The locomotive with which the experiment was made consists of a platform set upon a four wheeled truck, carrying a cylindrical reservoir 37 inches in diameter and 9 feet long, with a steam dome 1 foot in diameter and 2 feet high. The steam space of the reservoir is connected with a pair of vertical engines, each having a diameter of 5 inches and a stroke of 7 inches; a 2 inch pipe, perforated with small holes, runs the whole length of the reservoir, near the bottom. In charging the reservoir this pipe is connected with the steam space of a stationary boiler, and steam is admitted until the pressure in the boiler and the reservoir are the same. The locomotive is then ready to run, and will continue to move until the water in the reservoir has cooled down so much as to be incapable of furnishing steam of a working pressure.

In making the trial trip, the pressure in the reservoir at starting was 142 pounds per square inch; and at the end of 49 minutes, during 35·5 of which the engines were in motion, it had fallen to 22, giving a mean pressure during the run of 81·5 pounds per square inch. At the start, the reservoir was half full of water. Indicator diagrams were taken during the run, and such *data* were noted as were possible. From these, it appears that the whole distance run was about 4·5 miles; the average horse power developed by the engines was 3·61, and the number of pounds of water evaporated in the reservoir, calculated from the indicator diagrams, 147. The writer then shows that if the engines had been designed in accordance with the best modern practice, the distance run by the locomotive, with this same evaporation, would have been from 2 to 2½ times as great. A calculation is then given, showing that, with a reservoir of the same size and engines about one and a half times as powerful as in the actual case, starting with a pressure in the reservoir of 275 pounds per square inch and ending with a pressure of 20, the locomotive might be expected to continue in motion for nearly six hours before the reservoir required recharging.

THE ORIGIN OF THE DIAMOND.

If we can trust a paragraph just now going the rounds of the press, the "diamond in the sky" of the nursery verses must be taken not as a happy comparison but as a genuine prophecy of scientific discovery.

It—that is, the paragraph—gravely alleges, on the strength of some supposed philosopher's opinion, that diamonds are in all probability a cosmic product—chips of original creation, so to speak—which the earth has picked up in the course of her travels through space; in short, that they are of meteoric origin. To the popular mind there must be something plausible in the suggestion, else it would not have been so favorably received by so many intelligent editors, ever on the alert for bits of valuable scientific information wherewith to regale their intelligent readers. Indeed, what could be more plausible to those whose knowledge of the diamond is embraced by the one word, carbon, and whose acquaintance with it is limited to some little familiarity with the appearance of the cut gem? How pure, how hard, how brilliant! What fitter product could there be of the heavenly spaces? But facts are earthly and very stubborn, prone ever to take the shine out of splendid theories. It is true that the diamond is a puzzle even to chemists; that the mode of its formation is a mystery; that even its place in the order of Nature is a matter of doubt. Like amber, it is found among minerals. Amber is known to be a vegetable product; and the diamond is thought by some to show strong evidence of a similar origin.

Its antecedents are mysterious, it must be admitted, but not wholly dark. Enough is known to make it certain that the notion of its cosmic origin is not to be seriously entertained, unless one is prepared to accept at the same time the farfetched, germ-bearing meteor which Sir William Thomson suggested as the importer of life to our previously lifeless planet. In no other way, barring the earthly production of the gem, can we account for the presence of plant germs in the bodies of diamond crystals. Where in extra terrestrial spaces could the diamond, now at Berlin, have picked up its enclosed organic forms, so closely resembling *protococcus pluvialis?* Or that other diamond its chain of green corpuscules, like *polinoylæa macrocca?*

As surely as flies in amber prove the presence of animal life during some stage in the formation of that singular substance, the vegetable organisms found in diamonds are proof that these gems were formed amid surroundings not inconsistent with the presence of vegetation, perhaps in water: a supposition that finds support not only in the fact of their occasional inclusion of organic matter, but still more in the presence of *dendrites,* such as form on minerals of aquatic origin, in a diamond belonging to Professor Goppert. Crystals of gold, iron and other minerals have also been found inside of diamonds; still other diamonds are superficially impressed by sand and crystals, which leads some to believe them to have been originally soft; but it is quite as probable that these foreign substances may have interfered in some way with the perfect development of the diamond crystals, forcing them to grow around or partly around the obstructions.

Thus, even in its crystaline condition, the diamond is not always such a simple body as is popularly supposed. The writer of the paragraph in question speaks of it as "pure carbon crystalized," fit product of pure matter in pure space. So it is, sometimes, but it is also stained with impurities at times, and tinged with color, a thing of grades and degrees. And lower down in the scale are the imperfectly crystaline forms, known as boart and carbonado, harder than the true gem, but cruder and possibly more useful. It would be as correct to judge the common mineral quartz solely from its appearance in what is known as Brazilian pebble, as the diamond solely from the flashing brilliant. One exhibits no greater range of grades and shades and qualities than the other.

