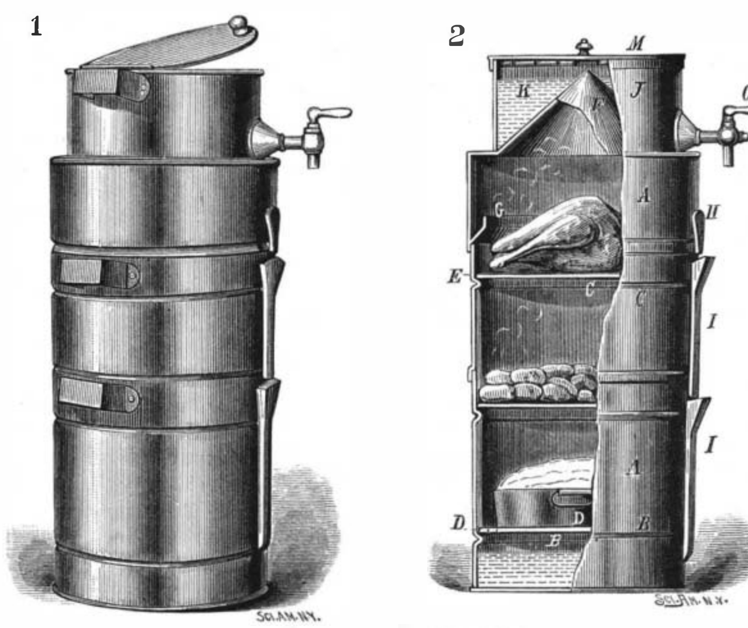
COOKING STEAMER.

The accompanying engravings represent a cooking steamer constructed with vessels having inwardly projecting beads near the upper and lower ends, to form flanges to support the partitions, upon which are placed the substances to be cooked. The lower partition, D, has a number of perforations formed through it to allow the steam generated in the lower part of the vessel to pass freely into the space above the partition. The next partition is made without perforations, so that steam can only enter the next space by raising the partition and passing up around its edges, the partition thus serving as a valve and causing the cooking to be done with steam under a slight compression. The lower edge of the cover fits snugly around the upper edge of the top vessel, and has a conical section as shown in Fig. 2. A flange, G, is secured to the inner surface of the cover at a little distance from the lower edge of the sides, forming a trough to receive the condensed water, and also serving as a shoulder to rest upon the upper edge of the vessel, and support the cover.

In a hole in the side of the cover at a little distance from its lower edge, is a siphon, H, the short arm of which extends nearly to the bottom of the trough, and its long arm extends downward at the outside of the cover, so as to discharge the outflowing water of condensation into the funnel-shaped upper end of the pipe, I. The lower end of the pipe enters the upper end of a similar pipe whose lower end is connected with an aperture in the side of the vessel, A, below the lowest bead, so that the water can flow back into the steam generating chamber. To the conical top of the cover is secured the lower edge of an annular flange, the space within which is divided into two compartments by a vertical partition, to the upper edge of which are hinged the straight edges of two semicircular lids. Each compartment is provided with a wire gauze screen, and within which is a faucet, so that the compartments may be used for making tea and coffee when desired.

In the several parts of the steamer are secured plates of glass in order that the operator may see whether the chambers are filled with live or partially condensed steam, so that he can regulate the application of heat. To use the steamer, water to a depth of one or two inches is poured in the lower vessel, when it is placed over an oil stove or other heat producer. While in operation all the steam is confined within the vessel, as are all odors arising from the cooking substances. As none of the condensed steam falls upon the food, it is kept dry, and does not become soggy.

This steamer is now being manufactured by the National Cooking Steamer Company, of Lancaster, N. H., who will furnish further particulars.



COOKING STEAMER.

A New Electric Railway.

