actions and its poisonous effects on the animal system. Professor Pelouze, in 1865, gave full credit to M. Sobreso at a meeting of the French Institute, and it is therefore somewhat remarkable that any question of priority could now arise.

M. Sobreso, at the time he made the researches (in 1847) was Professor of Applied Chemistry in Turin, and there is no doubt about his being entitled to the honor of having discovered nitro-glycerin.

COMPRESSED AIR AS A MOTOR FOR SUBTERRANEAN RAILWAYS.

BY J. DUTTON STEELE, C.E.

[Read before the American Institute of Civil Engineers.]

It is scarcely necessary for me to state that compressed air may be used in all respects as steam, and worked in the same engines; that its chief characteristics are perfect ventilation and cleanliness, and that it may be carried in pipes long distances without loss from condensation, and similar causes, to which steam is liable. At Mont Cenis the air pipes must be as much as five miles in length, and the loss of pressure is not such as to impair the working of the drills, but I am without accurate information as to its extent. At Hoosac they are one and a half miles long, and the loss is two pounds to the square inch. At Nesquehoning they are one third of a mile in length, and there is no appreciable loss of pressure. In all these cases the air is worked at about fifty pounds per square inch; and the difference in pressure at the steam valves, when the power is generated, and the air after it is compressed, may be taken at about ten per cent when the best compressors are used. It will then be seen that the loss of power from the friction of the compressing machinery, and from the movement of air in the pipes, is not of a very serious character, and, if the pipes are tight, the pressure is well maintained while the machinery is standing.

With this brief reference to the leading characteristics of compressed air as a motor I will proceed to consider its possible application to subterranean railways; and in doing so will assume as a basis for discussion, that we have a double track railway ten miles in length, with moderate curvature and reasonable grades, and an air pipe along its center of ten or twelve inches in diameter, with compressing machinery at either end driven by steam of sufficient capacity to maintain a pressure in the pipes of any given standard.

Let us also assume that we have an endless wire rope passing along the center of each track, supported upon pulleys, and that it can be kept tight; and to compensate for its expansion and contraction, by changes of temperature, that it is passed around movable pulleys of large diameter at stated intervals, say every half mile. These durable pulleys may be arranged in vertical plains, so that one of each pair may move in its pedestal, and be weighted to take up the slack, while those in the top, which receive the rope at the level of the rails, are fixed upon their axles and provided with cranks for the application of power. I would next propose that at each of these main pulley stations, a stationary engine be placed to move them; each engine drawing its power from the air-main in the center of the road. We should then have a drawing rope moved by twenty stationary engines distributed along the line, acting in unison, connected by telegraph signals, and working under the same pressure.

There is no doubt as to the unity of action in such engines: their connection by means of the drawing rope would be perfect, and their speed would be regulated by governors; they would require but little attention, and their exhaust would produce the most perfect ventilation. If it is conceded that we may thus obtain a satisfactory motion in air-drawing ropes, either of one continuous rope, or of ropes in sections (and I apprehend either is practicable), it only remains to transfer that motion to the cars.

In this connection and explanation of the principle in view, I would invite your attention to the new tramways now building in Europe for the transportation of ore and fuel in the mining and manufacturing districts. They consist of endless wire ropes supported upon pulleys, which are fixed to strong posts and elevated more or less above the surface, with the moving power at the end; upon these wire ropes, boxes or cars are suspended at intervals, which contain the load, and which move with the rope, and are passed without difficulty over the pulleys, the opposite rope taking back the empty cars.

Many of these wire tramways are now in use, some of them as much as four miles in length, and so satisfactory in their operation that as much as one hundred miles are said to be under construction in England.

It will be observed that the hight of the suspended load produces the necessary friction for transmitting the motion of the rope to the cars, and that they are passed with ease over the pulleys. The rope, as proposed for a subterranean railway, is in a better position for such use than in the wire tramway, and if it is possible to make use of the load, as a means of transmitting the motion to the cars in the latter, there should be no difficulty in doing the same thing in the former. Let us then suppose brakes dropped from the cars upon the driving ropes, so as to transfer only so much of the weight of the cars to the rope as may be necessary to communicate the motion, we would then have, by the use of the breaks on the rope and brakes upon the wheels, the means of stopping and starting the car at pleasure. The grades upon which such a system may be worked, will be about the same as with locomotives: and the advantage of air over steam as a motor, will be found in its perfect ventilation and cleanliness; the nearly uniform pressure under which the several engines can be worked; and the distribution along the line of the power which is generated at the ends. But the air in the mains may be used for other purposes, with profit and advantage, such as driving printing presses and other light machinery to aid the industry of large cities, and, wherever used, pure air and a reduction of the liability to fire will be the result.

