about in the following way: When wheat is ground in the ordinary way, the centrifugal force and the angle of the cut in the stones forces the flour to the periphery across the face of the fixed stone; but in the improved mill, both stones being in motion, each helps the corn to the edge, and the corn consequently leaves the stones much more rapidly than it would do if one were at rest. In practice it is found that the speed of the stones may be brought up to 30 feet per second at the periphery, or say 127 revolutions per minute for a 4 feet 4 inch stone, without heating the flour.

The gear is the invention of Mr. Cullen, a British engineer, and has in practice been found thoroughly successful in every respect.

Correspondence.

The "Etheric" Force.

To the Editor of the Scientific American:

I have read with some interest the articles in the SCIENTIFIC AMERICAN on the so-called "etheric" force, in pursuit of which Mr. Edison is said to be now conducting experiments at his shop in Newark, N. J. At the same time, I cannot but believe that somebody is somewhere mistaken. Mr. Edison is perhaps sincere in his belief that he has discovered a new and valuable force, and if so he is deserving of credit for continuing his investigations; but he will soon learn, if he has not done so already, that the hopes excited are delusive and evanescent.

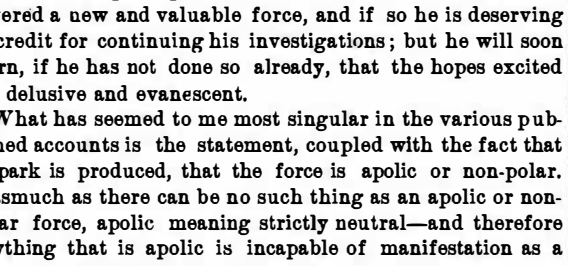
What has seemed to me most singular in the various published accounts is the statement, coupled with the fact that a spark is produced, that the force is apolic or non-polar. Inasmuch as there can be no such thing as an apolic or non-polar force, apolic meaning strictly neutral—and therefore anything that is apolic is incapable of manifestation as a force, manifestation involving force—hence anything apolic is not a force. The very fact that the force is manifested shows that it is either a positive or a negative condition at the instant of manifestation—by no means neutral; and your assumption, that one condition succeeds the other so rapidly as to prevent material manifestation in the galvanometer or other instrument, indicates to me your acceptance of this truth.

Some two years ago, I was considerably interested in this subject, and conducted a series of experiments at my laboratory, then in Washington, for the purpose of ascertaining whether the current could be utilized so as to effect a record or actuate a receiving instrument. So far was I from having discovered the force that I had learned its existence from others; and it seemed to me that, if it consisted purely of the molecular magnetic vibration, it might follow a metallic conductor in preference to running to earth, just as the magnetic force will extend from one end of an iron bar to the other, with equal facility, whether the bar is insulated or surrounded by other conductors, such as liquids. I soon became convinced of three things:

1. That the current can be made to produce a record.
2. That it is not purely the magnetic force, but what might be understood as the magneto-dynamic current.
3. That it is practically of no value.

I had in my possession a rather powerful magneto-electric machine, on the same principle as Ladd's machine. The revolving Siemens armature was wound with wire, which, starting with the slight resident magnetism in the electro-magnet between the poles of which the armature revolved, returned the induced current to the helices of the electro-magnet, thus building up the magnetic force in the electro-magnet, so that the induced current might be increased indefinitely. The machine produced the magneto-dynamic spark in great brilliancy. I witnessed, at times when the armature was revolving very rapidly, sparks of from $\frac{1}{8}$ to $\frac{1}{2}$ an inch in length between the poles of the magnet, although a carbon battery of 100 cups failed to indicate the least connection between the helices and the metal of the electro-magnet. When a piece of metal or a plate was interposed, it apparently became charged with electricity. The accumulation seemed to be in principle something akin to that of a Leyden jar, but it did not continue a sufficient length of time to produce a direct electric record. The manner in which I operated will be understood from the following:

Fig. 1.

