Experiments on the Poisonous Action of Acetylene.*

Thanks to the extreme kindness of M. Moissan, who has given me a sufficient amount of calcium carbide to prepare several hundred liters of acetylene, I have been able to make a series of comparative experiments, which I have the honor of presenting to the academy.

I caused to be introduced into a mercury test glass, well dried, 400 grammes of carbide of calcium. A rubber cork pierced with two holes received a glass funnel with a cock in it and the other end a conducting tube, which carried the gas obtained by the flowing of water, through the glass retort, which allowed the regulation of the outflow; when all the air had been forced out, and when the gas obtained burned without explosion, the acetylene was received in a gasometer (model of Dr. Saint-Martin).

I successively titrated mixtures of acetylene, of air, and of oxygen, adding always 20·8 of oxygen as in the atmospheric air.

Mixture of 20 to 100.—I caused a dog to breathe a mixture composed of 20 to 100 of acetylene; the animal remained quiet; the respiratory movements became larger in extent. At the end of 35 minutes, 44 c. c. of arterial blood was injected into the empty receiver of the mercury pump, and I extracted the gas which had been collected over the mercury, in a little bell with a glass cock; after the absorption of the carbonic acid by potash, the gaseous residue was introduced into the fire damp indicator, whose receptacle had been filled with three quarts of air, and the gaseous mixture was contained in the receptacle and in the entire length of the graduated tube. At the first passage of the current, we saw a very clear blue flame and a detonation was produced with a sharp sound; the reduction was equal to 82·4 divisions and indicated a considerable volume of acetylene, which had been absorbed by the blood; 1 c. c. of acetylene giving a reduction three times as large as that of carbonic oxide gives; that is to say, $3 \times 6 \cdot 6 = 19 \cdot 8$ degrees in my fire damp indicator; 100 c. c. of blood contained 10 c. c. of acetylene.

Mixture of 40 to 100.—The oxygen of Passy contains 90 to 100 of the pure oxygen. In order to obtain a mixture of acetylene of 40 to 100, the calculation indicated that it was necessary to add 55 liters of this gas, 66 liters of air, and 16·5 liters of oxygen, in order to prepare a mixture containing 79 of acetylene and 20·8 of oxygen. A dog who breathed this mixture, after having presented a long period of agitation, circulated in its lungs 112 liters of the mixture. Suddenly, 51 minutes after the commencement of the experiment, the animal extended its paws and died; the heart had stopped; we drew off the blood into the lower vena cava; it revealed in the fire damp indicator the presence of 20 c. c. of acetylene in 100 c. c. of blood.

Mixture of 79 to 100.—I made a mixture of acetylene and oxygen in which combustible gas replaced the nitrogen of the air. At the end, a dog caused to breathe this mixture presented a continual agitation and very ample respiratory movements. Eleven minutes afterward, we observed general convulsions; 27 minutes after the commencement, he extended his paws, and there were some painful respiratory movements, which preceded death.

This mixture of 79 to 100 was conducted into a bell formed glass jar in which there was a guinea pig. In 6 minutes the animal fell upon its flank; had convulsions, fluttering movements of the limbs and of the head. At the end of 39 minutes, we drew out the animal, which rested flat on its flank. Some minutes later the guinea pig raised itself and revived, but it died during the night.

I concluded from my experiments that the acetylene is poisonous when one employs a strong dose, if administered in large doses between 40 to 100 and 79 to 100. The employment of the fire damp indicator easily allowed the discovery of this gas in the blood.

I endeavored also to compare the poisonous quality of acetylene with that of illuminating gas. Starting from the fact often proved by analysis that coal gas (illuminating gas) contains 7 to 100 of carbonic oxide, I made a mixture of 150 liters of air, 5·3 of oxygen, and 20 liters of coal gas, which should contain 1 to 100 of carbonic oxide and 20·8 of oxygen. A dog forced to breathe this mixture presented at the end of 3 minutes a lively agitation, and at the end of 6 minutes very violent movements of agitation. We took, 10 minutes after the commencement of the experiment, blood from the carotid artery, and from 100 c. c. we could withdraw 27 c. c. of carbonic oxide. The dog when released remained lying on the floor—was very sick; and if the experiment had lasted some minutes more, it would have died. Illuminating gas is, therefore, much more poisonous than acetylene.

Exposition at Montreal.

The British Empire Exposition and International Display of All Nations will be held in Montreal, Canada, from May 24 to October 12, 1896. The plans of the exposition include an electrical display, and the successful exhibitors will receive handsome awards.