In submitting these general views, I have avoided as much as possible mechanical details, which those who may take an interest in the subject will have no difficulty in supplying. They are speculations as to growing wants in advancing cities, and if they aid in ever so small a degree in giving direction to the stronger mental currents which these wants will attract, the writer will be compensated for the little thought he has given to the subject.

COMPRESSED AIR, AMMONIA, AND RUBBER VS. MULE POWER.

New Orleans, with all its other attractions, is fast becoming a home for new inventions, especially those relating to motive powers. The city rests on a dead level, and so easy is it there to propel railroad cars, that the whole team consists of a single mule, which answers all requirements admirably. Any one would naturally suppose that this is about as good and economical a motive power as could be employed. But genius will assert itself, and, according to the New Orleans *Republican*, "the death knell of the mule is already sounded."

The first improvement over the mule, proposed by the inventive geniuses of New Orleans, was to place tanks on the cars, within which air was compressed to a pressure of 300 pounds to the square inch. To run the car, you simply turned a faucet, and away it went from one end of the town to the other, and back. This style of pneumatic car was tried not long ago in New Orleans with success, a stock company formed, and everything for a time looked lovely.

But another genius soon improved upon the improvement, and got up a plan to drive the car by substituting compressed ammonia for the common air. This car is said to have been run with so much success, that the pneumatic stock immediately went down, and the ammonia began to rise.

But before the full effect of the ammonia had been experienced, still another genius enters the field and astounds the Southern community by the announcement of a third motive power, far cheaper and better than either of the two systems before made known.

This remarkable motor is nothing more nor less than *india-rubber*. It is the discovery, says the *Republican*, of "Mr. Solomon Jones, a gentleman of a mechanical turn of mind, who has heretofore distinguished himself by the invention of the most intricate and remarkable descriptions of machinery. He had, in his experiments, his attention called to the wonderful power possessed by india-rubber when contracting after having been stretched.

"After a long series of experiments, he discovered that the Para rubber was capable of stretching ten feet for every one of its ordinary length, and that the retractile power was enormous. He made a system of turnings, windings, and twists of this rubber power, which would enable him to place it under any car without altering its present build, and which would give him a power capable of propelling that car through the streets at a rate always at the command of the man in charge, and capable of lasting the wear and tear of constant service for years.

"His machinery was very simple, the rubber was wound upon a drum, and the drum once let loose the car commenced to move at a speed more than could be desired were it not that it is under perfect command from a simple system of cogs working under the leverage power in the hands of the conductor. His model was sent to Washington to the Patent Office, and although it was not all he could wish, as he was compelled to use a common gas-pipe rubber in place of the prepared material he proposes to use, it passed the rigid scrutiny of that office, famous for the care and strictness of its examinations, and a patent was issued to him, in connection with Mr. Bernard Terfloth, one of our well-known mechanics, for this new invention.

"For street cars two bands of the rubber, two and a half inches in diameter and fifty-six feet in length each, will be used. Each piece will be attached to a separate drum, and as the stretch of the rubber will be ten feet for one, five hundred and sixty feet will be run off the drum before it becomes necessary to use its fellow-drum. In running off this five hundred and twenty feet, a distance of 14,175 feet, over two miles, will be traversed by the cars; the other drum is then called into requisition, and while it is propelling the car the exhausted drum is wound up by the same leverage which the conductor uses to stop and control the car; the only trouble the conductor has is to throw the lever off the drum in motion, a simple operation, which can be reversed in a minute if it becomes necessary to stop the cars.

"This invention is not by any means intended to be confined to the propulsion of street cars; it is intended to be adapted to everything now monopolized by steam. It can be made useful in the household or the factory to run sewing machines, and our citizens will soon have an opportunity of seeing it tested working fans in one of our churches. Its remarkable cheapness, and the economy with which it can be used, make it all the more desirable.

"The Mobile city railroad companies are preparing to accommodate their cars to the new invention, and the death-knell of the mule is already sounded there, and perhaps in a few months we shall be able to witness the astonishing spectacle of our own cars running the streets by india-rubber power.

"The inventor holds his patent, we understand, at the service of Northern and Western railroad men, and will give them rights at remarkably low rates. A New Orleans inventor is not by any means an anomaly, but our sharp and shrewd mechanics have held themselves too closely to business heretofore, and we welcome Mr. Jones' enterprise as creditable to the city and the State."

SCIENTIFIC INTELLIGENCE.

