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SCIENTIFIC AMERICAN SUPPLEMENT

No. 663.

For the Week Ending September 15, 1888.

Price 10 cents. For sale by all newsdealers.

TELEPHONE CONVENTION NOTES.

Many men, ingenious and enterprising, with every incentive for study and investigation, are constantly at work perfecting the telephone service, and when they meet to compare a twelvemonth's notes, as they did last week [see another page], the progress made is clearly perceptible. The aim is, of course, to cheapen processes for the projector's benefit as well as to improve them in the interest of the subscriber, and so, though the user may get a deal of comfort in the promises held out last week of improved service, not a word was said to lead to the hope that it will be cheapened to him as much as a penny in the dollar.

It must be said, however, that even a telephone monopoly has its merits as well as its defects. It is to the interest of the parent company to experiment, to keep a sharp eye out for improvements in apparatus, making the fruits of the first widely known and securing for its sub-companies the right of using the latter. It was stated at the convention that out of the 600 telephones and 3,000 parts patented here, all that is worth having has been secured and turned over for the use of licensees.

The feature of the meeting was the virtual admission of ignorance, on the part of the parent company, of a recent and apparently highly important discovery in telephony made by one of its sub-companies, as if the telephone octopus was not sufficiently sensitive to feel what is going on at its extremities. On the second day of the meeting, an employe of the parent company, and supposably speaking with authority, declared substantially that, though the telephone has been in operation these eleven years, the bugbear "induction" has not lessened the potency of its grip a jot or tittle. And in the face of that statement, one of the best known among the brotherhood of electricians rose in his seat and declared that nearly all the telephone troubles popularly supposed to arise from induction are the result of leakage only, induction operating at minute distances, while leakage occurs across wide intervals. Then he proceeded with argument and demonstration, the first founded on an assumed theory, but the latter based on practical experiment, the account of which was listened to with close attention. Neither did the discussion following serve to point a fallacy in the argument nor discredit the means used.

To Mr. C. E. McCluer, of Richmond, Va., this discovery, if it really is a discovery, is due. There they have an electrical railway on the overhead wire system, besides an extensive arc lighting system, trying conditions, it is obvious, in which to operate a telephone service. No sooner did he get rid of the lighting current interference when the railway appeared, not, of course, having the same E. M. F. as the lighting current, but what it lacked in electromotive force it made up in current strength. Yet, acting on his theory that the interference was due to leakage rather than to that induction to which it is usually ascribed, he succeeded in absolutely silencing it. He constructed an artificial "earth" by means of a large copper conductor, and his answer concerning the effect of this on one of the worst portions of his line, which, because of the interest excited, he was compelled to pause in his reading to give, is worth reproducing.

Question: "You say you removed the artificial 'earth' wholly from direct influence?"

Answer: "You understand that when this general return wire was used as a general wire, one of the wires on such a tap being connected to this one ground wire, and all seeking earth at the central office instead of at the point where the subscribers' station was located, it reduced the interference from street railway and electric light currents at least 50 per cent; so that when it was only with difficulty that you could make a man understand what you said, with this general return wire we could hear very well indeed."

Question: "That general ground wire was grounded in the central office?"

Answer: "Grounded in the central office, but when made wholly detached from and wholly in place of the earth, they reduced the other 50 per cent or eliminated it entirely. On these stations I spoke of before, the leakage from the electric light wires had been so strong that the subscriber could not use his telephone at night and the operator could not hear him with distinctness when he ordered a connection. Therefore, he told me he never thought of using his telephone after the electric light had been started. As soon as I had this tap connected to one of these artificial ground connections, I sent one of my inspectors to make some experiments. He called me over this general ground wire. The operator heard his order to connect with 180, which is the chief operator's telephone in the central office. I went to the telephone and talked with him without any difficulty at all. Then I removed this plug from the switch and converted that ground wire with all its attached wires into a metallic circuit, and he and I then carried on a conversation in a whisper, of course getting close to the transmitters, as you have to do under these circumstances. But I have just mentioned that to show you the difference between the general ground wire and the metallic surface. Then, when I made him take out the general ground wire and replace the old natural wire, the din from the electric light was so great that he could not hear a word. I then called the subscriber to the telephone, and the very moment I spoke to him he said 'Hello! What have you done here?' I told him I had been experimenting to see if I could not relieve him of the trouble he had been complaining of. He said: 'You have done it.' I then took the plug out of the central office, disconnected the earth entirely, and talked to him over the metallic circuit. He then expressed still greater wonder that the electric light noises were gone entirely; he could not hear a sound of it. I then made some remark in a whisper, which he heard without difficulty, and replied to me in the same way."