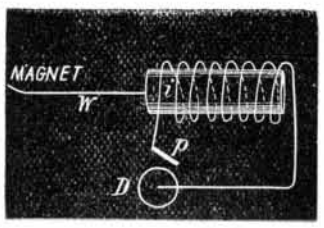


In the engraving is shown a plate electro-magnet, of which *m m* are the poles, curved inside for the revolving Siemens armature, which, however, is not shown. The iron projecting pieces, *h h*, were fastened to the ends of the cores in order to bring two points, *a* and *b*, near together, and thus afford a ready passage for the magneto-dynamic current. Between these, but not touching them, was a metallic plate, *c*, from which led a short conducting wire. At each half revolution of the armature, the piece or plate, *c*, became charged, and the charge extended to the second plate, *f*. Upon the plate, *f*, was a point, *d*, and whenever another plate, *g*, with a point, *e*, was brought in close proximity to the point, *d*, the third plate, *g*, also became charged; but here the spark was much weaker than at *c*. As near as I can understand it, this is practically what Mr. Edison has accomplished; and it really amounts to nothing at all. Nor did it seem to make any difference with the charging of the plate, *f*, when I placed the conducting wire in water; but it was observable that the plate, *g*, would also become charged from the water, although there the spark was very faint indeed, owing probably to the poorer conducting power of the water.

I of course tried all the suggestive experiments for producing a record, but could not do so directly. By placing moist litmus paper between the points, *a* and *b*, and covering the points with a thin, close chemical mixture affecting the litmus, it is true a mark was produced upon the litmus paper at every spark; but this was owing merely to the pro jection (by the discharge) of atoms of the chemical upon the litmus paper; and a spark of sufficient intensity would be impossible with a long distance between the poles of the magnet, even were this distance artificial and formed by means of a metallic conductor. In the same manner, paper saturated with a solution of ferrocyanide of potassium showed a faint mark, an atom of the points, *a* or *b*, being projected upon it by the discharge producing the spark. Both these experiments were naturally suggestive to me, I having many years ago discovered, or rather learned, that electric disruption, or the electric discharge, is the projection of an atom of the metallic or other conductor, and that, if the distance between the discharging and collecting points be not sufficient to allow of consumption or volatilization of the metal in its passage across, a portion of the metal will reach the opposite point in its natural state, and thus, by reason of chemical combination or decomposition, produce a record.

Entertaining at the outset the mistaken notion that the electricity thus developed is purely magnetic, or the magnetic circuit, or the molecular motion in which magnetism consists, I conceived the idea that, although itself incapable of producing a record when apart from the magnet, it could be converted, just as at the magnet itself, into dynamic electricity, and thus be brought under control. I carried the conducting wire to an iron plate in place of the plate, *f*, and wound the plate with very fine wire.

Fig. 2.



In the engraving (Fig. 2) I have omitted the electro-magnetic connections, *i* being the iron plate to which the magneto-dynamic current is conducted. This is wound with insulated wire, forming a closed circuit through the stylus, *p*, and drum, D. Over the drum runs chemically prepared paper. I may remark that, although I succeeded at times in producing a record, my tests were far from satisfactory, and many things combined to prevent my proceeding with the experiments at that time, the chief of which was my conviction that, even if carried to a successful conclusion, the results would be utterly valueless practically. Many other experiments, however, had been tried by me, involving convolvular wires, etc.; but they all came under the general rule of rejection. During my course of experiments, I tried electro-magnetic vibrators, similar to those in use on electric bells, and attached mechanical vibrators to the shaft of the magneto-electric machine, for the purpose of preventing the neutralization of the positive spark force by a succeeding negative, and with some success; but everything pointed to the conclusion set forth above.

Without criticizing Mr. Edison's taste, as an electrician, in selecting the name "etheric force" to designate the observed electric current (I think Mr. Keely calls his tremendous and unapproachable force by the same name), I wish to point out some features in the published accounts which may lead to serious errors of judgment.