EXPERIMENTS WITH THE DIAMOND.

According to Morren, the diamond heated to bright redness in a current of illuminating gas becomes covered with a deposit of graphitic carbon, which can be partially rubbed off, and can be entirely removed by polishing; if it be afterwards cautiously heated to redness on platinum foil, it recovers its original luster and weight.

In hydrogen gas the diamond can be heated nearly to the point of fusion of platinum without undergoing any change; it rather increases than diminishes in luster. In carbonic acid it loses slightly in polish and weight, and the resulting gas contains carbonic oxide and oxygen; the carbonic acid is not decomposed by the diamond, but by the white hot platinum, and the loss of weight in the diamond is due to partial oxidation.

The diamond not only burns in oxygen gas, but in the air when heated to redness before the oxyhydrogen flame; it takes fire and burns like coal, but goes out when the heat is intermitted. It then becomes white like ground glass, and does not blacken, nor swell up, nor splinter, unless previously cracked. The unconsumed portion exhibits under the microscope innumerable triangular facets, evidently derived from actahedra. Diamonds with native lenticular faces and such as are used for glass cutting, look, after having been strongly heated in the air, as if they were composed of so many prisms inclosed in triangles. Whether black diamonds would exhibit the same behavior under similar circumstances has not been determined, as no experiments have thus far been made upon them.

PRESERVATION OF MEAT.

Mr. Georges, in Montevideo, S.A., preserves meat by immersing it in a liquid composed of 85 per cent water, and a mixture of glycerin with acid sulphite of soda and hydrochloric acid, and afterwards strewing dry sulphite of soda upon it, and sealing hermetically in cans. After the lapse of a year the flesh was perfectly fresh. Before using, it must be rinsed with dilute vinegar, and left exposed for a short time in the air. Meat thus prepared costs, in Paris, five cents a pound, and is said to be a valuable article of food. Meat can also be kept perfectly sweet by being immersed in melted paraffine, and when required for use only needs to be greatly heated to melt off the covering of paraffine, which can be saved for further use.

PLATING COPPER AND BRASS WITH ZINC.

According to Böttger, copper and brass can be easily coated with zinc by immersing them in a boiling bath of sal ammoniac containing zinc foil or powder. The deposit of zinc made in this way is brilliant, and adheres firmly to the copper and brass. Whether iron could be coated or galvanized in the same way is not stated by the author, though the use of sal ammoniac in the ordinary process is well understood.

METHOD FOR PURIFYING ILLUMINATING GAS.

E. Pelouze modifies the Lamming mass now generally employed for the purpose of purifying illuminating gas, by adding sulphuric acid. He sprinkles the purifiers containing oxide of iron and sawdust, with water, to which 20 per cent of sulphuric acid, of specific gravity 1·53 (53° B.), has been added, and after the mass has dried up sufficiently, passes the gas through. After use it is necessary to restore the sulphuric acid, and to remove the sulphate of ammonia that may have been formed. It is said that napthalin is not removed from the gas by this method.

A mixture of oxide of iron and sawdust thus prepared would serve an excellent purpose as a disinfecting agent to be added to the earth in the earth closet, in stables, cess pools, and the like, but where it has to come in contact with metals care must be taken not to have free sulphuric acid present.

Ordinary copperas or sulphate of iron and sawdust, with native hematite, or bog-iron ore, would also make a valuable disinfecting mixture, and would be cheap.

SYNTHESIS OF ACETIC ACID.

Berthelot has succeeded in making vinegar from acetylene, one of the products of the distillation of coal, and a frequent constituent of illuminating gas. He accomplished this in one way by first producing alcohol from illuminating gas and subsequently oxidizing the alcohol into vinegar in the usual way. The process is curious scientifically but not practicable on a large scale. The most important method proposed by Berthelot is to dilute acetylene with twenty times its volume of air, and allow it to stand for six months at ordinary temperature exposed to the light in a closed jar over a solution of caustic potash—it then changes spontaneously into acetic acid—

$$C_4\ H_2 + O_2 + H_2\ O_2 = C_4\ H_4\ O_4$$

Only one half the hydrocarbon of the acetylene is thus transformed, the other half being converted into a resinous mass. It would certainly be a great triumph of modern science to be able to make alcohol and vinegar out of illuminating gas, as that would save us the loss of sugar, and suggest a good many refuse articles that could be made useful by distillation. Perhaps some of the natural gas springs of the world could be turned to good account in such an industry.

WESTERN papers chronicle the death of "the first white child born in Ohio," at the age of eighty years. A rather backward infant that.