A light railway system, driven by electricity and running at high speeds, has been devised by Mr. F. Hahn Dauchell, C.E., of London, whose object is to effect the rapid transit of letters and parcels by electrical means. The distinguishing feature in its construction is that it has only one rail for the train to run on, instead of two, and that it is balanced by another rail overhead, which at the same time performs the function of conducting the electric current, and also prevents the train from leaving the metals, as it is embraced by side friction pulleys, placed in pairs and connected with the roofs of the carriages. A successful working model has been tried; in it the wad is circular and about 8 feet in diameter, the motor being about 12 inches long, 8 inches high, and deriving its current from an ordinary bichromate battery. This motor, or engine, has a pair of grooved driving wheels of large diameter, and placed in line with each other. The object of this construction is to reduce the friction to a minimum, and thus facilitate the production of high speed. Mr. Dauchell proposes a speed of from 150 to 200 miles per hour, the railway being specially designed for the transit of letters, parcels, and light goods.

THE French Government, with a view to the revival of the somewhat languishing industry of coral fishing on the Algerian coast, has published a decree containing certain prohibitions and regulations on the subject. It forbids in future the use of machinery made of iron or other metal, as being destructive of the reefs, and preventing their reproduction.

The First Gas Burner.

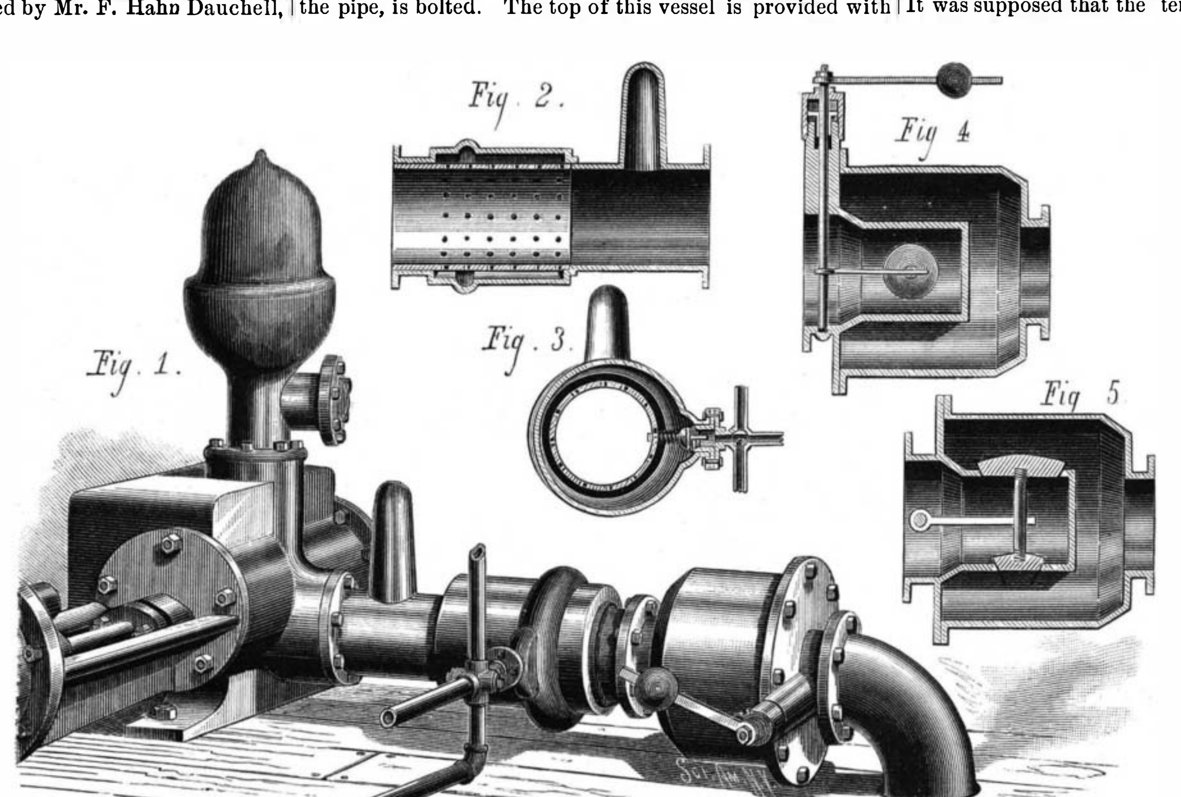
The first gas burner was a very simple and unpretentious contrivance. In one of the earliest works on gas lighting, we read: "The extremities of the pipes have small apertures, out of which the gas issues; and the streams of gas being lighted at those apertures, burn with a clear and steady flame as long as the supply of gas continues." Familiar as it is to us, and from its familiarity unnoticed, the phenomenon presented by the flame thus produced continuing to burn "as long as the supply of gas continued," was doubtless, to the first experimenters, a wonderful sight. Though we may smile at the question, it is not difficult to understand the incredulity of the honorable member who, when Murdock was examined before a Committee of the House of Commons, in 1809, asked the witness: "Do you mean to tell us that it will be possible to have a light *without a wick?*" "Yes; I do indeed," replied Murdock. "Ah, my friend," replied the member, "you are trying to prove too much."