*By M. N. Grehant, in Comptes Rendus.

Correspondence.

ELECTRIC IGNITERS FOR GAS ENGINES.

To the Editor of the SCIENTIFIC AMERICAN:

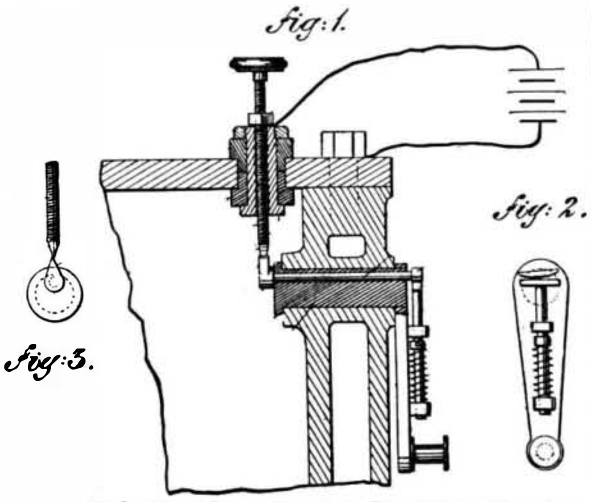
Allow me to call your attention to the fact that the rotary spark arrangement, Figs. 3 and 4, in an article on "Electric Igniters for Gas Engines," by George M. Hopkins, in your issue of January 11, is covered by my patent No. 546,238, of September 10, 1895, which particularly describes and claims the eccentrically bored spindle. FRANK S. MEAD.

Montreal, Canada.

[The several devices illustrated in the article referred to are based on the principle of the ordinary electric igniter used in connection with burners for illuminating gas. These illustrations were given merely as suggestions, leaving it to the reader to make the practical application. When this article was published the writer did not know that there was in existence a patent for a device similar to one shown in the article.

As Mr. Mead has called our attention to the similarity existing between his device and that of one of the illustrations, we reproduce some of the figures shown in his patent. This igniter is arranged to give a strong spark from a current derived from a battery, which insures the ignition of the explosive mixture at the proper time, and although no spark coil is shown in the circuit of the battery, we presume it was the intention to use a coil.

As shown in Fig. 1, the cylinder of a gas or oil engine is provided with the usual jacket, the end of the cylinder being closed by a cylinder head. In the cylinder wall is mounted a rock shaft connected at its outer end with a crank arm, as shown, or the shaft may be provided with a wheel receiving rotary motion from some revolving part of the engine. In the shaft is mounted eccentrically an electrode provided at its outer end with a cross bar on which presses the head



MEAD'S ELECTRIC IGNITER FOR GAS ENGINES.

on the end of the spring-pressed rod carried by the crank arm. On the end of the electrode within the cylinder is secured a pointed arm, as indicated in Fig. 3, adapted to engage the pointed end of a fixed electrode inserted in a sleeve held in the insulating bushings in the cylinder head. On the upper end of the electrode is secured a hand wheel to facilitate setting the point in proper position relative to the point of the arm of the movable electrode. A wire from an electric generator is connected with the adjustable electrode, and another wire from the generator is attached to some part of the cylinder.

It will be seen that when a rocking motion is given to the shaft by the crank arm, the spring-pressed head engages the cross bar, causing the movable electrode to move in line with the crank arm, and the oscillating electrode is moved into contact with the point of the fixed electrode, and by turning in its bearings in the shaft it finally passes the fixed electrode and produces the spark which ignites the explosive mixture in the cylinder. A similar result is obtained when a complete rotary motion is given to the shaft.

In the article to which reference has been made it was suggested that a small dynamo had been used successfully for producing the ignition. A correspondent has inquired as to the method of using a dynamo for igniting the explosive mixture. The dynamo is driven by the engine, and its terminals are connected with the movable and fixed contact points. When the points are separated, a spark is produced by the extra or self-induced current of the dynamo. No coil is needed.—ED.]

Call for a Motor Driven Sleigh.

To the Editor of the SCIENTIFIC AMERICAN:

We hear a good deal said about the horseless carriage. Why not take the sleigh in hand and move that with a similar motor? Such a sleigh would require the addition of a driving wheel back of the seat and midway between the two runners. This wheel would have a semi-free vertical movement and would be kept close to the road's surface either by weighting or by a spring or springs above it. It would need to be light, should have a polished surface, and should be rimless at edge, thus offering little, if any, chance for snow to adhere to it. At points around the margin of the wheel, two or three inches apart, little projecting spurs would give it the required hold upon the road to insure a forward movement to the vehicle. This wheel would get its motion from a crank or band connected with the oil or other motor, under the seat, as in the horseless carriage.