Primarily, it was stated that Mr. Edison was led, from the unusual brilliancy of the spark he accidentally observed, to suspect that it was due to something more than induction This cannot be as stated. Mr. Edison could not have suspected such a thing from the phenomena observed, or for the reason alleged, for he could not have witnessed in any of his experiments a more brilliant spark than that of the inductive or static discharge.

Secondly, the spark has no lack of polarity.

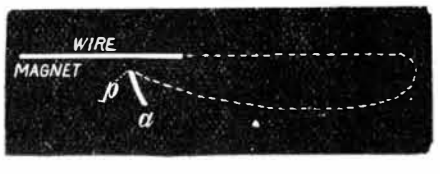
Thirdly, it is not indifferent to the earth.

Fourthly, it is practically incapable of transmission through any considerable length of uninsulated wire.

Fifthly, it is practically incapable of transmission through a city by means of gas or water pipes.*

The fact that a spark is obtained when the wire is turned back upon itself proves nothing beyond the general law that electricity prefers the shortest circuit.

Fig. 3.



This will be understood from the above engraving (Fig. 3), in which the wire coming from the magnet is shown turned back upon itself at *p*. Being static, dynamic, or magneto-dynamic, the current would naturally cross the space by the metal or person, *a*, from the point, *p*, to the wire instead of traversing the larger circuit of the dotted loop. This may be tested by any person having a good induction coil, when, if rightly connected, he will observe a spark pass from the point, *p*, to the wire, or *vice versâ*, although there is a good metallic connection by the dotted loop. In this respect, clearly nothing whatever has been shown.

The seeming lack, in the "etheric" force, of physiological effects, is really of no more moment than the seeming lack of physiological effects when a person, upon holding a finger in proximity to one of the ends of the secondary wire of a low induction coil, witnesses the passage of sparks without experiencing physical sensations. I have often stood with a constant stream of sparks passing between my hand and a piece of metal and an electrode, the whole passing through my person, without the least physical knowledge of the fact.

Permit me to conclude with the following statement and propositions:

When I first saw in the press the accounts of Mr. Edison's experiments, two questions naturally arose:

Will an inventor, really believing that he has discovered something of value, give the public the advantage of his researches until such time as he shall have secured himself by letters patent?

Does Mr. Edison declare, over his signature, that he considers the "etheric" force to be of any value?

New York city. W. E. SAWYER.

* There is no adequate evidence, as yet, that the force has ever in any degee been so transmitted.

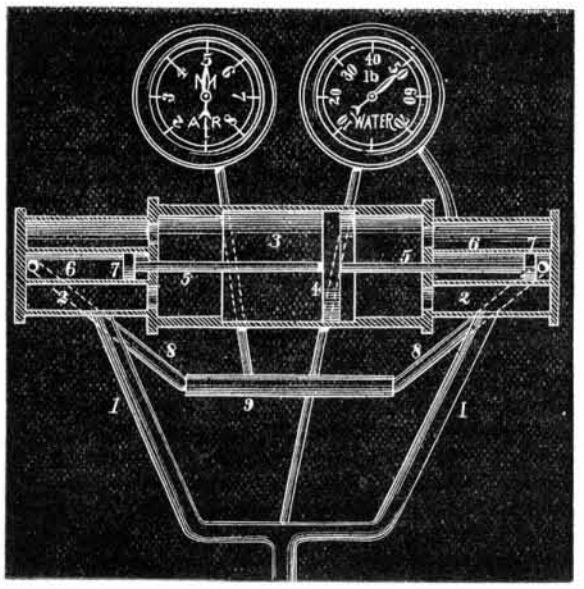
The Hydro-Pneumatic Puzzle.

To the Editor of the Scientific American:

In No. 23 of your last volume, I find an article headed "Keely out-Keelied, or the Hydro-Pneumatic Puzzle," with a challenge to your readers to solve the mystery. I offer, therefore, the following as a possible solution:

In the accompanying drawing I have confined myself to the solution of the problem, and I have left out several parts which appear on the original engraving, as I desire to show only the arrangement necessary to create the necessary pressure to act on the gage.