REGULATOR AND CONDENSER FOR STEAM PUMPS.

The accompanying engraving represents a device for regulating the supply of water required to condense a certain quantity of steam, so that the quantity of water supplied will always be in proportion to the quantity of steam to be condensed; and also a device for condensing the exhaust steam from any steam pump or engine, so as to relieve the piston of back pressure. The regulator consists of a short pipe closed on top and provided with a flange for coupling it to a suction pipe. A short distance above this flange is a larger flange, on which a large vessel, surrounding the pipe, is bolted. The top of this vessel is provided with a neck having a flange to which the condenser or suction pipe can be attached, so that the device will be interposed in the length of the suction pipe. Fig. 4 is a horizontal and Fig. 5 a vertical section through the regulator. The small pipe is provided with two opposite ports, one of which is larger than the other, in which fit valves connected by a rod having a slot in its middle, through which an arm passes, as shown in Fig. 5. The arm is attached to one end of a shaft which is journaled transversely in the bottom of the pipe, and passed through a tube provided with a stuffing box. The outer end of the shaft has an arm (Fig. 4) on which is an adjustable balancing weight which seats the valves. The position of the weight can be adjusted so as to admit a greater or less quantity of water into the injection pipe, according to the amount of steam to be condensed. The apparatus can be placed in any position and can be attached to any injection pipe. It can be adjusted to maintain a high vacuum in the pump at all times.

In the suction condenser, shown in longitudinal section in Fig. 2 and cross section in Fig. 3, the suction pipe of a steam pump is provided with a series of perforations, and the perforated portion is surrounded by a pipe forming a jacket. The inclosing pipe is furnished with an eccentric channel (Fig. 2) for conducting the exhaust steam into the space between the two pipes; the depth of the channel gradually decreases from the entrance port for the steam to a point diametrically opposite, as indicated in Fig. 3. At the widest part of this channel is a neck containing a bushing, forming the seat for a puppet valve, mounted on a stem guided in an aperture in the suction pipe in a cross piece in the neck. The steam is conducted to the neck by the exhaust steam pipe, which is provided with a three-way cock, to permit adjusting the exhaust steam pipe for exhausting in the air. The condenser is provided with a vacuum chamber, to prevent pounding in the suction pipe. A spiral spring around the stem closes the valve automatically. When in operation, the steam is exhausted into the air until the water rises in the suction pipe to the perforated portion, when the steam issues in jets through the perforations into the water and is instantly condensed. The spring closes the valve after each exhaust of the pump, thus preventing the water from the suction pipe from rushing into the steam cylinder of the pump. The condenser is simple, and occupies but a small space. The steam from a steam engine can also be conducted to it, if desirable.

