

## ANOTHER NEW MOTOR.

The latest candidate among inventors for immortal honors is Prof. John Gamgee, of London, now residing in Washington, for he claims to have found out how to prevent a large part of that celebrated ninety per cent of loss which has hitherto been incidental to the use of steam for dynamical purposes. We learn from the newspapers that President Garfield, Secretary Windom, and others, have examined the new engine, and that Chief Engineer Isherwood has prepared a report on the subject to Secretary of the Navy Hunt.

A correspondent of the *Evening Post* says: "One of the examiners of the Patent Office tells us he regards it as the most important patent since the telephone. If it succeeds at all, however, it will be of far greater consequence than that or any other invention of modern time." The patent is dated April 19, 1881, and is entitled "Thermo-dynamic engine;" also the new engine is called a zeromotor, in recognition of the fact that it is designed to operate it at about the temperature of zero.

The patent clearly and fully describes the invention, and the few paragraphs which we quote will make the matter pretty plain.

"My invention," says Prof. Gamgee in his patent, "relates to the employment as a motor fluid of a liquefiable gas or vapor of adequate tension, the product of a liquid which boils at or near the temperature of surrounding objects.

"I find that by working such a gas or vapor expansively in one or more engine cylinders, its heat can be converted to such an extent into mechanical energy or motion that at the exhaust it will have returned in great measure to its original liquid condition, from which state it may be again caused to assume the condition of a motor vapor or gas by exposing it to the needed temperature.

"It is this feature, viz., the working of such a vapor or gas expansively to the extent of more or less complete liquefaction, and the reconverting it from the liquid to the vaporous or gaseous condition for use again as a motor fluid, which mainly characterizes my invention.

"The vapor having expended its energy, and being mostly liquefied by the conversion of its heat into motion, is discharged from the engine cylinder into a close exhaust vessel protected or insulated from environing heat. The maintenance of the exhaust at the boiling point (for atmospheric pressure or thereabout) of the liquid used may be insured in various ways; for instance, by means of an injector or pump.

"By the injector or pump, or both, the cooled vapor is forced into an apparatus for convenience sake termed a 'boiler,' where it is exposed to the temperature needed to restore it to its original tension, and thence returns to the engine.

"It will thus be seen that it is my object to obtain in a motor engine the conditions of a closed circuit with a liquid boiling at a low temperature relatively to water transformed into vapor, the molecular energy of which is converted into the mass as molar motion of the piston, so that its initial condition is restored.

"In this way in a heat engine I expend the temperature within which the heat is utilized downward in the direction of the absolute zero, instead of upward above the temperature of surrounding objects.

"The intense heat of boiler furnaces, the internal work heat necessary to the formation of water steam, the abundant exhaust waste of the steam engine, difficulties of lubrication, etc., are one and all avoided by my invention.

"The cycle I propose can be performed more or less satisfactorily with almost any liquid yielding expansive vapor below the temperature at which water boils; but in developing most power with most compact apparatus it is essential to use a compound which has a maximum amount of latent heat.

"The agent which I find in practice most available for this purpose is anhydrous ammonia, the boiling point of which at atmospheric pressure approaches closely to 34° F. At 0° C. its vapor tension is about four atmospheres, while at 10° it attains to six atmospheres. When the mean temperature attains 20° C., no less a pressure is exerted than nine atmospheres, and at 30° C., or tropical heat, it reaches over ten and a half atmospheres in tension. Since at blood heat two hundred pounds to the square inch is available it is evident that the usual temperature of ocean or river water is most desirable in practice and best in my opinion when below 0° C.

"The latent heat of ammonia is about 900°, as against 960° for water. It is this latent heat which I use in developing energy so as to reduce the amount of rejected heat to a minimum and obtain a maximum rate of liquefaction. Although high pressures are attainable at low temperatures, it will always be found best in practice to work below rather than over 100 pounds to the square inch.

"From the fact that I utilize in this system downward to 0° C. and below toward absolute zero, I propose for convenience to name the apparatus which I employ 'zeromotor.'

"The operation is as follows: The ammonia gas or vapor passes from the boiler into the smaller or high pressure cylinder, where it is worked expansively, the cut-off being adjusted, for instance, to one-tenth of the stroke. In thus expanding and doing work, the gas parts with its heat to a considerable extent. It then exhausts into the second or low pressure cylinder, where it is cut off, say at one-half the

stroke, and is thus caused to do further work expansively. The result is that the vapor, by the time that it passes from the second cylinder into the exhaust, has been almost entirely liquefied, only an exceedingly small proportion of the ammonia retaining vaporous form. The engine thus may be said to act not only as a motor, but as the condenser. From the exhaust vessel the ammonia is, by means of the compound pump and injector, forced back into the boiler, to be again brought to the condition of a motor or gas."

