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A MODEL ELECTRIC RAILWAY PLANT.

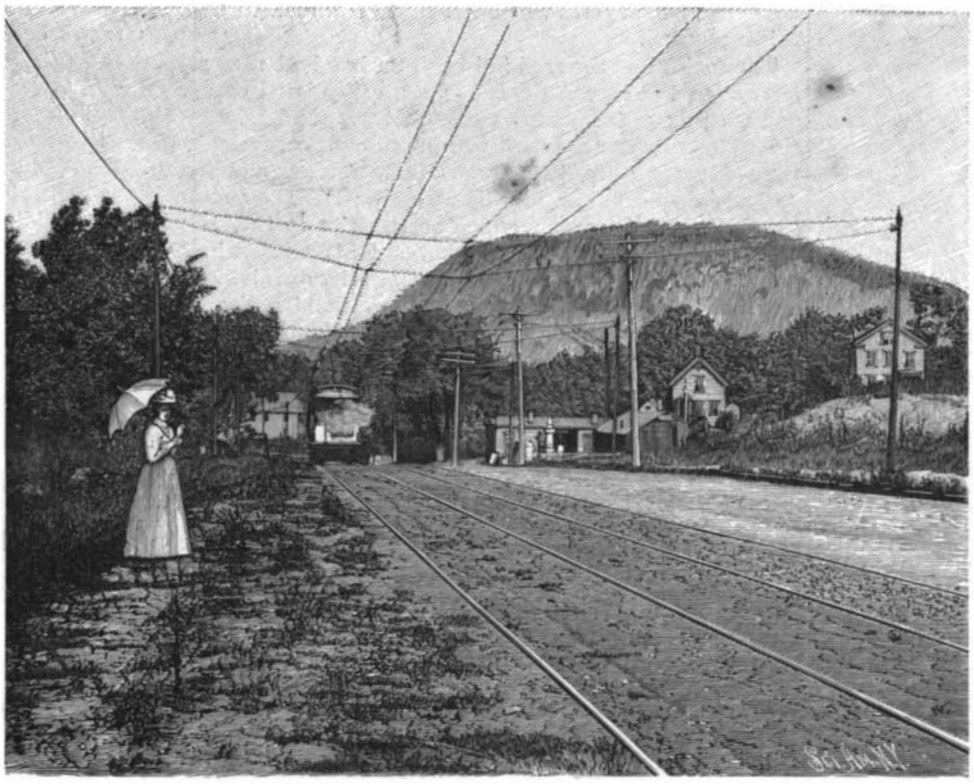
Trolley railways are now so common that it is taken as a matter of course that they are all pretty nearly alike, and that all that is necessary to constitute an electric railway is a source of current and cars provided with motors for using the current; but while the fundamental principles controlling the trolley systems of railways are the same on all roads of this description, there is a marked difference between the recent roads equipped with first class machinery and appurtenances and the earlier roads upon which the great problem of economical electric propulsion was worked out.

We present to our readers an illustrated description of a very complete plant located in New Haven, Conn., and belonging to the Fair Haven and Westville Railroad Company; in fact, the engines, machinery and general equipment of the road are so complete that we have ventured to call it a model trolley railroad.

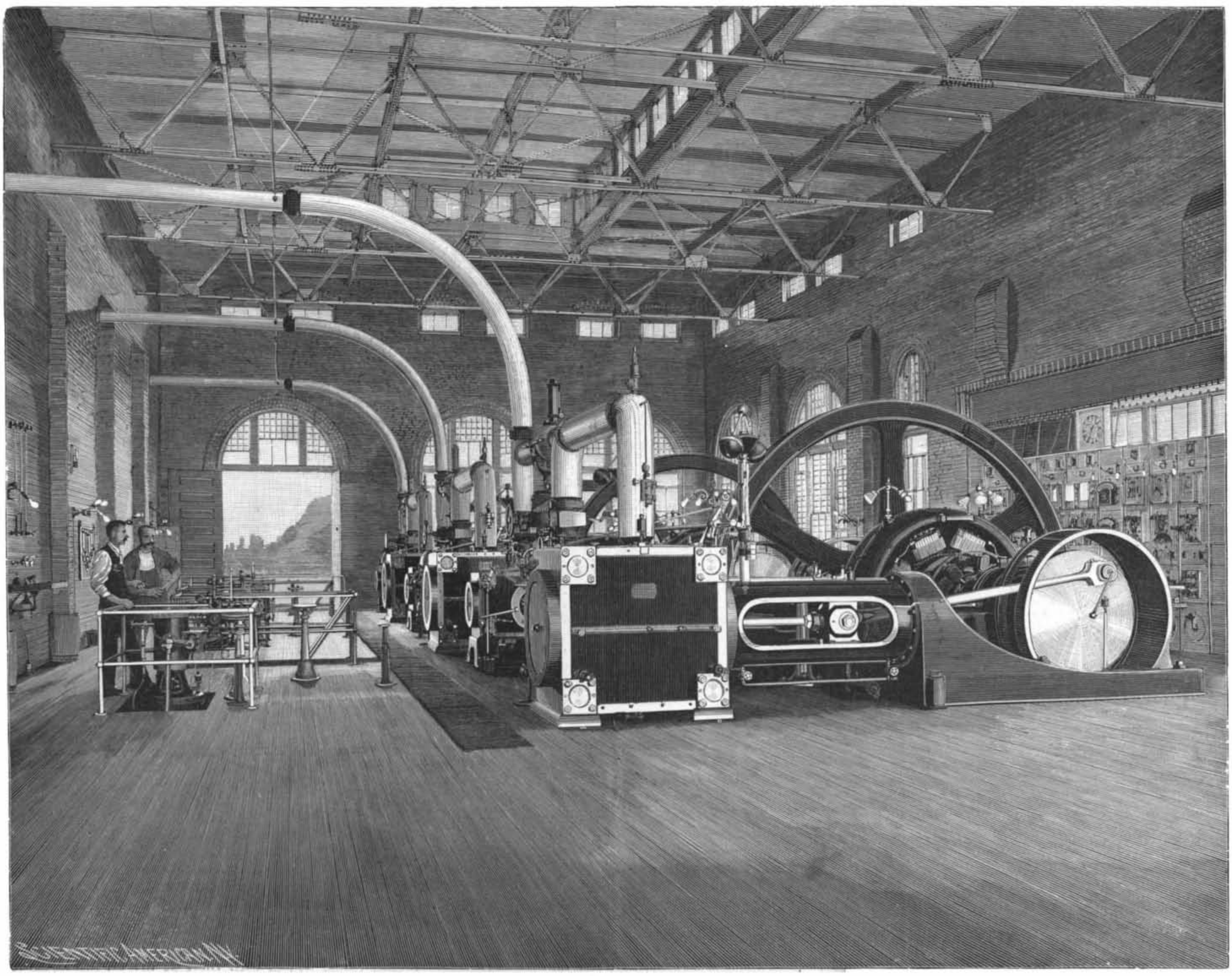
We give a view of a portion of the road showing Westville, with West Rock in the distance, and an interior view of the power house, showing the engines, dynamos and appurtenances. The power house is located on Mill River, in New Haven. Seven lines of railroad are operated from this station, employing 38 open cars, 42 closed cars and 3 sweepers. The combined length of the different branches is 25 miles. The power house is provided with three cross compound Allis engines, each having a stroke of 36 inches. The high pressure cylinders are 16 inches in diameter and the low pressure 30 inches. These engines are operated under a steam pressure of 120 pounds, and make 92 revolutions a minute. The pressure in the receiver between high and low pressure cylinders is 8 pounds; consequently the initial pressure in the low pressure cylinder is 8 pounds. The vacuum is 27 inches or 13 pounds.