In the underground wire discussion it was stated as a self-evident truth that buried wires cannot be expected, because of the conditions of operation, to give as good service as those strung on poles; the air being the best and the ground the worst description of insulation. The transmitter and the battery, too, are prolific sources of trouble. The many contacts in the magnets, bells, and other mechanisms require especial care, and it was suggested that platinum should be more generally used. Wires connecting insulators outside of buildings with instruments inside are often carelessly set, and defective service is frequently charged, when really the trouble is alongside the subscriber; the window connections of his wire being unprotected from moisture. As to underground service, there is little doubt that, as it increases in dimensions, it will bring new difficulties and require more careful and frequent inspection. Because of the certainty of this there was a general feeling evident about the convention that it would be necessary in the future to construct metallic circuits to insure anything like the service that was had with the pole system.

THE LOCOMOTIVE WATER SCOOP.

J. W. B. asks: Is the device for scooping up water for a locomotive, while going at a high rate of speed, an American or English invention? Answer: It is an American invention, patented by Angus W. McDonald, of New Creek Depot, County of Hampshire, Va., November 28, 1854, No. 11,998.

Philip Henry Gosse.

A telegram from London announces the death of Philip H. Gosse, the distinguished English naturalist. Mr. Gosse was born at Worcester, April 6, 1810, and early developed a taste for natural history. In 1827 he went to Newfoundland, where he remained in mercantile employment eight years, devoting his leisure to collecting insects and making colored drawings from them. In 1835 he settled in Lower Canada, where he resided four years. He traveled subsequently in the United States, and remained nearly a year in Alabama, where he made a large collection of drawings of insects. Returning to England in 1839, he prepared valuable works, entitled "The Canadian Naturalist" (1840), "The Ocean Described," and "Letters from Alabama on Natural History." He resided in Jamaica for eighteen months in 1844–45, and as a result published "The Birds of Jamaica" (1847), followed by an "Atlas of Illustrations" and a volume entitled "A Naturalist's Sojourn in Jamaica" (1851). For several subsequent years he was employed in composing popular books on zoology and allied subjects. He was one of the first persons to give an impulse to the formation of those public and private collections of living marine animals which became popular under the name of *aquaria*, a term probably of his invention. He published two elaborate memoirs on the natual history of the class *Rotifera*, in the "Philosophical Transactions of the Royal Society," and was elected a fellow of that learned body in 1856. He also published "The Natural History of Birds, Mammals, Reptiles, and Fishes" (4 vols., 1848–51); "British Ornithology" (1849, new edition 1853), "A Text Book of Zoology for Schools," and many other books on kindred topics. His greatest undertaking was "Actinologia Britannica: A History of the British Sea Anemones and Corals" (1858–60). His son, Edmund H. Gosse, is an eminent naturalist and Scandinavian scholar.

Continuance of the Yellow Fever.

Contrary to the expectations that were formed, the yellow fever continues its ravages in Florida. The number of new and of fatal cases in Jacksonville shows no diminution, but on the contrary a tendency to increase is discernible. The epidemic seems so firmly established that the outlook for many weeks to come is far from a bright one. The arrival of frost will stop the infection, but if winter has to be waited for, the intervening period will be a severe ordeal for the afflicted regions. A rigorous quarantine is now in force throughout Florida and the adjacent regions, and its effects upon business have been naturally very disastrous.

The Telephone Convention.

The Telephone Exchange Association, composed wholly of licensees of the American Ball Telephone Company, met in convention at the Hotel Brunswick, in this city, on Tuesday, September 4th, and Wednesday the 5th. Papers on the theory and practice of telephony were read and commented upon before a large and attentive audience.