It seems that some parts of the original were put in by the maker to complicate the problem.



No. 1 is a water supply pipe. 2, a fore chamber to 3, the cylinder (of 20 square inches cross section); 4, piston; 5, piston rod, with 7, a small piston (1 inch cross section) connected to it. No. 6 is an air cylinder; 8, air pipe; 9, prolongation of air pipe, or if necessary, a cylinder for converting the power produced into motion.

This arrangement might be called a hydro-pneumatic lever, as it is but a translation of power, and so, I believe, is the "Hydro-Pneumatic Puzzle."

If a stream of water of 50 lbs. pressure is let into pipe No. 1, the full pressure, bearing on the piston, the piston rod, and the small 1 inch piston in the air cylinder, 6, would be $50 \times 20 = 1{,}000$ lbs.; and (allowing for the elasticity of air) that amount, more or less, will be indicated, through the connecting pipes.

I have left out the waste exhaust pipes, and the valves, as they are unnecessary to explain my idea.

Syracuse, N. Y. CHARLES KRONMEYER.

Through the Hoosac Tunnel.

To the Editor of the Scientific American:

A late train landed myself and a friend about dusk, at North Adams, a few days since, for a brief pastime in the region of the great tunnel.

The village of North Adams is situated, apparently, at the extreme northerly angle of a vast recess or niche in the Hoosac mountain, through the easterly side of which the tunnel runs. There are now two trains daily through the tunnel, one at 6 A. M. from the west and one at 6.30 P. M. from the east. We had resolved to foot it through the tunnel, following the six o'clock train, provided we found it safe to do so, knowing that the work of blasting and arching was still going on inside. After an early breakfast next morning, we proceeded directly up the track towards the mouth of the tunnel, inquiring, of the first man we met, whether it was customary for visitors to walk through the tunnel? He said that parties of a dozen or more sometimes went through, but that it was not exactly safe for one or two, as there were some hard customers at work in there. Surely there was a scare for us, of a quite different nature from what we had anticipated. Instead of nitroglycerin, falling rocks, midnight darkness, perennial showers, it was highway robbery; but thinking the scare might have been intended for our personal benefit, and not being very richly endowed with gold watches and greenbacks, we did not turn back, but bent our steps towards a primitive grocery store on the bluff ahe, da

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for the purpose of sounding the storekeeper as to the feasibility of walking through the tunnel, and as to hard customers in particular. He did not "know about hard customers, but you cannot get threugh the tunnel today, for a large mass of rock fell last night, and the train cannot get through this morning." "But perhaps we can walk through?" "Well, you can try it, but I would not insure your safety." We tried it. Procuring a miner's lamp, which resembled a diminutive coffee pot, with a wick in its snout and a large fish hook for its handle, we were soon within the yawning portal,

"Leading to gloomy arches,
"Where the June sun ne'er is seen,'

and traversing the weird solitude of the Hoosac Tunnel.

A massive arch of stone masonry, of comely design, forms the westerly portal; brick and cement arching extends from this far beyond the reach of frost and daylight. A leisurely walk of about one hour (escaping several brief showers by dodging from the railway sleepers to the curbing of the central drain, and *vice versâ*) brought us to the sound of workmen ahead. Up to this point, darkness and silence, save our own voices and feeble lamplight, had prevailed, the stillness being broken by the faint music of water trickling from above and flowing copiously along the central drain towards the westerly portal. Here we were saluted by two blasts some rods ahead, sharp and terrific, like claps of thunder, which made old Hoosac tremble. Lamps began to multiply, and the aspect ahead was soon changed from utter darkness to that of a section of an illuminated street on a dark night. The numerous lamps moving hither and thither, the glow of several forges in full blast, together with the ceaseless din of the hammers, anvils, drills, and trowels of one hundred and sixty workmen, rendered the scene and sensation at once novel, strange, and exciting. We soon came upon the mass of rock and *débris* which fell in the previous night, and which prevented the passing of the cars that morning. It was a huge pile, and would probably require the entire day for its removal, to allow the train to pass. In getting over this obstruction, my friend managed to blunder into the central drain; but as the water was but little above his knees, his agility saved him from much wetting and discomfort. The work now in hand here consists of dislodging a large amount of rock, pronounced unsafe by the judges, and filling up the recesses thus formed with brick and cement arch work. This job is chiefly west of the central shaft, and is swallowing up a vast amount of brick and cement. As we advanced, we soon passed the central shaft, which appeared to be nearly closed up with timber. The air soon became stationary: up to this point we had noticed a decided current from the west, but it gradually diminished, and what seemed to be a compound of smoke and fog now increased in density. The darkness and silence soon became profound.