Steam for these engines is generated by three vertical Manning boilers, another boiler of the same description being held in reserve

(Continued on page 265.)



FAIR HAVEN AND WESTVILLE ROAD.



FAIR HAVEN AND WESTVILLE ELECTRIC RAILROAD—INTERIOR OF POWER HOUSE.

A MODEL ELECTRIC RAILWAY PLANT.

(Continued from first page.)

with the fire banked, and there are also two additional reserve boilers, so that there are in all six boilers which are rated at 160 horse power each.

With the crank shaft of each engine is directly connected a Westinghouse dynamo, having an armature 4 feet in diameter, with a capacity of 450 amperes at 500 volts. The dynamos are compound wound, and are connected with each other by an equalizing conductor to check any tendency of one dynamo to run as a motor by the current from the other.

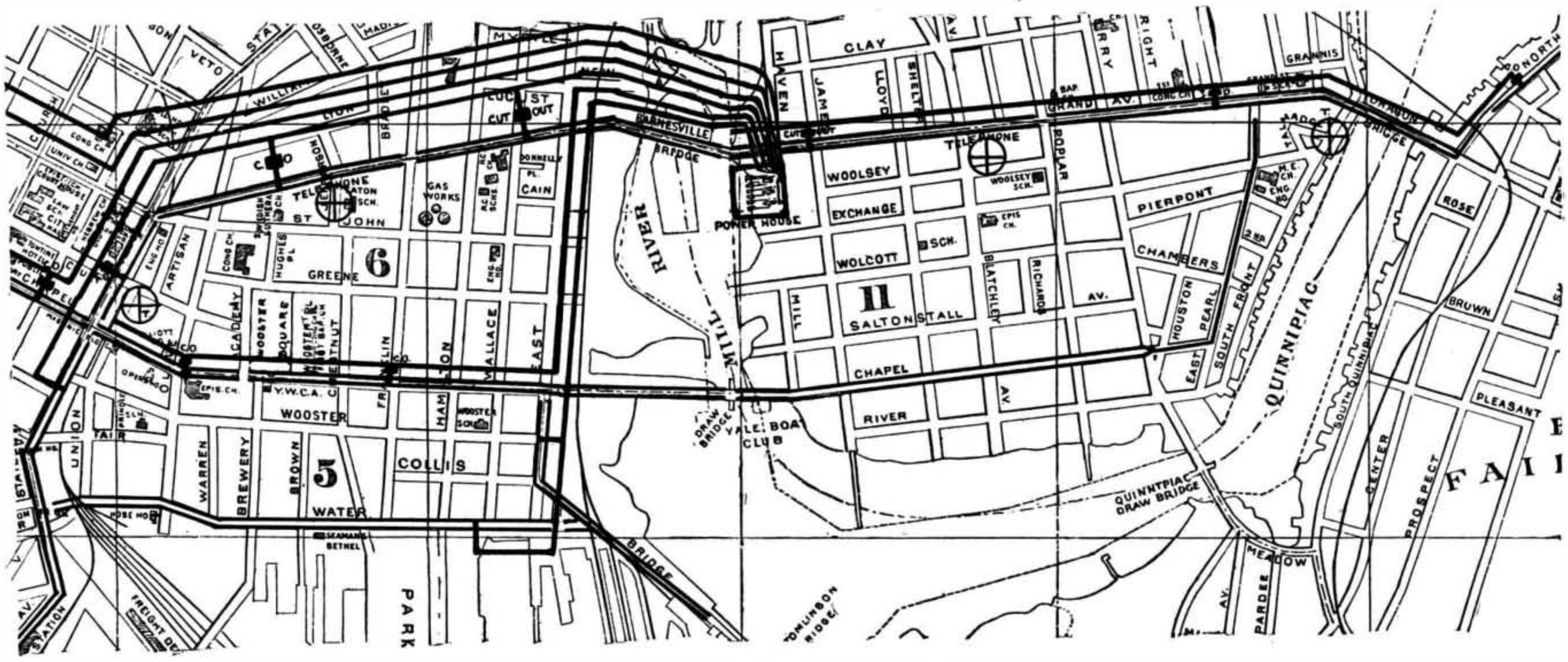


Fig. 3.—BRANCHES OF THE ROAD.

Fig. 4 shows the arrangement of the dynamos, connections, switches and ampere meters at the power house. Only dynamos 1 and 2, which are supposed to be in active operation, are here represented. A represents the positive main conductor and A′ the negative, while E E are the equalizing conductors from the two dynamos, the positive and negative conductors being designated by the usual signs + and —. The positive and negative conductors of dynamo 2 lead to the switch, B, and connection is made by this switch with the conductor, C, which connects with the main conductor through the ampere meter, D. The positive conductor from the dynamo is also connected with the main conductor by the conductor, F, through the circuit breaker, G.

The conductor, C, includes the electro-magnet, a, which controls the automatic releasing mechanism of the circuit breaker, G, so that when there is a cross or short circuit upon the line, the switch, G, is automatically released and the dynamos are thereby protected from injury. Two switches, two circuit breakers, and two ampere meters are here shown, one of each for each dynamo. The dynamos are each provided with a resistance box, H, which is connected up in the shunt circuit of the field magnet and is used to regulate the voltage in starting the dynamo. The dynamo is started with the switch, B, open, and when the required voltage has been reached the switch, B, is closed, thereby throwing the current into the main conductors, A, A′. Should the load increase so that the action is below the normal in either of the dynamos, the deficiency in the series winding of the field magnet is supplied by the equalizing conductor, E, thereby bringing the voltage up and preventing one dynamo from acting against the other.

At I, in Fig. 4, is represented a panel having switches by means of which the particular branch of the road connected with the panel may be thrown into or out of the circuit. Each branch of the road has such a panel in the power station.