Mr. C. E. McCluer, of Richmond, Va., in an instructive paper on "Dynamo Current Interferences with Telephone Systems, and Means of Relief," said in substance that he once believed in the theory now usually accepted that the earth is an immense reservoir of electricity, but because of the behavior of telegraphic apparatus under the influence of extraneous currents he is led to question the correctness of the theory of the infinite conductivity of the earth. He had also been led into the error of attributing the many ills of the telephone to "induction," but experience had convinced him that nearly all these are the result of leakage, induction operating only at minute distances, while leakage will occur across wide intervals. Recent experience with electric lighting currents has confirmed him in these views. When a few years ago the electric light came to Richmond, telephony became disturbed with strange noises. He first attributed the telephone disturbances to induction, but his linemen discovered that even in the driest weather enough of the dynamo current on a large arc light circuit escaped over the insulators and down the poles to be perceptible to the tongue when applied to a pole four or five feet from the ground, while in rainy weather a very perceptible shock could be felt by applying the hand to a wet pole. He decided that leakage and not induction, as this is always called, was the force to be dealt with, being confirmed in his opinions by the fact that the interferences were greatly increased during wet weather.

On January of the present year, a long electric railway was started in Richmond, having no metallic circuits like light and power systems, but mixed earth and metallic circuits, the current carried to the overhead trolly wires by a system of distributing mains on poles and connected frequently with the trolly wire by short lateral wires or feeders.

In six weeks we had eight sets of telephones and one central office annunciator burned out by these railroad currents, most of them due to crosses between the telephone wires and the supposed to be harmless wires [non-electric wires running across the streets and joining the line of poles on one side with the line on the other]. The effect of this railway has been and is a serious obstacle to the telephone system. At the generating station of the railway, three squares away from the central office, the battery of five or six dynamos was grounded, the negative electrodes connected to several large sheets of copper at the bottom of a deep well. The positive electrode of the dynamo, coupled up in multiple arc, being connected "to air" or to the distributing mains. In all our exchange stations in the vicinity we got a negative leakage current, while at the more distant ones we got a positive one; it being, therefore, impossible to arrange our galvanometer batteries to coincide with these leakage currents of opposite polarity. The galvanometers cannot today be used for testing off the stations near the generating station. He found the railway people were utilizing the municipal gas and water mains in order to re-enforce their ground connections, and thinking it might be a cause of trouble, his company similarly grounding their lines, he had them directly connected with the earth, but without altering the result.

The 500 volt currents of the railway do not interfere so much as the 4,000 volt currents of the arc light. What the railway currents lack in E. M. F., however, they make up in current strength, and are therefore more dangerous to property than the more intense light currents. The greater tension of the electric light currents, he thinks, makes them disastrous to telephonic exchange service. Acting upon his theory that telephone troubles are due principally to leakage from light and railway wires rather than to induction, the leakage overflowing in the wires from the earth because the earth offers an appreciable resistance to the passage of the currents, he adopted a metallic conductor of exceedingly low resistance and approximating that of the earth, using it in place of the earth as the return conductor, an "artificial" ground, cutting loose from the earth wholly, with all the benefits of metallic circuits. The result he says is altogether successful.

Mr. L. F. Beckwith, of the New York Subway Construction Company, gave some interesting facts on the New York subways. He said that, with the exception of the Edison, they are all built on the "drawing-in" system, being groups of ducts extending between a series of manholes. He believed experience had shown that a main conduit of separate pipes that may be crowded or curved or kept apart is best adapted to overcome the many obstacles met with in the ground. Screw-jointed, asphalted wrought iron pipes, laid preferably in hydraulic cement concrete, give most tightness of duct against gas and water with greatest strength. The cement pipe and creosoted wood tubes have also some valuable features. In some places they had met a steam heating company's pipes and had great difficulties because of them, the steam constantly escaping, and, therefore, not permitting the use of materials of construction melting or softening at from 160 degrees to 200 degrees on Fahrenheit's thermometer. Non-metallic and metallic ducts five miles long have been purposely constructed, that the telephone people may have a chance to experiment as to their influence on low tension currents. The work done up to the 1st of the present month is here given:

Dorsett ducts, coal tar concrete	235,837	feet.
Zinc tubes laid in hyd. cement concrete	68,883	"
Creosoted wood tubes	167,175	"
Cement pipe laid in hyd. cement concrete	216,626	"
Iron pipe laid in asphaltic concrete	131,284	"
Iron pipe laid in hyd. cement concrete	1,423,722	"
Iron distributing pipe	23,301	"
Edison iron tubes	222.794	"
Grand total length of single duct	2,489,602	feet.
" " "	472	miles.
" " " trench	37	"
Number of manholes	523	
Total length telephone and telegraph ducts	376	miles.
" " electric light ducts	96	"
Length of telephone and telegraph trenches	19½	"
" " special electric light trenches	17½	"

About three-fourths of a million feet of single duct for telephone, telegraph, and electric light purposes authorized by the Board of Electrical Control remains to be built.

For telegraph purposes an iron pipe from a manhole connects underground with a building or with the foot of a pole. For telephone purposes the above method is used, and a pipe runs up the face of a building to the roof, wherefrom a fixture the cable is divided for distribution on the block and surrounding blocks. Sometimes the pipe is carried up through an elevator or ventilating shaft. In the down town district, and along Broadway to Union Square, an iron 3 inch pipe is laid in the trench above the subway, provided at intervals of about 50 feet with malleable iron circular distributing or service boxes with screw covers 12 inches in diameter, with side outlets through which a cable can be conducted by a service pipe into the buildings.

For electric light distribution the Edison Co. have their special system laid. A cast iron distributing conduit with 6 ducts and flush boxes has been authorized to be laid in Broadway from Fourteenth Street to Thirty-fifth Street. Up to August 27th, 1888, there were 3,567 miles of wire laid in the subways by the Metropolitan Telephone and Telegraph Co., and a 100 wire lead-covered cable from Whitehall Street to Fifty-eighth Street, about 6 miles, and the longest of this size in existence underground. The Western Union Co. have about 100 miles of wire underground, and the Edison about 126. The Brush Co. are putting an 8 conductor cable in the Broadway conduit from Fourteenth Street to Thirty-fifth Street, making 8 miles of electric arc light wire.

Mr. W. D. Sargent, engaged in constructing the Brooklyn subways, sent a paper on the subject. He says the first section of the creosoted wooden conduits, which have been used four years, do not show any evidences of decay, the ducts remaining clean and dry, and the cables drawing in and out easily. Three-inch ducts he thinks the best. Of the cables laid four years ago, those covered with pure lead have been more than half eaten through. One just drawn out, and only two years buried, is badly corroded. Those with a mixture of tin show only slight corrosion. He thinks that if in addition to the tin, cables were drawn through a bath of gas tar or asphaltum, then covered with a good stout braid, and again run through the bath, they would be practically imperishable. The greatest length of cable now underground in Brooklyn is 11,800 feet, between the Bedford and Williamsburg offices, of 100 wires, twisted in pairs, the pairs broken up at all the splices, conductors 0·035, insulated to 0·075. The insulation of this cable is 39 megohms per mile; capacity, 26 microfarads; resistance of the construction, 47 ohms per mile.

The electrical qualities of this two miles cable are: insulation 50 megohms, capacity 52 microfarads, resistance of conductors 94 ohms. There have been and still are many complaints of the imperfect working of this cable, but he is inclined to attribute the trouble to other causes rather than inefficiency on the part of the cable itself. The Dorsett conduit, of which much was expected, he says, has proved very unsatisfactory. They have five miles of it, with ducts two inches in diameter, and these, because of irregularities at the joints, will only permit of a cable 1¼ inches in diameter being drawn in.

As the mileage of underground wire increases, the obstacles in the way of good service will be increased. The actual extent of the Brooklyn underground wires was on September 10:

Length of conduit	15·17	miles.
" " duct	105·5	"
" " cable	22·93	"
" " conductor	2'053·3	"

1913 subscribers are using underground wires, the length of the latter being 1229·9 miles.