To guide our sleigh, a rudder-like fixture would be attached to the rear end of each runner, and the two would be moved, in concert, by the sleigh's occupant.

A long brake, following the side of each runner, would have a roughened or lower surface, which would be brought to bear lengthwise upon the snow coating of the road by a bar, in the usual place, at the side of the carriage seat.

It seems to me the successful horseless sleigh is an easier problem to solve than that of the horseless carriage.

As to its rapidity of movement, it might easily outstrip the ordinary railroad train, if the road traveled would admit of it, or the occupant could bear the lively stirring up. B. F. LEEDS.

San Diego, Cal., December 6, 1895.

Care of Books.

Even to those who are most careful and particular with their loved and treasured libraries accidents will happen, and the human bookworm is at his or her wits' end to remove the difficulty, which threatens perhaps to ruin forever one or more of the choicest volumes.

An English magazine lately published the following items, which will probably be found useful by any librarian:

To remove ink stains from books—A small quantity of oxalic acid, diluted with water, applied with a camel's hair pencil and blotted with blotting paper, will, with two applications, remove all traces of the ink.

To remove grease spots—Lay powdered pipeclay each side of the spot and press with an iron as hot as the paper will bear without scorching.

To remove iron mould—Apply first a solution of sulphuret of potash and afterward one of oxalic acid. The sulphuret acts on the iron.

To kill and prevent bookworms—Take one-half ounce of camphor, powdered like salt, one-half ounce bitter apple, mix well, and spread on the book shelves. Renew every six months.

To polish old bindings—Thoroughly clean the leather by rubbing with a piece of flannel; if the leather is broken, fill up the holes with a little paste; beat up the yelk of an egg and rub it well over the covers with a piece of sponge; polish it by passing a hot iron over.

Do not allow books to be very long in too warm a place; gas affects them very much, Russia leather in particular.

Do not let books get damp or they will soon mildew, and it is almost impossible to remove it.

Books with clasps or raised sides damage those near them on the shelves.—Inland Printer.

Calcic Carbide as Motor Fuel.

The Gas World quotes some interesting figures given by Dr. Adolph Frank, of Charlottenburg, in a paper communicated by him to a foreign contemporary, and recommending the direct use of calcium carbide in motors, the gas being liberated as required by means of water, and not carried about in a compressed state in cylinders. According to the authority quoted, both the Bitterfeld and the Neuhausen works have improved their products up to 90 per cent yields, and, it is added, a price of 90s. a ton does not now look at all unlikely. The theoretical yield of acetylene is 26 pounds per 64 pounds of carbide, and the extra weight, that of the calcium, is a small matter in comparison with the expense and risk of fifty-atmosphere cylinders. Curiously enough, the liquefied acetylene obtainable from a given quantity of carbide occupies, as nearly as possible, twice the volume of the carbide itself.

The data arrived at are, for a 1,000 horse power marine engine, worked for 600 hours: Coal, at 1·54 pound per horse power per hour, 420 tons, occupying a space of 420 to 430 cubic meters; liquid acetylene, at 0·396 pound per horse power per hour, 108 tons, filling cylinders of an aggregate capacity of from 270 to 300 cubic meters, and of sufficient strength to withstand a pressure of 50 atmospheres; carbide of calcium, 90 per cent, or 36·56 per cent of acetylene by weight, total required, 300 tons, occupying 131 cubic meters only. In the last case the whole, which required protection from damp, etc., would not bring the space occupied up to 150 cubic meters. This (our contemporary remarks) is a very remarkable comparison in view of cases where storage capacity is all important, for the whole of the steam boilers would at the same time disappear; but, of course, in the meantime the price of carbide stands in the way of the practical adoption of acetylene for motor purposes.

Wampum.

This is the English name for the shell beads used for ornament and as currency among the northern tribes of Indians previous to the settlement of the country. They were made chiefly on Long Island and around New York Bay, and were of two kinds, one made of conch or periwinkle shells and the other of hard clam shells. The making of wampum, to be sold for ornaments, has been carried on for nearly a hundred years by the Campbell family at Pascack, N. J., and they are now said to be the only persons who know how to bleach and soften the conch shells used in making white wampum or to drill holes through the still harder clam shells that are made into the more valuable black or deep purple wampum. The conch shells are brought from West Indian ports by schooners. The clam shells are of the largest size obtainable, the smaller ones being too thin for the purpose.