The specification continues the subject through various details of construction, but the matter quoted above is sufficient data for a full consideration of the pros and cons. We are obliged to find, however, that Gamgee's motor is mostly delusion; it is likely to be literally a zero-motor. The trouble is not with the ammonia. Dr. Lamm, of New Orleans, Teller, of Paris, and others have made ammonia motors which had a measure of success. Gamgee's theory would fail with steam or air. A motor vapor during its expansion is a useful source of power, but after it has expanded it is wholly unavailable. It may be brought again to the expanding or condensed condition, but if the cost of the restoration be computed, not the smallest fraction of gain can be discovered. Gamgee's motor would make one stroke, but never another of its own accord. Think of a steam engine which exhausts directly into its boiler! Prof. Gamgee has made an interesting invention, and if he can find some spot in nature where it may rest it promises to make a sensation.

It is certainly a curious incident of this matter that Chief Engineer Isherwood may become an advocate of working engines expansively, the cut off being adjusted, for instance, to one-tenth of the stroke.

## THE KEELY MOTOR DECEPTION.

The stock in this lunar enterprise has of late fallen very low, and a new exhibition of its incomprehensibility has been deemed necessary. The last performance, given on the evening of April 22, in Philadelphia, is thus described by a reporter of the New York *Herald*:

"The first public exhibition of the Keely engine was given this evening, in the presence of a large body of New York men. Among others present were J. Nelson Tappan, City Chamberlain of New York; Thomas Rowland, of the Continental Iron Works; George H. Peabody, E. F. Searls, General John Carrier, secretary of the American Wrecking Company; J. J. Smith, Edward W. Denny, and others. A private showing was given a few days ago before Major Conway, United States Ordnance Department; Commander Gorringe, United States Navy; Mr. Blanchard, vice president Erie Railway; Commodore Kane, New York Yacht Club; President Sayre, of the Lehigh Valley Railroad; E. J. Randall, Erie Railway, and twenty others. Commander Gorringe frankly declared that Mr. Keely had thoroughly removed the strong prejudices which he had had against both inventor and discovery, and that the exhibition was a wonderful one. To a *Herald* correspondent Commander Gorringe said: 'I am amazed at what I have seen. It is certainly one of the most remarkable curiosities I have ever looked upon, and appears *bona fide*.'

"To-night's exhibition was a very extended one. The two parts of the 'motor,' called the 'generator' and the 'engine,' stand in separate rooms on the second floor of a building on Twentieth street, in the vicinity of Girard College. Without expressing any opinion whatever regarding the scientific principles alleged to be involved, a simple narrative of the evening's occurrences may be set down as follows:

## CURIOUS EXPERIMENTS.

"When the visitors, almost completely filling the front room, had been seated, they saw before them an odd-looking machine built of steel, that shone like a mirror. The only description possible to give without an illustration to accompany it is, that it is wholly unlike any other collection of globes and tubes that has ever been exhibited. The first act was to remove every cock and tube, ostensibly to show that the apparatus was empty. Lights were placed underneath it and the visitors were invited to look into and through the various chambers. All the plugs and attachments having been replaced, one of the company drew a glass of water from the hydrant and poured the contents into half a dozen funnel-topped tubes, and in exactly twenty-nine seconds a force was generated sufficient to raise a six-foot lever (one inch fulcrum) upon which were hung 700 pounds of iron. The pressure was asserted to be fifteen thousand pounds to the square inch. The vapor said to create this pressure was then stored in a steel cylinder about thirty inches long and five inches thick, through the center of which is stretched a piece of piano wire. The vapor thus confined was then further 'vivified' by external vibrations of great energy obtained from a tuning fork of immense size. This done, a long tube of very constricted orifice was attached to this steel chamber, to form the connection with the engine in the rear room. Thither, then, all the visitors moved. The engine is called a 'compound' one, which is explained to mean that 'it can be worked with equal effect by positive or negative energy.' After a few cocks had been opened, the 'spiropHONE' contained in one of the drums began to roar, and the shaft, carrying a belt-wheel, began to revolve with great velocity. The whirring sound (much resembling the rising of a flock of quail), gradually became regular and harmonious, and the engine settled down to a regular speed of about sixty revolutions per minute. Some curious experiments were then made, to exhibit

what was denominated 'vibratory energy.' The revolutions of the engine were increased or diminished at will by Mr. Keely striking an iron disk or a gigantic tuning fork, or drawing a bow over a tightly stretched steel wire. The change from the negative to the positive 'energy' was made, resulting in an almost instantaneous reversal of the engine. This reversal, Mr. Keely declared, could be made at the very highest velocity without breaking anything. A brake, specially made with wooden lining, was then applied to the belt wheel with a leverage of five feet and the weight of two of the heaviest of the party, but no perceptible diminution in the speed resulted. Many other strange experiments with the vapor gun and other appliances of the alleged invention were given, after which the party separated.