E. F. Sherwood of the Metropolitan Telephone Company of New York City, said they were serving 7,300 subscribers. They are using what they call trunk calling wires between the several exchanges, one ending at John and the other at 39th Street, for calling all trunk connections to the many exchanges operated by the company. The number of trunk wires connecting the exchanges in New York City is 532, and average 60 connections a day. This average could be increased to 70 per day, the number of subscribers could be increased 600 without increasing the trunk facilities. To other exchanges the Metropolitan has 187 trunk lines, all running smoothly, including the new Brooklyn exchange of the New York and New Jersey Telephone Co. The new switch board at 18 Cortlandt Street is wired for 5,100 subscribers and 900 trunk wires. The local battery of each operator's outfit will be two cells of storage battery, one for day, the other for night. That used by day will be charged at night from the main storage battery, and the night battery charged from a dynamo during the day. 1,527 miles of wires are now underground, and 2,784 separate wires are altogether or in part so working.

A New and Remarkable Gas.

A new gas, possessing some remarkable properties, has been discovered by Prof. Thorpe and Mr. J. W. Rodger, in the research laboratory of the Normal School of Science. It is a sulpho-fluoride of phosphorus of the composition PSF_3, and is termed by its discoverers thiophosphoryl fluoride. The best method for its preparation consists in heating pentasulphide of phosphorus with lead fluoride in a leaden tube. It may also be obtained by substituting bismuth fluoride for the fluoride of lead, the only difference between the two reactions being that the second requires a higher temperature than the first. Again, when sulphur, phosphorus, and lead fluoride are gently warmed together, an extremely violent reaction occurs, but if a large excess of the fluoride of lead be employed a tolerably steady evolution of the new gas occurs, the excess of the lead salt appearing to act as moderator. It is an interesting fact, throwing considerable light upon the constitution of the sulpho-fluoride, that it may be obtained by heating together to 150° C. in a sealed tube a mixture of the corresponding chloride—thiophosphoryl chloride, $PSCl_3$, a mobile colorless liquid—and trifluoride of arsenic. The simple exchange of chlorine for fluorine here brings about a striking physical change, from a highly refracting liquid to a colorless gas. And now for the remarkable properties of the gas. In the first place, it is spontaneously inflammable. If it be collected over mercury, upon which it exerts no action, in a tube terminating above in a jet and stop cock, and the latter be slowly turned so as to permit of its gradual escape, the gas immediately ignites as it comes in contact with the air, burning with a greenish yellow flame tipped at the apex with blue. If, however, a wide tube containing the gas standing over mercury be suddenly withdrawn from the mercury trough, the larger mass of gas ignites with production of a fine blue flash, the yellowish green tint again being observed as the light dies away. Thiophosphoryl fluoride is readily decomposed by the electric spark with deposition of sulphur. If a quantity contained in a tube over mercury be heated for a considerable time, complete decomposition occurs, sulphur and phosphorus both being deposited upon the sides of the tube and gaseous silicon tetrafluoride left. From a spectroscopic examination, dissociation was shown to occur at the lowest temperature of the electric spark. The gas is slowly dissolved by water, and appears to be somewhat soluble in ether, but alcohol and benzene exert no solvent action upon it. Finally, the colorless, transparent gas was reduced to a liquid, somewhat resembling the sulpho chloride, by means of Cailletet's liquefaction apparatus.—*Nature.*

Suggested Improvement in the Manufacture of Paper.

It has often been stated that the cause of paper becoming brittle or tender is to be found in the presence of alum or sulphate of alumina in the paper. Herr C. Wurster's observations, according to the *Papier Zeitung*, extending over ten years, tend to the conclusion that neutral or basic sulphate of alumina exercises no decomposing influence at ordinary temperatures on paper, whether size be present or not, but that sulphate of alumina has a strongly caustic action if chlorides, such as those of sodium and calcium, be present, especially at higher temperatures. In this case an injurious action on the paper arises from the formation of aluminum chloride or free hydrochloric acid, which acts by abstracting hydrogen, or the elements of water, from the cellular substance. The manufacturer should therefore endeavor to remove, as far as possible, by washing from the fabric any sodium or calcium chloride resulting from the bleaching powder. It is accordingly not advisable to kill the bleach by antichlor without subsequent washing. From these considerations, the testing of paper should include a qualitative or quantitative examination of the chlorides present, which, the *Journal of the Society of Chemical Industry* says, have hitherto been regarded as quite harmless.