The white wampum and hair pipes are, according to the New York Sun, made from the lip of the shell, which is cut into suitable sizes after being detached from the body and put through a softening process that also bleaches it white. The hair pipes are somewhat thicker than a clay pipe stem, tapering from the center to both ends, and are graduated in length, by half inches, from one to six inches. They have a hole through the center lengthwise. They were used to ornament the long hair of the chiefs, which was run through the holes and secured with gaudy colored strings.

Black or dark purple wampum has always been more costly than the white because it was worn only by the chiefs and medicine men and because of the difficulty of drilling the holes. But a small portion of a clam shell yields material of the proper hue, and when it is cut in sections there is so much waste by breakage that only the most expert workman can be intrusted with the task. The dark shell is cut in lengths like the white. A number of sections having been drilled, they were, according to the old process, strung on a wire and placed in alternating grooves running around a fine grindstone. As the stone revolved Rockaway sand and water were dropped on it and a piece of hard board was rubbed back and forth across the face, thus moving the wampum and rounding its outer surface. Then it was washed, dried, dipped in olive oil to give a gloss, and afterward made into strings for market. The clam shell could not be softened without ruining its color.

NEW ARMY BICYCLES.

The new army tandem and the model 40, mounted with a Colt's automatic machine gun, which have been made by the Pope Manufacturing Company, were exhibited at the Madison Square Garden Cycle Show and attracted great attention.

The tandem is one of the Pope Company's regular model 43s taken directly from stock and finished plainly in enamel and nickel. On the front handle bars are tightly strapped two army overcoats, and on the rear bars a pair of blankets. Resting safely in brackets on either side of the machine is a twelve shot repeating rifle, and hanging on each seat post a Colt quick action revolver of the latest pattern. In addition to this there is a case of signal flags extending almost the whole length of the machine, but not interfering with the riders in the least; and this is the case with all the equipments, being as well and safely placed, ready for use in a moment, and yet causing not the slightest interference.

The Colt automatic gun mounted on the model 40 is the one recently adopted by the government for our navy. This gun weighs between thirty-nine and forty pounds, shoots two hundred and fifty or five hundred times—being automatically fed—and is remarkably accurate. It is fastened securely to the head of the machine, can be easily directed at any angle, and does not interfere with the rider or affect the steering of the machine.

These two wheels are as perfectly equipped with the necessary accouterments of war as would seem possible, and the interest which army people and civilians alike have shown in them leads one to believe that it will not be long before the wheel will form a very effective adjunct to regular army service.

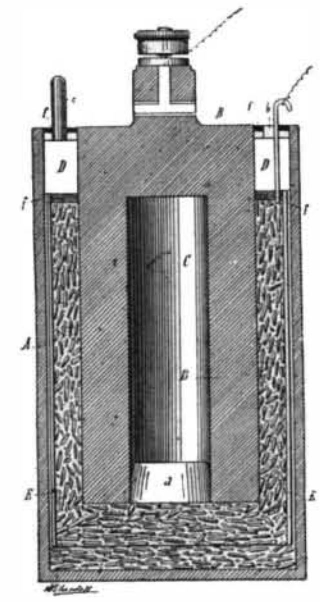
NEW ARMY BICYCLE MOUNTED WITH A COLT MACHINE GUN.

NEW ARMY TANDEM BICYCLE.

IT is proposed to construct a railroad from the city of Mexico to the harbor of Acapulco, on the Pacific coast. Acapulco has one of the finest lock harbors to be found anywhere, with 25 feet of water, and capable of floating all the navies in the world.

A NEW DRY BATTERY.

The battery represented herewith is said to be more durable than its congeners when not in operation. It consists of a glass vessel, A, in which is placed a carbon electrode, B, and a zinc one, E, which is closely applied to the inner surface of the vessel. In the carbon electrode there is a cavity, C, which may be filled with any kind of depolarizer and then be closed with a stopper, a. The space between the zinc and the carbon, as well as the lower part of the battery vessel, is filled with chopped rye straw, to which adheres bichloride of mercury, and which is quite strongly compressed. This filling extends to within three-quarters of an inch or an inch and a half of the upper



NEW DRY BATTERY (VERTICAL SECTION.)

edge of the vessel, so that a space may be reserved for the reception of the liquid before the reaction is brought about. Upon the filling, moreover, there is placed a cap of hemp, f, designed to prevent the element from emptying when it chances to be inverted. The aperture of the glass, likewise, is closed with a cap of hemp, f', impregnated with a resinous substance, and to which is applied a coating of asphalt cement. Finally, three filling apertures are formed in the cover and are closed with stoppers, c.

