only too modest, many a man having publicly brought down a house by skillful fiddling.

And just here we may express our conviction that Mr. Keeley's practical labors have furnished a demonstration of a theory which we have long entertained as furnishing an explanation of the conduct of the Emperor Nero during the great fire in Rome. Nero fiddled while Rome was burning, but he did it to save the city. The conflagration had reached a pitch at which it could not be stayed except by surrounding it with wide spaces vacant of buildings. Modern firemen clear such spaces when occasion demands by blowing down the houses with gunpowder. Nero—the Keeley of his age—resorted to "the power of vibration," and called it into action by means of his fiddle, thereby leveling whole blocks of temples and palaces and tenement houses, for the salvation of the rest of the city. The ignorant populace thought he was fiddling for fun. Those who do not understand Mr. Keeley are liable to misjudge him in like manner.

WHEN ARE LAWS DISCOVERED?

In his letter to the SCIENTIFIC AMERICAN, of April 5th, Mr. Gary intimates that the world is not indebted to "learned professors" and to "laboratories" for a knowledge of the laws of gravitation, of magnetism, and of electricity, and he takes pains to specify the names of Newton, of Franklin, and of Faraday, as if they would exemplify his text. He evidently thinks that ignorant plow boys have not unfrequently broken into these fields that are supposed to be in the special charge of "learned professors," and have taught the latter that they did not know much about their subjects, and that their so-called laws were not laws at all.

But Mr. Gary's knowledge of history is as defective as his knowledge of magnetism and of electricity, and it may interest him, and perhaps some others, to learn how much of the knowledge we possess on the above subjects came from "learned professors" and their "laboratories."