Though supremely beautiful in its best estate, the diamond appears to be but an earthly product, after all, subject like everything else, even theories, to earthly imperfections There may be a diamond factory up in the sky somewhere but the evidence of it is not strong. Arizona, even, promises a better field for exploration.

THE DEATH OF DR. LIVINGSTONE.

Information has recently reached England of the decease of Dr. Livingstone, the celebrated African explorer, during June last. It seems that, in journeying over a partially submerged country, he was obliged to wade some four days through quite deep water. The exposure brought on a severe attack of dysentery, of which he fell the victim.

David Livingstone was born near Glasgow, Scotland, in the year 1815, and at the age of twenty-five became one of the agents of the London Missionary Society in Southern Africa. During the sixteen years of his residence in that country, he traversed the region from the Cape of Good Hope to 10° south latitude, and then followed the Zambesi river to its mouth, thus completing a journey of over 11,000 miles. Returning to England, he organized a small expedition which set out in 1858, and returned in 1863, after further exploring the above mentioned country. In 1868 Dr. Livingstone again went back to Africa, and again entered a region totally unknown to civilization. Until found by the *Herald* reporter Stanley, some two years ago, little was heard from him, and numerous rumors of his death were extensively circulated. After Stanley's departure, he continued his exploration, but no news of him has been received until the present time, when the British officials at Zanzibar transmit the intelligence of his death.

It would be difficult to describe the labors of this most indefatigable of travelers in the space here at our disposal. In his death geographical science loses one of its most persevering students. It may be truly said that for a blank spot on the map of Africa—for a region unknown save through tradition—he has substituted a country rich, fertile and productive, which, before many years, will exercise no small effect upon the commerce of the world. His labors toward the suppression of the slave trade are well known, and have tended largely to limit the spread and decrease the barbarities of that infamous traffic. He resolutely refused to discontinue his work until he should believe it complete; and so, isolating himself from home and his own race for nearly a quarter of a century, he has existed among the savages, enduring privations without number. Though to many his toil may appear fruitless, and the years of patient search, barren in directly useful results, the world is nevertheless the gainer by the example of "one who loved his fellow men," who, single hearted in his devotion, died as he had lived, a martyr to science.

STEAM BOILER EXPLOSIONS.—THE WORK ACCOMPLISHED BY THE UNITED STATES COMMISSION.

We have received many inquiries of late as to what has been accomplished by the Commission appointed to investigate the causes of steam boiler explosions. The preliminary report of this Commission has just been transmitted to Congress. Below we give a summary of the principal points:

The following Commissioners were appointed to conduct the experiments: D. D. Smith, Supervising Inspector-General of Steam Vessels, President; Charles W. Copeland, of New York city; Benjamin Crawford, of Alleghany City, Pa.; Isaac V. Holmes, of Mount Vernon, O.; and Francis B. Stevens, of New Jersey. Mr. Stevens having declined to serve, J. R. Robinson, of Boston, Mass., was appointed in his place. The Commission above named held their first meeting on June 25, 1873, and in September issued circulars to scientific men and engineers, asking for expressions of their views. In these circulars they state the various theories of steam boiler explosions:

1. Gradual increase of steam pressure.
2. Low water and overheating of the plates of the boiler.
3. Deposit of sediment or incrustation on the inner surfaces exposed to the fire.
4. The generation of explosive gases within the boiler.
5. Electrical action.
6. Percussive action of the water, in case of rupture of boiler in the steam chamber.
7. The water being deprived of air.
8. Spheroidal condition of the water.
9. Repulsion of the water from the fire surfaces or plates.

The Commission also issued a circular, asking that safety valves be sent to them for test.

They received numerous replies to their first circular, which they state contained valuable suggestions. More than twenty safety valves were sent to them, both from the United States and abroad.

The Commissioners divided themselves into two committees, the eastern and western, the first to make arrangements for conducting experiments at Sandy Hook, and the second at Pittsburgh. There were five boilers, with the necessary connections, at Sandy Hook, which had been placed there by Mr. Stevens, and these were presented to the Commission by that gentleman. A bomb-proof was erected, the pipes were re-arranged and extended, a blower engine and blower were set up, an old steamboat boiler was connected, and four ordinary range boilers were set up. Gages were procured, and were compared with each other and otherwise tested for several days. On the 7th of November, 1873, the Commissioners commenced their experiments.