The large engraving shows the pump cylinder of a steam pump, to which is attached the condenser, from which leads the regulator to the suction pipe. These devices are now being manufactured by Messrs. Fink & Angevine, of Mount Riga, New York, who should be addressed for further information and catalogue.



REGULATOR AND CONDENSER FOR STEAM PUMPS.

A Process for Softening Iron Castings.

A revolution in the manufactured iron trade is announced from Melbourne, where two local iron founders (Messrs. Jenkins and Law) are reported to have discovered a new process in their trade. It appears that an accidental discovery was the commencement of the invention; a fragment of cast iron having been dropped while hot into a water channel, and afterward broken, when it was observed to be soft and tenacious, instead of hard and brittle as might have been expected. This phenomenon led to inquiry and experiments, with a view to ascertain the reason for the change. It was supposed that the temperature of the metal and the composition of the water were the principal circumstances which combined to produce the transformation; and, after numerous trials, the right temperature to which the iron should be brought before immersion was discovered, and also what foreign elements were required in the water. The metal is merely dipped in the bath, not steeped, the required change being physical, not chemical; and the ingredients of the liquid are common and cheap. As patented, the process is briefly as follows: The castings are run in a chill, or iron mould, allowed to cool, reheated in a furnace to a particular temperature, and then plunged into the bath. Thus treated, the iron develops a close, tough, and comparatively soft grain, so much like that of average steel that, according to the *Melbourne Argus*, experienced founders in the colony had great difficulty in believing the metal to be cast iron at all. By this process it is claimed that the adamantine hardness of chilled castings is removed, and further positive advantages are conferred. This is saved by the great extension of chill castings for purposes to which their hardness formerly rendered them inapplicable. It is contended that the metal is also made much stronger; a bar that would break with a load of 1,200 pounds under the old system being capable, if made in the new way, of withstanding a strain of 1,900 pounds. Lastly, the soft, tough grain produced by the new process increases the facility of working the metal, with a corresponding diminution in the wear and tear of tools, and a finer appearance in the finished article.

The Eighty Ton Gun at Shoeburyness.

The fourth of the series of experiments with the 80 ton gun was carried out at Shoeburyness on November 8, in the presence of the War Office Departmental Committee, and other officers of the Royal Artillery and Royal Engineers. The experiments were previously directed with the view of demonstrating the effect of the fire of the heaviest ordnance against forts of the Spithead type, sections of which were built up on the marshes. On November 8 the test was of a slightly different character, a special target being built up on the range, consisting of a compound slab of iron and steel 5 feet square, the iron being 12 inches thick and the steel 6 inches. Colonel Strangways, R.A., commandant of the School of Gunnery, superintended the operations. The huge gun, mounted on an experimental carriage on a line of rails about 200 yards from the target, was loaded with a charge of 450 pounds of prism No. 1 powder and a Palliser projectile weighing 1,700 pounds. Only one round was fired, but this demonstrated again that the 80 ton gun is still superior to any armor plating that has yet been submitted to its powers. The 18 inches of iron and steel were not only cut clean through, but the target, with its 36 inches of oak backing, was completely smashed up. The experiment appeared to give great satisfaction to the committee, and it is probable that a more exhaustive test will be carried out on a future date.

Transmission of Power by Shafts.