The trolley wire, T, is connected with the positive conductor at the power station, and the rails are connected with the negative conductor at the power station. To insure continuity of the return conductor, a wire cable usually extends under ground to the power station and is connected with each rail. At the power station the rails are connected with the main conductor by a cable, as shown in Fig. 5, the flange soldered to the end of the cable being clamped to the rail web by bolts. A lead plate is interposed between the flange and the rail to make the joint watertight, thereby obviating electrolytic action in the joint itself, and thus preventing corrosion. The trolley wire is suspended above the center of the track by a cross wire supported at either end by a small windlass in the end of a curved arm pivoted in a hood clamped to the trolley pole, as shown in Figs. 6 and 9. The curved arm is carefully insulated by a bushing and washers of insulating material. The cross wire which supports the trolley wire is provided with an insulator by which the trolley wire is suspended. This insulator is in the form of an inverted cup, as shown in Fig. 7, with a central aperture in which is inserted a screw covered with insulating material, as shown at 1. This screw is held in place by a screw cap, as shown in the engraving. On the lower end of the screw is placed a cross arm, having several hooks. A folded and perforated piece of metal is placed around the trolley wire and on the hooks projecting from the cross arm, and a long, narrow key is driven in between the cross arm and the trolley wire, bringing the folded piece of metal into firm engagement with the hooks and clamping the trolley wire. The narrow key has its smaller end split, with the upper part thereof bent up against the end of the cross arm to hold the key in place. This form of trolley wire suspension is very readily applied and easily removed and repaired.

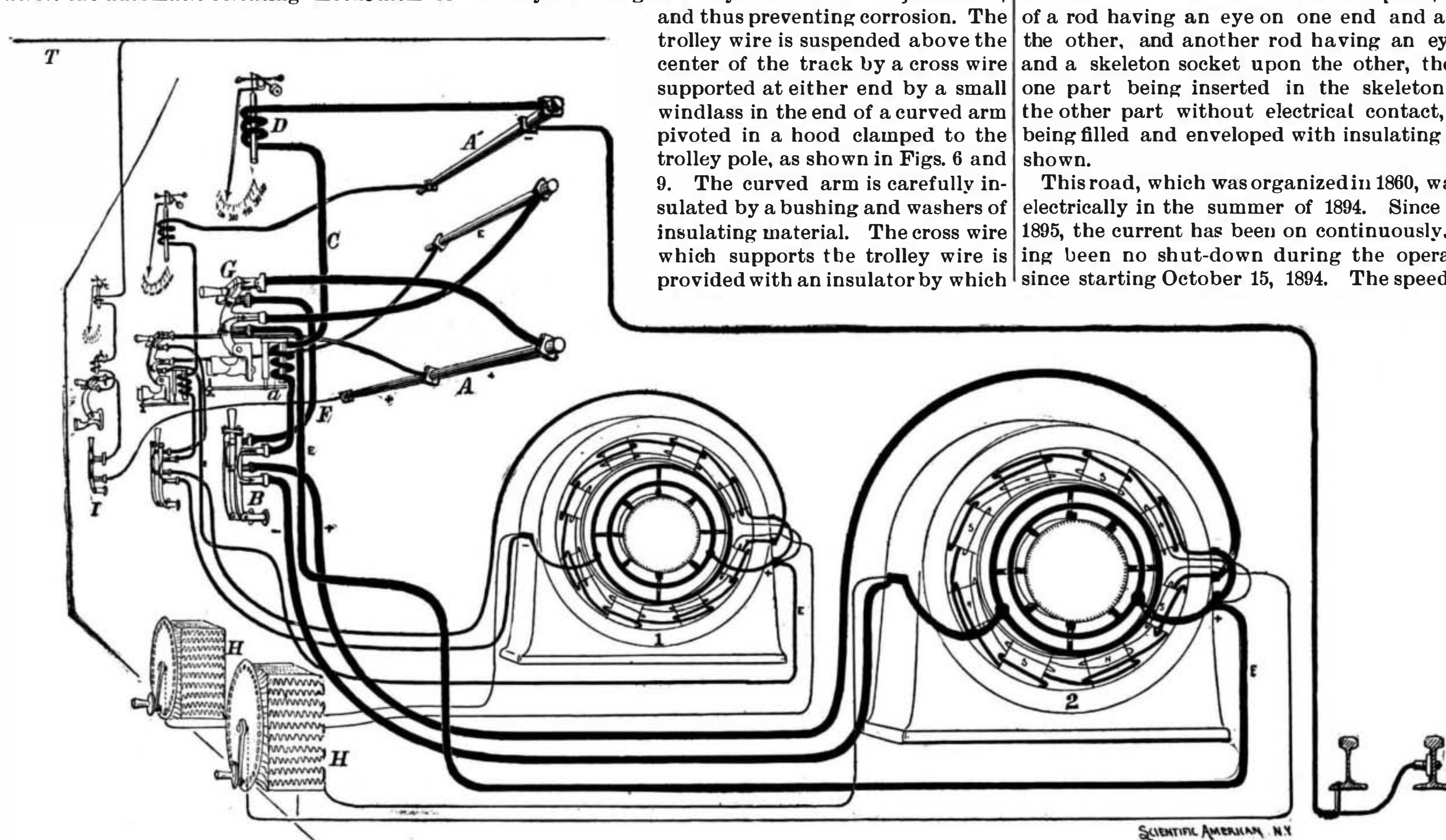


Fig. 4.—DIAGRAM OF DYNAMOS AND CONNECTIONS OF POWER HOUSE.

The trolley wire at the ends of different sections is supported as shown in Fig. 8, the ends being clamped to a double wedge of insulating material, the lower edge of the wedge serving to form a bridge between the two ends of the trolley wire, which allows the trolley to pass smoothly over the break. The connection between two adjacent sections of the wire is completed or broken by means of a cut-out, shown in Fig. 9. This cut-out is secured to a trolley pole in such a position as to be accessible to linemen or other authorized persons, so that should anything occur on one section of the road which requires it to be cut out, the section may be rendered "dead" electrically, by swinging out the arm of the cut-out.

An insulator which is inserted in the wires where the circuit is to be interrupted, and for connecting conductors with their supports, is shown in Fig. 10. This insulator consists of two parts, one formed of a rod having an eye on one end and a button on the other, and another rod having an eye upon one and a skeleton socket upon the other, the button of one part being inserted in the skeleton socket of the other part without electrical contact, the socket being filled and enveloped with insulating material as shown.

This road, which was organized in 1860, was equipped electrically in the summer of 1894. Since January 1, 1895, the current has been on continuously, there having been no shut-down during the operating hours since starting October 15, 1894. The speed of the cars is limited by city ordinance to 10 miles per hour within a mile of the City Hall and 12 miles per hour beyond that distance. The cost of fuel for operating the road is $0·0045 per car mile.

For the courtesy which enabled us to procure the information here presented we are indebted to H. S.

Parmlee, president of the company. We have reserved our description of the cars, the motors, and the wiring and operating of the cars for a future article.

Action of the Rain.

The rain falling on the rocks sinks into every crack and crevice, carrying with it into these fissures surface material which has been degraded by the weather, and thus affording a matrix sufficient to start the growth of vegetation, and afterward to maintain the plants. The fibers and roots of these plants, bushes, and trees thus brought into life, growing and expanding, act as wedges to split up the surface of the rock and to commence the process of wearing away. From this quality of destruction a large class of plants derive the name of Saxifrages, or rock breakers, from their roots penetrating into the minute fissures in search of water, and so assisting in the process of disintegration. In winter the water collected in the hollows and crevices becomes frozen, and expanding as it changes into ice, acts like a charge of blasting material in breaking up the rocks. The pieces thus detached become further disintegrated by frost and weather, and, being rolled over and over and rubbed against each other as they are carried away down the mountain currents, are ground gradually smaller and smaller, till from fragments of rocks they become bowlders, then pebbles, and finally sand. As the mountain stream merges into the river the pebbles and coarse sand continue to be rolled along the bottom of the channel, while the argillaceous particles and salts become mingled with the water, and flow on with it either in suspension or solution.—Longman's.