One hour and twenty minutes more of this most strange experience found us nearing the easterly portal: here the smoke and fog were so dense that daylight could scarcely be discerned five rods before we emerged into the outer world. The easterly half of the tunnel is comparatively dry. Its arching is of Nature's own masonry, and the easterly portal is fringed with Nature's own handiwork, which apparently will stand till old Hoosac shall be riven.

Let the reader cast his eye upon some object five miles away, and then imagine an underground passage twenty-six feet in diameter from beneath his feet to that object, and he may have some conception of the extent of this vast excavation. Or let him take a piece of No. 16 wire (the size of a small knitting needle) five feet long, make it perfectly straight and level, then elevate its center about one eighth of an inch for the grade of the tunnel; then erect a piece of similar wire, three inches long, upon the center of the long one for the central shaft, and he will have a good model and a comprehensive idea of the proportions of this notable work.

Worcester, Mass. F. G. WOODWARD.

Carbonic Acid as a Preventive of Decay.

To the Editor of the Scientific American:

In September, 1868, I had occasion to be at the Avondale mines shortly after the shafting and brake were destroyed by fire, causing over one hundred persons to be smothered to death, all means of escape being cut off. On the fourth day after the disaster, the bodies were reached and brought to the surface. On inspection, I noticed that they did not present the appearance of being dead. The looks on the faces were natural, and the skin soft and pliable and of a pinkish or flesh-tinted hue; the limbs were limber and movable. No blackness or discoloration was visible.

In trying to account for this condition, I was led to reflect as to what might be the cause which checked these bodies from decay; and I could only attribute the effect to the conflagration, which made large quantities of carbonic acid gas: which, being heavier than air, filled the mine entirely, excluding the atmosphere and preventing its oxygen reaching the bodies: thus protecting the animal substances from change

I afterwards tried by actual experiment if my idea was right, and I found, to my entire satisfaction, that if any animal or vegetable body was placed in an airtight vessel, and the atmospheric air excluded, its place being supplied by pure carbonic acid gas, it will keep without any sign of decay or change so long as it is kept hermetically closed. I have not the least doubt that, by the proper construction of large metallic vessels or tanks, made perfectly airtight, animal and vegetable bodies placed in such receptacles (all air being drawn out and pure carbonic acid gas forced into its place under pressure) could be transported to great distances and kept for a long period without any loss by decay. By the use of said gas, I think, dead bodies could be kept in a properly constructed case, thus obviating the use of ice. Medical colleges could use it to keep subjects from putrefaction, and do away with the use of alcohol, thus lessening expense and giving better specimens for dissection.

Wilkesbarre, Pa. C. W. S.

A Worm in a Horse's Corn.

To the Editor of the Scientific American:

I desire to give you a piece of my experience in horse-shoeing. Not long since, a horse was brought to me to be cured of a corn in the foot. In paring the corn, I found a worm about ⅝ inch long, ⅛ inch thick, and sharp at each end as a needle point. One end was black and the other white. The black end was next the sole of the foot and the white end in the flesh. After removing the worm, and burning with nitric acid, the corn was entirely removed, and the horse permaturely cured of lameness, with which he had been troubled for some time. D. O. W.