In his recent lectures on "Transmission of Energy," Professor Osborne Reynolds said: "In a revolving shaft, neither the stress nor the velocity is uniform over the section, both varying uniformly from nothing in the middle to their greatest value on the outside; so that their mean product is exactly half the product of the greatest values. The greatest power per square unit of section a shaft can transmit is half the product of the greatest stress into the velocity at the outside of the shaft. Taking, then, the greatest safe working stress of steel at 15,000 pounds on the square inch, taking what is the greatest practical velocity at the surface, 10 feet per second—the speed of railway journals—the work transmitted is 75,000 foot-pounds per second per square inch of section—135 horse power; so that we should have to have a shaft of upward of 7 square inches in section to transmit 1,000 horse power; that is, a shaft of over 3 inch diameter. The friction between such a shaft and lubricated bearings is well known—0·04; so that, calculating the weight of the shaft 24 pounds per foot, we have power spent in friction about 52,000 foot-pounds per mile, that is, one-tenth the total power the shaft will transmit. That is, if we put 1,000 horse power into a 3 inch shaft, making 500 revolutions per minute, we ought, at the end of a mile, to be able to take 900 horse power out of it. If we had to go farther, the size of the shaft might be diminished, so that in the next mile we should again lose a tenth, and if we repeat this process seven times we shall, at the end of seven miles, have left about half the original power put in. It will be thought, perhaps, that a 3 inch shaft is very small to transmit so large a force; this is because the speed of 500 revolutions per minute is inconveniently high for purposes of employing the power; but if it were merely a question of transmission, it would be about the best speed. This, then, shows the limit of the capacity of shafts as transmitters of work."

These two lectures of Prof. Reynolds are full of valuable practical suggestions and information. They are given in full in the SCIENTIFIC AMERICAN SUPPLEMENT 413, and occupy over three pages. All the different forms of transmitting energy are discussed.

To Make Casts Larger or Smaller than the Original.

It is well known that ordinary casts taken in plaster vary somewhat, owing to the shrinkage of the plaster, but it is not possible to regulate this so as to produce any desired change, and yet preserve the proportions. Hoeger, of Gmuend, has recently devised an ingenious method for making copies in any material, either reduced or enlarged, without distortion.

The original is first surrounded with a case or frame of sheet metal or other suitable material, and a negative cast taken with some elastic material, if there are undercuts; the inventor uses agar-agar. The usual negative or mould having been obtained as usual, he prepares a gelatine mass, resembling the hektograph mass, by soaking the gelatine first, then melting it and adding enough of any inorganic powdered substance to give it some stability. This is poured into the mould, which is previously moistened with glycerine to prevent adhesion. When cold, the gelatine cast is taken from the mould and is, of course, the same size as the original.

If the copy is to be reduced, this gelatine cast is put in strong alcohol and left entirely covered with it. It then begins to shrink and contract with the greatest uniformity. When the desired reduction has taken place the cast is removed from its bath. From this reduced copy a cast is taken as usual.

As there is a limit to the shrinkage of the gelatine cast, when a considerable reduction is desired the operation is repeated by making a plaster mould from the reduced copy, and from this a second gelatine cast is taken and likewise immersed in alcohol and shrunk. It is claimed that even when repeated there is no sacrifice of the sharpness of the original.

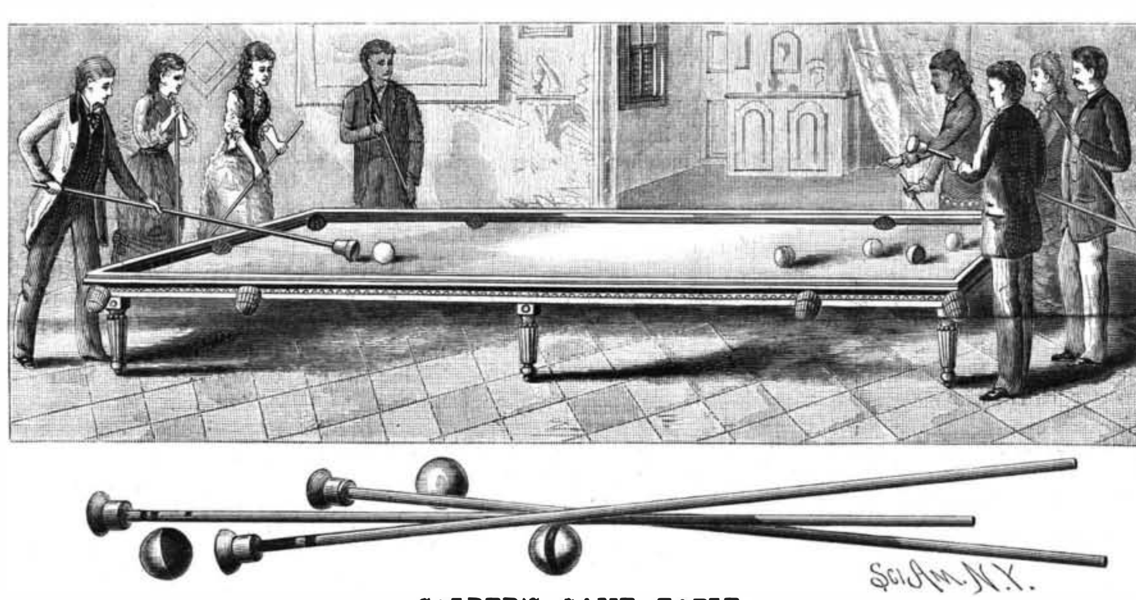
When the copy is to be enlarged instead of reduced, the gelatine cast is put in a cold water bath, instead of alcohol. After it has swollen as much as it will, the plaster mould is made as before.