Why We Like Dogs.

And why do people keep such lots of dogs themselves and go in such numbers to see other people's dogs? queries Popular Science News, and then proceeds to answer. Because the dog is at once the sincerest flatterer and the most successful cheerer that the human race ever had. A good dog always gives us the feeling that we men and women are a sort of gods. No other animal does anything of the kind. The cat treats us as an inferior, and the horse will treat us as a dear friend, not a divinity. The dog, moreover, imparts something of his peculiar gayety to us in a way that is irresistible. He mingles his suggestion of gayety with his flattery; for he not only leaves his dinner untasted to walk with us, but the mere fact that we are apparently giving ourselves the pleasure of a walk raises him into such a delirium of delight that the sight of it puts all our dumps and blues to such reproach that we shake them off in very shame. And when we don't walk, but sit moodily at home, the dog curls up lovingly at our feet, and looks up now and then into our eyes, and "glides into our darker musings with a mild and healing sympathy." Yes; there is solid reason for the fondness of men for dogs, and it will never come to an end until either men or dogs become very different beings from what they are now.

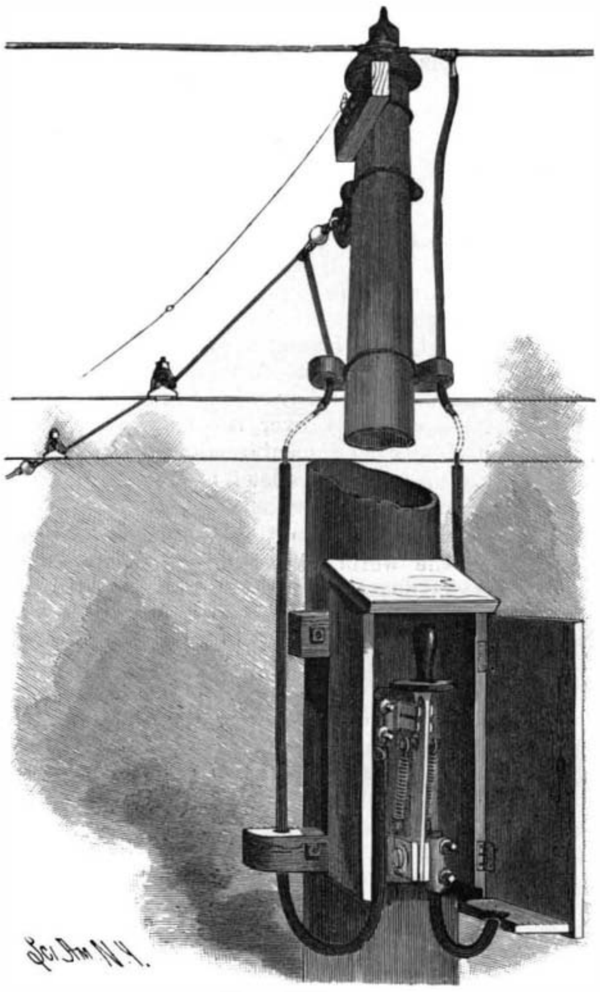


Fig. 9.—CUT-OUT

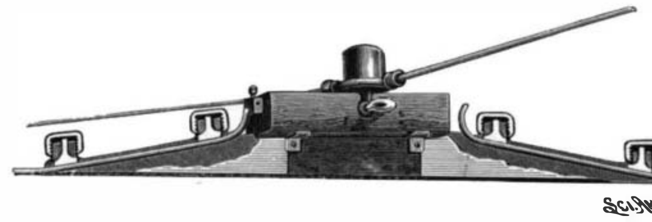


Fig. 8.—WIRE SUPPORT AT THE ENDS OF ADJACENT SECTIONS.

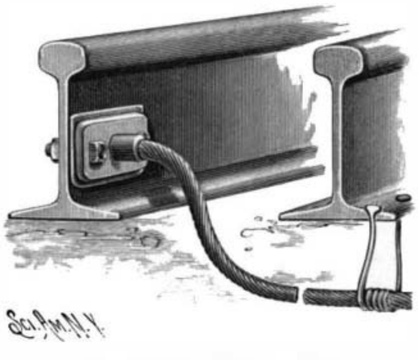


Fig. 5.—RAIL CONNECTIONS.

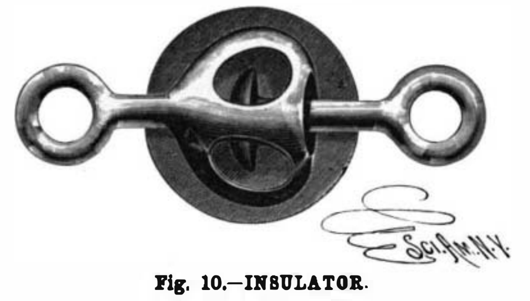


Fig. 10.—INSULATOR.

Fig. 6.—WINDLASS AND BRACKET FOR CROSS WIRE.

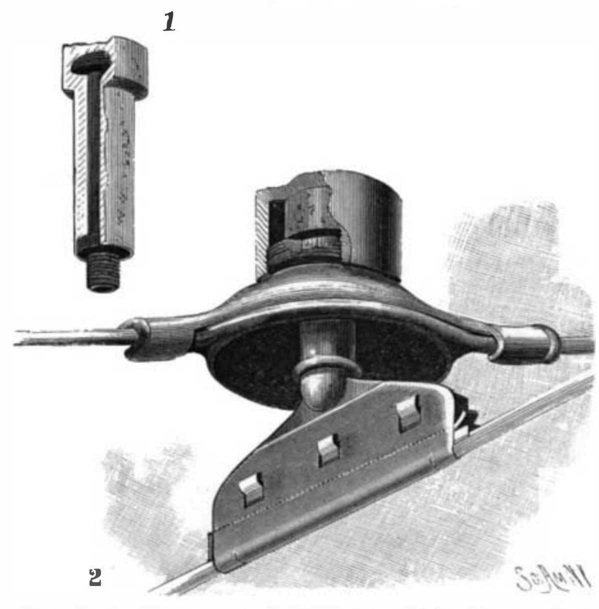


Fig. 7.—TROLLEY WIRE SUPPORT AND INSULATOR.

FAIR HAVEN AND WESTVILLE RAILROAD.

Spontaneous Combustion.