After the liquid that is to dissolve the exciting salt of the battery has been introduced, the electric current produced decomposes the bichloride of mercury into chlorine and mercury. The latter amalgamates the zinc, and thereafter prevents it from being attacked when the battery is at rest. As for the chlorine, that combines with the hydrogen of the reaction and forms hydrochloric acid, which, when the battery is not in operation, dissolves the layer of oxide of zinc, and thus permits of a new attack of the positive electrode over its entire surface.

At rest, the element, however, remains perfectly dry, and so no reaction occurs, and it loses neither its electromotive force nor the force of its current. Thus is explained the longer duration of this new battery.—La Vie Scientifique.

Egypt's History Traced from its Plants.

Dr. Schweinfurth made recently before the Egyptian Geographical Society, of Cairo, an address on the origin, or, more exactly, on the history, of cultivated plants in Egypt. He spoke in the first place on the route of the Hamitic race to the Nile valley, and concluded that they first lived in Northern Abyssinia and Southern Nubia as cattle breeders. From this point a nation of herdsmen could easily spread, and they certainly brought the ass with them from Somaliland and Nubia—an animal that had been used by man in Africa from prehistoric ages. The agriculture, literature, and religion of the ancient Egyptians were connected in the widest sense with the cultivation of plants. If all means of historical research are directed toward this subject, we find that of the 1,320 existing plant species of Egypt, of which 150 are useful plants, cultivated in great quantity, only 50 species of the latter were known before the Christian era, of which 40 are pictured on the monuments and the remaining 10 are mentioned in the inscriptions. If we would have a conception of the agriculture of the ancient Egyptians, we must exclude fully two-thirds of the plants cultivated in Egypt to-day. Dr. Schweinfurth distinguishes six epochs, according to the kinds of plants that were introduced into the country, as follow:

Epoch I.—Egypt is covered with grassy plains and forests, inhabited by the primitive African race, now extinct. Part of the cultivated plants belonged to the primitive flora of the Nile valley, whose representatives yet flourish over about 15° of latitude. . . .

Epoch II.—Colonization of Egypt by the Hamitic race. Disappearance of the forests, spread of the pastures, beginning of agriculture.

Epoch III.—Beginning of civilization; development of religion and art. Introduction of frankincense; acclimatization of the sacred trees of Arabia. . . . Toward the end of this epoch the cereals were brought in from the Euphrates valley. Beginning of the cultivation of corn, barley, flax, and the vine.

Epoch IV.—Epoch par excellence of Egyptian agriculture. The three kingdoms and the Lybian-Ethiopian domination.

Epoch V.—Egyptian agriculture spreads to foreign lands and the land receives in return many useful plants from abroad. This epoch includes the Persian, Greek, Roman, Byzantine, and Arabian periods.

Epoch VI.—Decay of Egyptian agriculture, about A. D. 1517. In the latter half of this epoch a regeneration followed and a return to civilization. By means of the Venetians the land received useful plants from America, such as maize, tomatoes, sweet potatoes, pimento, and tobacco. Tropical Africa gave it sesame, rice, sugar cane, and sorghum; Arabia, the sycamore, the fig, the pomegranate; Babylonia, cereals, speltz, corn, barley, etc. . . . and America again the most valuable of all her plants, namely, cotton.—Gaea, Leipsic.

Poisoning by Stale Eggs.

Dr. Cameron has reported the occurrence of vomiting and purging in seventy-four nuns and girl pupils in the boarding school attached to a convent in Limerick, following a dinner at which mutton and a custard composed of eggs, milk, corn flour, and sugar were eaten. The corn flour was suspected to contain arsenic, but analysis showed it to be free from poison of any kind, and to be of good quality. The sugar also proved to be pure. No other constituents of the meal could be obtained. The vomit and the stools were intensely green from the presence of biliary matter, but careful analysis failed to disclose the presence of ordinary poison. The viscera of two patients who had succumbed were also examined, but no poison was found. Ptomaines were found present, but in small quantity. The milk used had been boiled, and the meat was above suspicion. The eggs, however, were not fresh, and one presented a reddish-brown color and was thought to be bad. Some of the custard given to pigs induced severe diarrhœa.—Dublin Medical Journal.