For enlarging, the mould could also be made of some slightly soluble mass, and then by filling it with water the cavity would grow larger, but it would not give as sharp a copy.

GAME TABLE.

The platform upon which the game is played is 18 inches high, 8 feet wide, and 20 feet long, and is provided with a spring cushion on the sides and a dead cushion on the ends, and also with pockets in the corners, in the ends, and in the sides near the corners. Smaller platforms may be used for private dwellings. The cue has a concave head which fits snugly upon a heavy 6 inch ball, and in which the ball revolves. Eight persons play the liveliest game, although twice this number can play, or even more if desired, at once. The object of the game is to pocket the balls; but the greater number of cushions or carroms that can be made before pocketing the ball the better. Each cushion, carrom, or pocketed ball is termed a "point" and counts five, provided the shot terminates with a pocketed ball. If the shot does not so terminate, carroms and cushions count nothing. All shots must be "called" or "directed." If every point called or directed is not made, the shot becomes a "chance" shot. Every ball pocketed by chance counts one point, or five to that ball, or the side to which it belongs; but when pocketed by a called or directed shot it counts to the player who drove it in. To play the game sides are chosen, and one-half of each side take position at one end of the platform and the other half at the other end. The balls are distinguished by red spots for one club or side and white spots for the other. Each player has two balls, and plays one at a time. When all have played from one end of the platform the total points are registered, and the players at the other end begin to play. At the conclusion of three rounds the totals are compared, and the side or club having the greater are the winners.

The game has been styled "Captus" by the inventor and patentee, Mr. George Calder, of Mill Creek, Utah.



CALDER'S GAME TABLE.

A New Compass.

Capt. Magnagin has invented and lately introduced in the Italian navy a compass which is thus described by the *Jewellers' Circular*:

"Its needle floats upon a pool of water, tinctured with spirits of wine to prevent freezing. The water is contained in a glass vessel, with an elastic vessel to allow its expansion and contraction without breaking the vessel. The needle consists of six bundles of fine magnets, built up of cast ribbon steel, and fixed on a cord. It is inclosed in a hermetically sealed case, which is delicately poised on a brass pivot. The pivot has a sapphire top and a jade point, all highly polished to diminish friction. The advantage of the compass is that the resistance of the water being great to rapid movement is comparatively slight to slow ones, and hence the ordinary movements of the needle are free enough, whereas those due to sudden shocks from without are resisted, with a consequent staying of the indications. Tried on board the Duilio, it is found that the discharge of a 100 ton gun or the motion of the screw does not affect the reading of the compass. The effects of the rolling and pitching of the vessel are guarded against by suspending the floating case a very little above its center of gravity."

How to Clean Stump Lands.