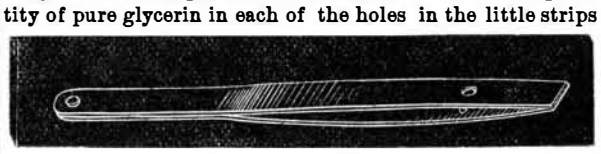
Carrollton, Ky.

The Cheapest Microscope.

To the Editor of the Scientific American:

Inclosed please find a simple little instrument of my invention, which, although of very insignificant appearance, is nevertheless, by the addition of a small drop of pure glycerin, converted into a wonderful little microscope of great power.

By means of the point of a fine needle, insert a small quantity of pure glycerin in each of the holes in the little strips



of brass; on withdrawing the needle, there will remain two perfect double convex lenses, one in each hole. Use one of the lenses as a receptacle for any minute object which you wish to examine; hold the instrument, with the other lens very near to the eye, between the thumb and finger, and adjust the focus by a gentle pressure.

Loda, Ill. HORACE C. DEAN.

Boil it Down.

[It is not often that we print poetry, but the following verses contain such good advice, to writers for the press and others, that we transfer them to our columns for the benefit of our readers and ourselves.

No editor likes to print very long articles; no reader likes to read them; and correspondents will do well to take the advice of our poet, and be brief. Condense and re-condense your copy; write with ink; state your inquiries briefly; communicate what you have to say without a prolix preface stating the great length of time you have been a subscriber, how greatly you prize the paper, etc., but come right to the point and state your wishes tersely. We are glad to receive suggestions, answer inquiries, and give written opinions on the patentability of any invention, and to publish correspondence on any subjects of interest which are appropriate to our paper.]

Whatever you may have to say, my friend,
Whether witty, or grave, or gay,
Condense it as much as ever you can;
Say it in the readiest way;
And whether you write of household affairs
Or particular things in town,
Just take a word of friendly advice:
Boil it down!

For if you go spluttering over a page,
When a couple of lines would do,
Your butter is spread so much, you see,
That the bread looks plainly through.
So when you have a story to tell,
And would like a little renown,
To make quite sure of your wish, my friend,
Boil it down!

When writing an article for the press,
Whether prose or verse, just try
To utter your thoughts in the fewest words,
And let them be crisp and dry:
And when it is finished, and you suppose
It is done exactly brown,
Just look it over once more, and then
Boil it down.

Liability of Palace Car Companies.

A case involving the liability of palace, drawing room, and sleeping car companies, was recently tested before a court in the State of New York. A passenger took a berth in a Pullman car from Detroit to Buffalo. Upon retiring, he placed his overcoat in a vacant berth over that in which he slept. In the morning the coat was missing, and diligent search failed to recover it. Evidently it had been stolen, and the passenger brought suit against the Pullman Palace Car Company to recover its value. The court held that the company was not liable. The judge who delivered the opinion said, among other things: "It is sought to charge the company with the responsibility of the innkeeper, upon the assumption that the law implied a contract or imposed a liability of the same nature; that responsibility was declared by the civil law to be as strict and severe as that of common carriers, and modern jurisprudence has adopted and applied the principle. But it went no farther, as is sought to be done in this case. He cannot lawfully refuse to receive guests to the extent of his reasonable accommodations, nor can he impose unreasonable terms upon them. The necessities of the traveler require these just rules to be adopted. As a compensation for the responsibility thus incurred, he has a lien upon all the property of the guest at the inn for all his expenses there. There are no facts in this case justifying the application of such rules of law. The company could not be compelled to receive and entertain passengers, however amenable it might be upon its contract with the carrier, and had no lien for the price of accommodations. The traveler voluntarily, and not of necessity availed himself of what was placed before him for his comfort, and he cannot cast the burden of care and diligence upon the defendant; neither is it right or just that the law should do so."

Decomposition of Products of Sewage.