A boiler was tested by hydrostatic pressure to 182 pounds per square inch. A pyrometer was arranged so that the temperature of the crown sheet could be ascertained. Steam was raised to 50 pounds per square inch, and the water was blown off below the crown sheet. When the temperature of the latter had reached 750°, and the steam pressure was 54 pounds, one of the flues collapsed.

An old steamboat boiler that had been tested with cold water to a pressure of 44 pounds was next experimented with. A fire was made in the furnace, the boiler having an ample supply of water; and when the pressure was 70 pounds per square inch, two of the top sheets of the boiler gave way. The pressure gradually rose to 73 or 74 pounds, when the safety valve suddenly opened and the experiment was brought to a close. A subsequent examination showed that an old crack had existed at some points of the rupture.

On the 13th of November, the water in the pipes was frozen, and the Commissioners decided to suspend operations at Sandy Hook for the season.

Preparations had been completed for the experiments at Pittsburgh, five boilers being placed in position, bomb-proofs erected, and a shop and store room fitted up. The boilers were of the ordinary two flue variety in use on western rivers, two of them being of steel and three of iron.

Experiments were commenced on November 20, with one of the iron boilers. The fire was not sufficient to produce a greater pressure than 195 pounds per square inch. The experiment was repeated, and a pressure of 202 pounds per square inch was attained. On the 21st of November another boiler was tested, and the fire gave out when the pressure had reached 342 pounds per square inch, with no other effect than producing some slight leaks. The first boiler was also tried again, its furnace having been enlarged, but the highest pressure attained was 220 pounds per square inch. On the 22d of November, the same boiler was tried once more, and this time a pressure of 275 pounds per square inch was reached before the fire gave out. Steam was then raised on the second boiler, and both flues were collapsed from end to end. An instant before the collapse, two men entered the bomb-proof, which contained three recording gages. According to their statements the three gages showed, at this time, 400, 450, and 500 pounds per square inch, respectively; but the record given by the gages, when examined after the collapse, was 350 pounds. The Commissioners remark that one of the results of the experiments has been to develope the fact that the instruments employed were quite unreliable, under the extraordinary pressures and temperatures to which they were subjected. No other results or conclusions are given, it being remarked that they can be more effectively embodied in a final report. The Commissioners report that about $50,000 (half of the appropriation) has already been expended.

The above is a careful synopsis of the report, given nearly in the words of the Commissioners. But we feel that we ought not to let the matter drop without some few comments. Our own position on the subject of boiler explosions has been often clearly defined, and our readers well know that we look for nothing more mysterious than too much steam, or too weak a boiler. At the same time, we are willing to concede that great good may result from experiments of this kind, properly carried out. One part of the work of the Commission we have looked forward to with the greatest interest. We refer to the test of safety valves. The only extended trial of the kind of which we have knowledge was made by the Life Saving Commission, a few years ago; and the result of that trial showed clearly that many of the safety valves in common use were wrongly named. It is difficult for us to see why the Commission, organizing early in the summer, delayed their experiments until the approach of cold weather. It is still more difficult to understand why the cessation of operations has been so complete. Surely, if every change of pressure and temperature of the steam affects the accuracy of a gage (which is quite a novel proposition to engineers) the Commissioners could continue their experiments, and reach a definite conclusion upon this point. The tests of safety valves, also, might well be continued through the winter. There is a strong suspicion in the minds of many that this Commission is not working purely in the interest of Science. It seems somewhat remarkable that the Supervising Inspector-General, who has so many other important duties, should be the chief man in the Commission. The fact that such an enormous sum of money has been expended, with such slight results, is calculated to awaken inquiry; and the refusal of Mr. Stevens, who inaugurated this style of experiments, to serve on the Commission, is a most significant fact. The public are vitally interested in all work of this character, and we but do our duty in calling attention to the shortcomings of the Commissioners, as evidenced by their own report.

Dangers of Gasoline.

At Bennington, Vt., last month, the knitting factory of H. E. Bradford was destroyed by fire. A leakage of the gasoline pipes permitted the flow of this heavy hydrocarbon gas along the floor until it reached the fire at the boiler, when a terrible explosion took place, demolishing the building. Nine women were instantly killed and several others were badly hurt. One of the especial dangers attending the use of gasoline is that, in case of leakage, it moves along the cellar bottom or lower floors of the building, and there is no means of detecting its presence until it reaches fire, when the entire mass explodes with terrible violence. Many sad accidents have occurred from its use. The ordinary street gas is less dangerous, because, being lighter, it commingles with the air, and its presence is soon detected by the olfactories.