"The experiments lasted three hours, and were in every way successful. A vote of thanks was given Mr. Keely, on motion of Mr. Tappan. The party returned to New York on the midnight train."

It will be seen from the foregoing that the Keely managers still look to the New York men. It was from them that their first treasure was extracted after the original first exhibition; and the new show is doubtless expected to yield another yellow harvest.

## THE GAMGEE PERPETUAL MOTION.

In another article we give the substance of Professor Gamgee's ideas, as expressed in his patent, concerning the principles and operation of his new motor, the practical value of which is alleged to be indorsed by the Patent Office Examiner, by Chief Engineer Isherwood, and by prominent officials of the American Navy Department.

In Professor Gamgee's engine the ammonia vapor expands against and drives the piston, then issues from the back end of the cylinder as a liquid, which runs to the front end of the cylinder, where it expands again as vapor against the piston, then runs back to the front end, and so on, in one perpetual round or "cycle" of duty, without any vulgar assistance from artificial condensers, or from coal, oil, gas, or other common fuel. Cold water—below 66° Fahr.—is the best fuel for him, says Professor Gamgee, in his patent. Water at 66°, he avers, gives heat enough to yield 100 lb. pressure per square inch on his piston. Water at blood heat, or 98° Fahr., would give him, he says, 200 lb. pressure per square inch, more, in fact, than he requires.

A correspondent of the *Tribune* lately asked Professor Simon Newcomb, the eminent physicist, for his opinion of the new device of Professor Gamgee.

Professor Newcomb said: "The question is purely one of physics, and not of steam engineering. The proposed machine, as Mr. Gamgee has explained it to me, and as I see it described in Mr. Isherwood's report, lacks the essential conditions which all experience shows a steam engine must fulfill; not merely because ammonia is used instead of steam, but because no source of external cold or exit for the vapor is employed, except that furnished by the engine itself. I think there is some mistake in describing the respective functions of the high and low pressure boilers in the printed remarks in the *Tribune*; but I think I see clearly what the essential principle is. We have a boiler of liquid ammonia exerting an enormous pressure at ordinary temperatures. A quantity of the vapor from this boiler is admitted into the cylinder of the engine, and thus presses upon the piston, expanding and moving the piston. Its heat is changed into force communicated to the piston, and it thus becomes in the cylinder intensely cold, so cold that a portion of it liquefies.

"So far there is no trouble in the action of the engine. It will make one stroke without doubt. The question now is to dispose of this cool and expanded vapor. The great mistake made by the promoters is in supposing that they can, by some ingeniously contrived machinery, force the vapor back again, so as to act again on the engine and still have a surplus of force left over. It is a perfectly established law of gases—as certain and universal as that of gravitation—that a gas when condensed generates the same amount of heat and exerts the same pressure as in expanding. The consequence is that, when the gas is condensed without some external source of cold, all the power expended in its expansion is used up again in contracting and heating it. Unless, therefore, as in the ordinary steam engine, some external source of cold is provided to absorb the heat which would thus be generated, the machine cannot act. Now this is the very condition which Mr. Gamgee proposes to dispense with. With the ammonia engine working at ordinary temperatures, the external source of cold must be as low in temperature as the expended ammonia itself, and therefore the ammonia cannot be used for the cold.

"To judge of all this we must remember that there is absolutely no new principle claimed in connection with the machinery, and claims made for it are in direct contradiction to the second law of thermodynamics. Yet I do not think a prudent physicist would claim that it was impossible to find in nature some mechanism by which this law could be evaded. All we can say is that to reach this result some radically new discoveries in the properties of matter must be applied. As there is nothing new in any of the principles called into play in the proposed engine, it may be pronounced a chimera with as much safety and certainty as we call perpetual motion machines by that name."

THE TOKIO EXHIBITION.—The National Industrial Exhibition at Tokio, Japan, was opened by the Mikado March 1. The attendance is said to be large.