Many substances take fire very easily. Greasy rags, cotton waste, etc., are readily self-ignitible. Some foreign manufacturer has instituted experiments on the self-ignition of cotton waste, and the results were very interesting. A handful of cotton waste was dipped into linseed oil, squeezed out, placed in a wooden box, and the temperature observed by means of a thermometer introduced into the box. The temperature surrounding the box was kept at 70 degrees C. Soon after the temperature in the box rose to 173 degrees C., and smoke issued therefrom. When opened so as to admit air a flame burst out at once. A box, from which the air was perfectly excluded, consumed after five or six hours. In another experiment, in which the cotton waste was saturated with rapeseed oil, the box burned after ten hours. With an outer air temperature of 56 degrees C., gallipoli oil caused the spontaneous combustion of cotton wrapped in paper; castor oil required twenty-four hours; sperm oil, four hours; train oil, two hours, for a lively combustion.

In view of these conclusive practical results, it will readily become apparent to the thoughtful person that it is extremely dangerous to allow greasy or oily rags or waste to lie around the paint shop. Indeed, it is wrong to throw such matter upon the floor at all, because it is apt to be forgotten and left lying there for some time. The safer and much better plan is to provide a galvanized iron receptacle, having a cover, in which to throw all discarded waste at once, so that even should ignition ensue, the contents would simply burn without damage to surroundings. If it be urged that one cannot take the time and trouble to throw such waste matter at once into the can, let us remember that the very habit of being careful in this matter will tend to making us careful in other and, perhaps, all things. Time spent in doing such little things is not thrown away; nothing can be gained by first littering the floor and then sweeping the litter up.

There are dry substances that sometimes self-ignite. There is the well known example of lampblack, though it is said that the presence of small quantities of oil, which is found in the black coming from the first condensers at the factory, is the cause of the spontaneous combustion to which it is liable. Still, even the driest black may self ignite. Instances are recorded where casks of lampblack have been found almost red hot after standing some time. Prussian blue is another pigment very liable to self-combustion in the dry state, but more particularly in the preparation at the factory. Then it is extremely dangerous, and the utmost caution must be exercised, not only to prevent its bursting into flame, but to arrange matters so that in case a fire does break out it shall be confined to small limits. Outside of the factory we have heard of no difficulty attending Prussian blue in this way; of course, it is usually ground in a medium that prevents this, the dry blue being more rarely employed.

The liability of certain dry matters to explode under certain conditions is well known. Prussian blue will burst into flame because of its chemical nature; lampblack, because, usually, of the oil present; while such dry matters as flour, coal dust, and other fine organic dust, explode when certain outside causes are present. Professor Tobin demonstrated before the Kentucky Millers' Association this fact, and further showed that dampness destroyed the explosive tendency. Live steam was recommended as a preventive, by damping the air of the mill. The same would apply to the air in a woodworking factory, where it is full of dry dust. Herr Baehr, of Dresden, found that leather belts, used in mills, are rapid generators of electricity, and that this would fire dry dust and cause explosions. Professor Pepper put some fine flour in a small box, fitting the top with fine wire netting, shook the box and caused the finer dust to come in contact with a flame, like that made with a lighted stick. Under the right conditions, the experiment will result in a large flame, resembling that made by burning of loose gunpowder.

To make combustion possible, oxygen must always be present. There must be air present. The greasy rags would not take fire of themselves if kept from the air; hence, in keeping them in a tightly covered iron can, the probability of combustion is reduced, and possible combustion made of no account. It is well to remember this fact. Liquid kerosene oil never explodes. Plunge a candle flame into a gasometer of pure coal gas and it will go out as it would if plunged into water; but mix air with the gas and the result will be much different. Lamps only explode from mixed air and oil vapor. Flour dust or fine wood dust, when mixed with air, will ignite like gunpowder. In a heap no trouble ensues.—The Hub.

Walking Backward Cure for Headache.

An apostle of physical culture says that an excellent and never-failing cure for nervous headache is the simple act of walking backward. Ten minutes is as long as is usually necessary to promenade. It sometimes, however, requires more than ten minutes to walk at all, if one is very "nervous." But it is not understood that it is necessary to walk a chalkline. Any kind of walking will do, provided it is backward. It is well to get in a long, narrow room, where the windows are high, and walk very slowly, placing first the ball of the foot on the floor, and then the heel. Besides curing the headache, this exercise promotes a graceful carriage. A half hour's walk backward every day will do wonders toward producing a graceful gait.—Medical Record.

THE fast run which was made on the New York Central September 24, 65·96 miles an hour for 147·84 miles, was beaten the very next day, another special train carrying newspapers having run from Albany to Syracuse, 147·84 miles in 130 minutes, equal to 68·23 miles an hour. Nothing is said in the reports about the amount of time occupied in running through the street approaching Syracuse. The weight of the two cars of this train is given as 167,107 pounds.

Old Rubber Shoes.

The business of gathering waste rubber is chiefly confined, so far, to cast-off foot-wear. The methods of reclaiming rubber were first applied to scrap of this class, and the organized channels through which 18,000 tons of scrap annually trickle from the hands of country peddlers into larger streams, until the rubber reclaiming factories receive it in carload lots, have all been planned for the collection of old shoes. The price of old shoes at the point where they first become a merchantable commodity it would be hard to say. In many rural districts rubber shoes are collected in the spring months, together with rags and other waste, by peripatetic merchants whose stock in trade, whether in a pack or a little wagon, consists of tinware and cheap trinkets, intended for exchange at the farm house for the contents of the scrap bag. No cash changes hands in these transactions. When the peddler returns to his starting point he turns over his collections to the village merchant for more tinware, with perhaps a little cash, and goes out over a new route in quest of rags. The peddler may be in business on his own account, or in the employment of the village trader, but in either case the latter has a chance to make a profit on the collections of scrap, which are shipped from time to time to a city dealer. The latter will offer his rubber stock, whenever it reaches good proportions, to a rubber reclaiming mill. In shipments from the West probably 5 per cent of the whole will consist of rubber scrap, 25 per cent of metal, and the rest of paper stock and rags. There is no one handling rubber shoes alone, however. Whoever buys the country merchants' collections must take the whole lot. But the rubber is the most prized part, in proportion to its extent, since the trade in rags for paper stock has been greatly depressed in recent years, while rubber scrap has gone upward in price, with the increased number of rubber reclaiming factories and the consequent competition in the business. It may be noted that, when old shoes first became a merchantable article, the price paid for them by manufacturers was 1 cent per pound, while the quotations have since averaged 5 cents per pound for months at a time.

The trade in rubber scrap is now most thoroughly organized in the West and Northwest. In the Southern States, where little snow falls, the consumption of rubber shoes is not sufficient to form a basis for a trade in old shoes. Even in New York City the use of rubbers is not large enough, in proportion to the population, to make the trade in scrap of importance. The rubber reclaiming works formerly received considerable shipments from Canada, but that was before the establishment of factories in the Dominion for working up old shoes. Of the rubber scrap imported the larger share comes from Russia. The imported scrap is not so desirable, however, as what is gathered at home. In spite of the good consumption of rubber foot wear in New England, there are no dealers in scrap there in a position of commanding importance. This is due in part to the existence of near-by factories which buy directly from the smaller dealers. In the West the principal center of the trade is Chicago.—India Rubber World.