A correspondent of the Ohio *Cultivator* tells how he gets rid of stumps as follows: "Last spring I sent to Indiana and hired a man to come and blast out stumps. I paid 42½ cents per pound for the powder, and 15 cents for each stump taken out, he to furnish caps and fuse. The stumps were mostly white and burr oak, from 20 to 40 inches in diameter, and had been cut from six to twelve years. Sixty-seven of the worst were taken out at an expense of 68 cents per stump. There were only three or four failures in the whole lot. As they were blown into pieces, it was much less work to pile and burn them than when taken out in the ordinary way. I bought material and took out nearly 200 smaller stumps at an expense of about 20 cents each. It took me about ten or fifteen minutes to prepare a blast. I used a 2 inch auger on a 5 foot shaft for boring under the stump. A crow bar will do in soft ground; those who follow the business use a 2½ inch auger. The charge should be put as nearly under the center of the stump as possible. It is not very dangerous to use, as fire will not explode it. The cap is placed in the cartridge and is connected by a fuse. You light the fuse, which in one or two minutes explodes the cap; the concussion of the cap, which is equal to 500 pounds, explodes the dynamite, or Hercules powder. Eight or ten rods is a safe distance if you are facing the stump, for you can easily dodge chunks, if any come toward you. It will not pay to use it very extensively on green stumps, as it will take from three to eight pounds per stump, and will not give very good satisfaction at that."

The Cost of Motive Power from Electrical Accumulators.

MM. Monnier and Guitton have reported to the French Metropolitan Electrical Syndicate upon the use of Faure-Sellon-Volckmar secondary batteries as a source of motive power, with special reference to the driving of tramcars. This is a class of work that has occupied the attention of electricians in England and on the Continent, without much success. Accumulators have been designed to supersede gas engines as sources of power for small users; and it has been considered that if tramcars could be economically driven by stored electricity, the way would be made easy for the introduction of the same system into warehouses and town factories. Hence the success or failure of accumulators on tramways has a secondary interest exceeding that of the immediate application. The experiment referred to by MM. Monnier and Guitton took place on September 26, between Paris and Versailles; the motive power being supplied by 109 accumulators, of the 17·5 kilogramme size, coupled in such a manner that the power of 50, 70, 95, or all 109 cells could be applied as required. The car itself weighed 3,500 kilos.; the accumulators weighed 3,200 kilos.; while the passengers weighed only 1,100 kilos. The distance run was 23,900 meters; the rise between the point of departure and the end of the journey being 78·4 meters. The total useful work done was 9·17 hour horse power; and the work given out by the accumulators was 17·6 hour horse power. With regard to the return journey, the falling gradient helped the traction; so that the work done both ways is calculated to be 1.51 times that of the outward journey, or a total of 26·6 hour horse power. In the case of an ordinary tramcar the power required for the day's work would be 74 hour horse power. As the cost of one hour horse power at the works is estimated at 51·7 c., the lowest cost of driving an ordinary car would be 38·25 francs per day, without reckoning the lubrication and maintenance of the dynamo electric motors. The *Revue Industrielle*, commenting on these figures, regards them as too favorable; and considers that the cost should be quite doubled. As expressed by MM. Monnier and Guitton, however, they are by no means favorable to the system.

An Interesting Experiment.

During a recent lecture in the Philadelphia Academy of Pharmacy, glass jars were passed around containing samples of cultivated disease germs. Potatoes cut in halves had been lightly smeared with a coating of substances containing germs. The bacteria were nourished on the moist surface of the potato, and presented very interesting appearances. Different results were obtained from different bacteria. Some of the half potatoes were covered with an ordinary deposit of mould. On others the disease germs had developed into thin, peculiarly shaped patches of fungous growth of bright blue, red, yellow, and greenish colors. Others had grown into an intricate and extensive network of fuzzy fibers, the growth on the surfaces of two or three potatoes reaching over and covering a space having a diameter of eight or nine inches.