Popoff has investigated the phenomena attending the spontaneous decomposition of a slimy mass taken from the mouth of a street sewer where it discharged into the river. It contained every possible sort of kitchen refuse, as well as other organic matter in an advanced stage of decay. It was of the consistence of pap, had a dirty gray appearance, and a reaction neutral or scarcely perceptibly alkaline, and emitted a peculiar odor. Flasks were filled with this matter, somewhat diluted, and the gas given off was examined at intervals of two to four days. One sample gave off the following amount of gases within 3½ weeks:

	Carbonic acid.	Marsh gas.	Oxygen.	Nitrogen.
A	11·75	2 48	4·71	81·06
B	34·99	29·03	0	35 98
C	55·81	42·54	0	1·65
D	56·00	42·70	0	1·30
E	45·90	54·10	0	0·00
F	43·30	56·60	0	0·10

At first the enclosed air lost its oxygen, and there remained merely a mixture of carbonic acid and marsh gas (CH_4); at first the carbonic acid preponderated, afterwards the marsh gas.

The slime consisted of (in addition to some amorphous inorganic matter and numerous crystals of carbonates) cellulose and a large number of pigment bacteria, among which the red and yellow predominated; then the green and other forms of zoögloa. These organisms were already present in the decomposing mass in large quantities, and increased so prodigiously, by long continued putrefaction, that it was easy for the unaided eye to recognize them from the red and green colors. This very considerable increase of the bacteria, which kept pace with the production of carbonic acid and marsh gas, permits us to recognize the reciprocal relation. Careful observation of the temperature within a flask, as compared with the air outside, showed that the heat in the flask was always greater. At the beginning the difference was slight, from 0·36° to 0·72° Fah.; at the close of the second month, the difference had increased to 0·8° and 1·0°. This production of heat in the putrefying substance, which could be detected in spite of the heat continually rendered latent by the developed gases, makes this operation analogous to alcoholic fermentation.

As in fermentation, so too in the production of marsh gas, the temperature has an important effect. The evolution of marsh gas was observed at different temperatures, which remained constant during the experiment, from 42·8° to 164° Fah., and it was found that the production of marsh gas increased very strikingly with a rise of temperature. The greatest evolution of gas was observed at 128° Fah.; from 113° upward it decreased, and ceased entirely at 122° to 131° Fah. Masses of this slime, which had been heated for one or two hours up to 275°, 230°, 212°, 167°, 127·4° Fah., so as to kill the bacteria, evolved no gas at all. On the other hand, a mass which had been frozen was just as capable of fermentation after it was thawed out, as that which had not been frozen. The composition of the gases evolved at various temperatures only differed in this, that at higher temperatures the marsh gas very soon began to predominate over the carbonic acid, while at lower temperatures this required a longer time.

Another analogy between the evolution of marsh gas and other forms of fermentation is found in the circumstance that such substances as the cyanide of potassium, quinine, chloroform, carbolic acid, etc., which check fermentation, also check the production of marsh gas.

Further experiments prove that, in the decay of cellulose, marsh gas is the chief product formed. Hence it is clear why marsh gas appears in Nature in places where large quantities of vegetable remains, which consist chiefly of cellulose, are heaped up, as in swamps and bogs, on river banks, in coal mines, etc., where the decomposition of cellulose takes place on a large scale. In this way, too, may be explained the fact that marsh gas is often evolved in the alimentary canal of man and the higher orders of animals.

Pumping Water Directly into Mains.

We recently published a communication calling attention to the water works at Ross in England, which anticipate an essential part of the well known Holly system in use in many parts of this country. Mr. T. C. Lewis, of Portsmouth, Vt., now writes to say that a similar plan has been in use in Bellefonte, Pa., ever since the year 1815. The water, from the spring that turns the wheel to supply power for pumping, is forced into the mains and is there kept constantly under pressure.

Mr. J. A. Richardson, of New York city, says that Mr. Holly's patent disclaims the idea that there is any novelty in furnishing water in limited quantities for ordinary use by means of forcing pumps, or in the use of stationary pumps for extinguishing fires; but that the Holly invention consists in effecting these two objects by a single apparatus.

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