The Trend of Electrical Development.

In years gone by, and not so many years at that, almost the entire energy of investigators into electrical science was devoted to the improvement of the primary battery. There was indeed reason for this in that its efficiency was comparable to that of the steam engine and far in advance of any known methods of obtaining available energy from fuel. Its drawbacks, however, were many. The fuel, which was zinc, and the atmosphere in which it was consumed, which was the acid or saline solution, were far more expensive than coal and atmospheric oxygen, and the care required to keep the batteries in working order was excessive and burdensome. It seemed very possible, however, to so improve the details of the battery as to render its care less irksome, and invention turned its attention with considerable success in that direction. How to produce a cheaper fuel and atmosphere, however, was not so apparent, and practically no progress was made in that direction. With the advent of dynamo-electric machines producing electricity from ordinary coal, and atmospheric oxygen through the intermediary of the boiler and steam engine, notwithstanding an inefficiency of over 90 per cent as against about 20, the primary battery came into disfavor and those who continued the investigation of the great problem connected with it became themselves the subject of obloquy and derision.

The dynamo-electric machine has now been developed so nearly to its theoretical limit as to leave no reasonable expectation of any further advances in the way of efficiency.

In the meantime electro-chemical science has been advancing with giant strides, and many metallurgical operations which before were dependent directly upon the combustion of coal are now performed more quickly and more cheaply by the intervention of the boiler, engine and dynamo.

It is the dynamo itself that has rendered this possible, and the next step will be that the dynamo by familiarizing us with electro-chemical processes will enable us to produce electricity itself by electro-chemical processes.

There seems to be no question that galvanism is to be re-enthroned somewhere in the near future. It will not entirely supplant dynamo electricity, however, for the latter will always have its field of usefulness, and there will always doubtless be conditions where, even with its 90 per cent inefficiency, it will be cheaper than the battery method. but it is not to continue to hold undisputed sway as it has during the past decade and more.

It is idle to suppose that any method can be devised of consuming zinc to compete with coal. The economic possibilities of batteries consuming zinc have been almost as nearly reached as have those of the dynamo, and no further progress can reasonably be expected in this direction. Nor is it reasonable to expect that electricity will be generated by chemical means directly from coal.

The fuel for our boilers requires some preparation before it can be economically employed there, and it is to be expected that it will require some special preparation to adapt it to the direct production of electricity. Under our boilers the admission of atmospheric oxygen has to be carefully regulated, else the results obtained are unsatisfactory. It is not unreasonable, then, to expect that the method of burning our fuel for direct electrical production will have to be carefully considered.

The direct production of electricity from fuel does not therefore mean the burning of an unprepared fuel in an uncontrolled atmosphere, but means a proper preparation of both, and their especial adaptation, so that the latent energy may become manifest in the electrical instead of the heat form. These are all problems for the electro-chemist, and they are problems that are being attacked by so many vigorous thinkers that their solution must be in the order of things.—Electricity.

The Telephone Newspaper.

The telephone newspaper organized at Pesth, Hungary, has now been working successfully for two years. It is the only newspaper of the kind in the world. It is called the Telephone Hirnondo, or Herald, costs 2 cents, like a printed paper. and is valuable to persons who are unable or too lazy to use their eyes or who cannot read. It has 6,000 subscribers, who receive the news as they would ordinary telephone messages. A special wire 168 miles long runs along the windows of the houses of subscribers, which are connected with the main line by separate wires and special apparatus which prevents the blocking of the system by an accident at one of the stations. Within the houses long, flexible wires make it possible to carry the receiver to the bed or any other part of the room.

The news is not delivered as it happens to come in, but is carefully edited and arranged according to a printed schedule, so that a subscriber at any time knows what part of the paper he is going to hear. It begins with the night telegrams from all parts of Europe. Then comes the calendar of events for the day, with the city news and the lists of strangers at the hotels. After that follow articles on music, art, and literature. The staff is organized like that of any other newspaper, and is only on duty from 7:30 in the morning till 9:30 at night. After the copy has passed through the editor's hands, for the paper is subject to the same restrictions as ordinary newspapers and is liable for its communications, it is given to the "speakers." These are ten men with strong voices and clear enunciation, who work in shifts of two at a time and talk the news through the telephone. There are 28 editions uttered a day. Additions to the first edition are announced as news items.

To fill up the time when no news is coming in, the subscribers are entertained with vocal and instrumental concerts.—N. Y. Sun.

Bacteria in Mineral Waters.

Dr. P. Seidler, at a recent meeting of the Berlin Pharmaceutical Society, read a paper in which he gave the number of bacteria per cubic centimeter found in two different bottles of each of several mineral waters, as follows (Am. Drug.):

Langenschwalbacher Wienbrunnen	44-147
Hunyadi Janos	4460-6615
Niederselters	136-855
Biliner	675-3456
Harzer	7600-12450
Egerer Franzquelle	302-504
Schlesischer Obersalzbrunnen	96-406
Fachinger	2250-16700
Kissinger Rakoczy	2250-12600
Emser Kraenchen	5890-7250
Karlsbader Muehlbrunnen	3890-27216
Vichy Grand Grille	13400-14300
Wildunger	870-945
Spaa Pouhon	1137-1160
Friedrichshall	5600-5795

The waters, as a general thing, are practically free from bacteria when they emerge from the earth, but these develop rapidly through carelessness in washing the bottles, corks, etc. The author found the artificial waters, as a rule, to contain as many bacteria as the natural.

The Bank of England.

Some interesting facts about the Bank of England and its history have been gathered by the Social Economist.

It will be remembered that on January 1, 1895, this institution celebrated its second centennial anniversary. It was organized to relieve William III from the difficulties he experienced in raising funds to prosecute the war against France. William Patterson, a Scotch merchant, was the original projector of the enterprise.

"The terms of the charter were that the sum of £1,200,000 ($6,000,000) should be raised, and that the subscribers should form themselves into a corporation styled 'The Governor and Company of the Bank of England.' The bank was also to have the privilege of keeping the accounts of the public debt, paying dividends, issuing notes, etc., for which an allowance of £4,000 a year was granted. The whole of the capital was to be loaned to the government at 8 per cent. This interest, together with the £4,000 allowance, gave the bank a revenue of £100,000 per annum.

"At its very outset the bank was a servant of the government, and it has retained that character, but in somewhat diminished degree, through all the ages of its subsequent history. It is a curious fact that, although founded by a Scotchman, Scotchmen are eschewed by the bank. What the first of the race did to entail the ban upon his fellow countrymen is not recorded, but it is commonly said in London that three descriptions of persons are excluded in practice from employment at the bank—namely, Scotchmen, Jews, and Quakers."

In the basement of the bank building are barracks in which are quartered thirty soldiers daily. It has been the custom to station soldiers at the bank ever since the riots of June, 1780, when an attempt was made to sack the bank.

"The Bank of England first issued notes in 1695, which were for £20. The £10 notes were issued in 1759 and the £5 notes in 1793. At one time during the early years of the present century notes of £1 and £2 were issued, but in 1844 they were all withdrawn from circulation, and no notes are issued for less than £5, and none higher than £1,000.

"These notes may be said to be the safest pieces of paper in the world, as under any circumstances the bank could pay with gold any one in circulation without one pound of the capital of the institution being touched. They are a legal tender everywhere in the United Kingdom, except at the bank itself, where they must be paid in gold.

"The bank started with a capital, as stated, of £1,200,000. In two years this was increased to £2,201,000. In 1710 it was again increased to £5,560,000. On June 29, 1816, it was increased to its present sum of £14,553,000, equal to about $72,700,000. No reports of the bank are made beyond the regular weekly statement.

"The Bank of England has sometimes been in difficulties. It failed in 1696, and in its earlier years it was subjected to many runs, some organized by the jealous private bankers, some the result of political causes. . . .

"The present governor of the bank and the deputy governor each receive a salary of £1,000 a year. The bank has 24 directors, each of which must hold £2,000 of stock, and who receive £500 a year compensation. There are in all 1,050 persons employed in the various departments of the institution, and their united salaries amount to about £1,400,000 a year.

"Up to 1826 it was the only joint stock bank in England, and until 1835 it remained the only joint stock bank in London. At that date the London and Westminster Bank was founded, and at the same time forty other joint stock banks were established in Great Britain. . . .

"The Bank of England is not only the banker of the government, but it is also the bankers' bank. All other banks keep their bullion reserves at the Bank of England, and this is one fact that gives the establishment its special importance as the center of England's monetary system. This reserve is seldom allowed to fall below £10,000,000, a fair average being from £10,000,000 to £14,000,000. The daily transactions of this institution sometimes run as high as £6,500,000.

"The number of persons receiving dividends is nearly 284,000. Nearly £25,000,000 ($124,000,000) are annually paid out by the bank as dividends on stock annuities reaching the enormous sum of £775,000,000 or say $3,873,000,000.

"During the year 1892 the stock of the bank sold as high as £344 per share and as low as £325. The highest dividend ever paid was in 1697, 27½ per cent, and the lowest during the years 1753-63, 4½ per cent. For twenty years the dividend has averaged about 10 per cent."

Pipe Line for Sewerage at Reading, Pa.

At a recent meeting of the Engineers' Club of Philadelphia, Mr. William H. Dechant read a paper fully describing the method of constructing the submerged pipe line across the Schuylkill River at Reading. The width in this particular part of the river along the pipe line is about 400 feet and the deepest part about 10 feet below extreme low water, the average depth being about 8 feet.

A 30 inch cast iron pipe was used, weighing a little over two net tons per length of 12 feet. The channel was excavated across the bed of the river to lay the pipe in, so that the bottom of it would be about 2 feet below the ordinary river bottom. Previous soundings with a pointed steel rod had shown the bed rock to be far enough down to allow the proper depth of trench, although the rock was scraped at several points in the dredging. The dredging machines were kept exactly on the line by means of a No. 8 wire stretched across the river 10 feet north of the center line. Tags were placed on the wire at a distance apart equal to the length of each pipe section, with the proper depth below the surface for each joint marked upon them.

The line of pipe was laid by first joining the sections suspended from trestle work across the river by means of long screw rods, attached to each pipe, so that the entire length occupied the same position that it was to have in the bottom of the trench. The whole thing was then lowered uniformly by a man at each screw, keeping time in the turning.

A flat scow was arranged to carry each section of pipe from the shore to the trestle work with a trunnion in its center, so that the pipe could be turned around into almost any position to anchor it along the line of trestles. The trunnion was so made that the operator could move the pipe some distance endwise also.

The methods of setting the trestle work, suspending the sections of pipe from the screw rods, making the joints and lowering the pipe were described in detail. Three days were occupied in the erection of the trestles and four more in getting the pipe ready for lowering. The lowering occupied altogether about five hours.

Snakes and Fishes.

One of those quiet workers connected with the Museum of Comparative Zoology, at Cambridge, who for years has been conducting most interesting researches, is Dr. Samuel Garman, whose name very rarely appears in the newspapers, yet whose work is of such quality that it has gained him the highest honors from institutions abroad.

Dr. Garman is a Western man, and has been on the staff of the Museum for thirty years or more. He was with the elder Agassiz in South America and elsewhere, and since that time he has accompanied or led a number of others of the expeditions of this institution. At the time that Stanley made his celebrated march across Africa, Dr. Garman was just about to head a small party for exploration in the Dark Continent, but the excitement among the natives which followed the former expedition made it seem judicious to give the latter up.

Dr. Garman's particular field in the animal kingdom is that of the snakes and other reptiles and fishes. He can tell tales from his own experience which would put to blush the most imaginative of the stories of the authors of to-day, and is well prepared to hold his own when the conversation takes on a fishy strain, even in the presence of the oldest and most fortunate of anglers.

He is on intimate terms with all the snakes, handles them without fear, keeps them about his laboratory (in cages, however) for purposes of study, and has discovered no end of curious things about them, all of which are faithfully stored in great volumes of publications, where the public has hardly a chance to get at them.

A rattlesnake, a native of Missouri, has boarded with him for upward of two years. It is a brightly marked beast, more vividly painted than are our native rattlers of Blue Hill or Mount Tom. It is large and well filled out and has a keen eye for the stranger, whose approach to his cage seldom fails to call forth a shrill alarm. It is active, but naturally is somewhat cramped in its comparatively small quarters. It has made a few excursions, however; one a while ago to a meeting of the Boston Scientific Society, where he was let loose to crawl about the floor, to show his curious oblique method of progression. Dr. Garman does not like, however, to take him into strange places, since a rat hole might afford him a safe retreat, and the chances of recovery in good condition would be very slight.

This beast seems to know his captor and makes no effort to strike him with his fangs, allowing himself to be handled with what seems like carelessness, but which is the skill born of long experience. He is more sedate than one of the younger specimens which was here a few years ago, which, while appreciating the warmth of Dr. Garman's hand and forming a coil upon it, was greatly incensed at visitors, and testified to this by vigorous rattling.

This Missouri specimen has yielded to science quite a number of interesting facts. He has been in his cage so long that it has been possible to follow step by step a number of his changes. It is known positively that he loses his skin twice a year, and that he adds a rattle for every skin. Instead of losing the rattles as he does his skin, they are retained by the closing of the inner end of the old rattle over the knob of the new one, and accidents excepted, the snake bears with him this record of his age. But accidents will happen. Through friction or for some other reason the horn which forms the rattle may become thin, and in such case, the catching of the rattle in some obstruction would tear it away. In this very snake some holes have now appeared near the base of the first loose rattle, and were the animal free in the woods, there is but little doubt that he might soon become a snake with only a single rattle on his tail.

As to snake bites, Dr. Garman is in position to speak authoritatively. He has had a great deal of experience, and has been bitten by all sorts of snakes. Most of them leave simply two little holes not more troublesome than the bite of a cat. The rattlesnake bite is quite different, and requires immediate attention. The part bitten is relieved of the poison as much as possible by sucking, while the member is constricted by an impromptu tourniquet, which permits the poison-bearing blood to reach the heart only in mere driblets. And nature does the rest. There is a possibility that if the tooth should penetrate into one of the larger blood vessels, this treatment or any other might not be successful, but the chances are in its favor.

One may very readily inquire how it is that such a skillful snake catcher could permit himself to be bitten at all, but this is easily explained. In the instances in which it has occurred the bite was not from the snake that was caught, but from a mate which had not been noticed, but which, disturbed by the capture of its companion, struck at the common enemy.

But to turn a moment to Dr. Garman's investigation among the fishes, there are a number of points of general interest whose elucidation has been due to his persistent research. One of these concerned the artificial hatching of trout. It was found at the fisheries that a very large number of the fry were joined, two and two, like Siamese twins, and so large a number as to be very noticeable. This was quite a puzzle to naturalists for a long time, for there was no evidence of its occurring in the brooks and natural hatcheries, and yet all the features of the hatching seemed precisely the same.

The female was customarily relieved of her eggs by gentle pressure, and these eggs were made fertile in the natural way, but nevertheless there was the peculiarity of Siamese twins, triplets, and even quadruplets. Why was it so?

Dr. Garman came at the solution a number of years ago, and his notion has since been generally accepted. The perfect egg has a solid shell all about it, one point excepted, where the fertilizing particles are to enter into the egg and give it life. The natural depositing of eggs by the female was an operation of some little time, and every egg had an opportunity to become perfect, and had only the one vulnerable point. With the artificial process, however, the eggs were discharged all at once, and naturally in different stages of completeness. In the less perfect ones, defects in the shell allowed vivifying particles to enter at two or more different places, and two or more embryos began their growth upon the same nucleus, which with later development became the curious twins.

But there is another discovery by Dr. Garman, a most remarkable one, which sounds like romance, that some fishes come in rights and lefts, for all the world like a pair of slippers, neither complete without one of the opposite kind. This is a very new discovery, and it is very doubtful whether even all the fish men in the different museums have yet read about it, for the proof of it finds place in a volume of Proceedings of the Museum in Cambridge, hardly two months published.

The poet Moore in his researches in Persian lore, made one day a great find, and has translated for us a poetical description of

Sweet birds that fly together,
With feather always touching feather,
Linked by a hook and eye.

These wonderful birds lacked each of them a wing, and so were not complete until they could find mates that lacked an opposite wing. This is a pretty fiction, and of course outside the bounds of possibility. But Nature is inventive even beyond the dreams of man; it is not possible to invent a form so curious that some one in a congress of naturalists would not be able to give the name of the organism that looks like it. The ridiculous drawings of great horrid fishes which the Chinese make for us, which surely cannot resemble anything on earth, in the seas or in the waters under the earth? But, they do; and if one is permitted to examine the priceless pictures made by the hand of the elder Agassiz himself, which are preserved in one of the attics of the Museum, he will find that the great naturalist is quite in accord with the Celestial in the queer shapes which he has depicted.

These queer fishes which Dr. Garman has studied belong to the genus Anableps, the haunts of which are in warm waters from South to Central America. There are several odd things about them. In the first place they bring forth their young alive instead of depositing eggs in suitable places and leaving the rest of it to good fortune. In the second place they have a very curious eye; it is the exact counterpart of the divided spectacle lens which is so commonly in use, one half for far sight and the other for reading. This is literally true, the eyeball of the fish is divided into two portions by a black curtain, so that there is an upper half eye and a lower half eye. The division begins very early in the development of the young fish, there being first a little encroachment of the black border into the eyeball, and, having entered it, finally stretches clear across horizontally. So the fish has two half eyes in each socket.

Anableps is a fish of rather large horizontal proportions, and as he swims, his head lies partly out of the water, the water line being in fact just at the division in his eye. The upper eye he uses for vision through the air, seeking for food in the vegetables floating on the surface. The lower half of his eye he uses for vision through the water, and thus gets timely warning of the approach of his enemies.

One would think these oddities quite enough for a comparatively insignificant little fish, a few inches in length, and not making much figure in society, but it is this same genus which exhibits rights and lefts. The proof of this peculiarity depends upon close scrutiny and the dissection of the animal, but its anatomy leaves no possible question in the matter.

A right Anableps is doomed to wander about in lonesomeness through the seas filled with Anableps of his own pattern, and can never be happy until some opposite example, opposite in sex as well as one-sidedness, is found to share his home. And here comes in a most curious bit of statistics. Of the specimens which it has been possible for Dr. Garman to inspect, a number sufficiently large to be tolerably representative, three-fifths of the males are rights and two-fifths are lefts, while of the females, three-fifths are lefts and two-fifths rights. The three-fiths of the males that are rights will find in three-fifths of the females that are lefts most congenial companions, while the two-fifths males that are lefts will find a mate for each in an equal proportion of females that are rights. This balance in nature is by no means the least remarkable feature in the story.—Boston Commonwealth.

How Lobsters Are Hatched.

"During the season that has just closed we have hatched 75,000,000 lobsters, 45,000.000 codfish, and 6,000,000 flatfish or flounders," stated Superintendent John Maxwell, of the United States fish hatchery station at Wood's Holl. "The lobster eggs are put into glass jars, each of which holds 75 ounces; they are placed on a table very similar to the one used to hold the cod-hatching boxes. There are two glass tubes which enter the jars at the top, which is closed with a porcelain cap. One of these tubes goes to within a fraction of an inch of the bottom of the jar, while the other enters only a short distance from the top, and just above the eggs of the lobster.

"The one which goes nearly to the bottom keeps the eggs moving at a lively rate, and it is this moving about that hatches them. As soon as an egg is hatched the young lobster, swimming about, rises to the top of the jar, and by the siphon is drawn into the receiving jar, which is covered with linen scrim, which allows the water to escape when it becomes filled, and still holds the young lobster captive. The eggs are still kept stirred up by the fresh supply of water until all that are alive have been hatched and drawn into the big jar. It depends upon the temperature of the water, the same as with the cod eggs. The required temperature is 55°, and the time usually required is from two to four days. We begin to hatch the lobster eggs on April 1. Several years ago an experiment in hatching eggs received during the winter months was tried at this station. Eggs were received on December 12 and continued to be taken until January 25.

"During this period 148 lobsters were stripped, yielding 1,717,700 eggs, which were placed in the hatching jars, the temperature of the water being 45°. None of these eggs, however, began hatching until May 25 following, the water being 54°, and on the 6th and 7th of June 856,500 fry were released in local waters. The period of incubation, therefore, ranged from five and one-half to four and one half months, the loss being over 50 per cent."—Boston Globe.

SUCH is the clearness of the atmosphere in the vicinity of Arequipa, Peru, that from the observatory, 8,050 feet above the sea, a black spot one inch in diameter, placed on a white disk, has been seen on Mt. Charchani, a distance of eleven miles, through a thirteen inch telescope.