found, could be rendered stronger by being hammered at the sides so as to form flanges upon them, much like those on modern rails. The blades were next cast with these flanges upon them, and it was then found advantageous to make them expand in the middle of the blade, so as to allow them to embrace the two sides of the split haft in which they were mounted. Eventually these projecting wings were hammered over so as to produce a kind of semicircular pocket for the haft on each side of the blade. At this stage a brilliant idea occurred to some ancient founder, and by means of a clay core he produced a single socket in the body of the blade itself, and thus did away with the labour of hammering out the wings on the flat blade and turning them over, and also with the trouble involved in making a deep notch in the haft, so that it might run down each side of the blade. But these semicircular wings had become a recognised feature in this class of hatchets, and out of regard to this fashion the earliest of the socketed blades were cast with the two wings on each face, in imitation of those of the older form. As has so often been the case in such developments, what was at one time of essential service survives at another as a useless ornament. And now comes in this little bit of history which these hatchets enable us to read. It is evident that the first socketed blades must have been cast in a country where the prevailing type of hatchet had the semicircular wings on each face; but this kind of hatchet, though abundant in some parts of the Continent, is very rare in Britain, and we are therefore justified in concluding that the art of casting hatchets with a socket was introduced into this country from abroad. Not but what our native founders cast plenty of hatchets of this socketed pattern when once they were acquainted with it, for the moulds for producing them have been found with lumps of metal and various bronze objects in different parts of the Kingdom.

Not only were the bronze-using people skilful as founders, but they understood how to work ornaments in amber and jet as well as in gold, and some few specimens of their ornamental inlaying are such as would do credit to any modern workman. The wooden handle of a bronze dagger found in the grave of a warrior in Wiltshire was inlaid with thousands of minute gold pins, arranged in regular patterns, and the amber pommel of a dagger found in Devonshire was as delicately inlaid with gold as any tortoise-shell patch-box of the last century.

The history of man in the bronze-using stage is, however, better read on the Continent than here. On the shores of many of the lakes of Switzerland, Italy, and the South of France the remains of settlements belonging to the Bronze Age have been discovered. As a safeguard against enemies and wild beasts, it was a custom in those times to construct artificial islands, or platforms carried on piles above the water, on which to erect their dwellings. The same custom also prevailed within the historic period both in Europe and Asia, and something of the same kind was practised in Ireland until comparatively recent times. A similar custom has been observed in other parts of the world by modern travellers. In such buildings, from time to time, disastrous fires occurred, and what was thus lost to the original occupants has been preserved beneath the waters for the instruction of long subsequent ages. Their houses seem to have been formed of interlaced boughs smeared over with mud, after the manner we now term "wattle and daub." They understood the art of spinning and weaving both woollen and linen cloth. Of domesticated animals they possessed the dog, ox, sheep, goat, pig, and finally the horse. In this country they hunted the red deer, the roe, the wild boar, the hare, and some other animals. But they also were to some extent agriculturists, and reaped their corn with bronze sickles. They made vessels of various shapes in burnt clay, but were unacquainted with the potter's wheel, though some cups of amber and a soft kind of jet were apparently turned in a lathe. Though using so many and such well-made tools and weapons of bronze, a certain number of appliances for both peaceful and warlike purposes were made of stone. The skins which they prepared as leather were scraped by means of flint scrapers. Their arrow points were made of flint, and their battle-axes and war maces were in this country carefully wrought out of stone. From the number and varieties of the bronze instruments found in Britain, it has been inferred that their use must have extended over several centuries, and it seems probable that the beginning of our Bronze Period dates back to at least some 1,200 or 1,400 years B.C. Such a date also seems to agree fairly well with what we learn from history as to the trading visits of the Phœnicians to this country in search of tin.

(To be continued.)

RECENT PROGRESS IN TELEPHONY[1]

THE Telephone was first introduced to the British public at the meetings of the British Association. In 1876, at Glasgow, Sir William Thomson startled his hearers by announcing that he had heard, in Philadelphia, Shakespeare quoted though an electric wire, by the aid of the invention of Mr. Graham Bell, which he then pronounced to be "the greatest by far of all the marvels of the electric telegraph." In 1877, at Plymouth, I had the pleasure of showing in actual operation the finally developed instrument now known as the Bell Telephone, which I had just brought over from America; and conversation was actually maintained between Plymouth and Exeter. Five years have elapsed since then, and it is fitting that the British Association should hear of the progress of this astonishing apparatus.

In 1877, it was a scientific toy; it has now grown to be a practical instrument. 1,550,000*l.* capital is already embarked in its extension in England, and it is earning a revenue of 109,000*l.* Hitherto it has been practically a monopoly in the hands of a private company, who hold the controlling patents, and of the Post Office, who possess the controlling power, but this monopoly has been broken, and we are about to witness severe competition. It is often said that competition in any business will have the effect of reducing the rates charged to the public, but the experience of the past in railways and telegraphs scarcely teaches this lesson. Undue competition tends to lower the rates for a time, but it eventually leads to amalgamation—to the absorption of the weak by the strong—to swollen and watered capital, aud, finally in many instances to higher rates to a too-confiding public. Competition, however, induces better service, and ultimately, in this respect, the public gain.

The free traffic in patents, however, leads to jobbery and speculation of the worst type. We have recently seen a mania for electric speculations that almost rivals the South Sea Bubble period. The public have wildly rushed into ill-matured schemes that have swollen the purses of gambling promoters, have turned the heads of inventors, have retarded the true progress of the beneficial application of this new science to the wants of man, and have thrown away millions upon imperfect schemes. Much has been said against the monopoly of the Post Office in telegraphic business, but at any rate it has the merit that it has checked the rapacity of company promoters and patent-mongers in that branch of the practical application of electricity, while no one can assert that it has checked the progress of telegraphy. During the first week that the telegraphs in this country were transferred to the State, the total number of messages transmitted was 26,000, while in the week ending August 11th it amounted to 724,000. There is no inventor who can assert that his scheme has not received proper consideration, nor show a real improvement that has not been adopted and remunerated; while the improvements of the Post Office itself are freely adopted by other countries, and America itself—the home of the inventor—has found the advanced system of England worthy of acceptance.

Receivers.—The original telephone receiver of Bell has scarcely been improved upon; it remains in form and construction very nearly the same as that which I exhibited in 1877. The perfection of its working depends upon the truth and perfection of its manufacture. It is now more solid and substantial than it was at first, more powerful magnets are used; but still it is the same simple, marvellous, and beautiful instrument that I brought over from America. Mr. Gower has increased its loudness by varying the form of its various parts, and using very powerful horse-shoe magnets of peculiar form; but experience shows that loudness is always obtained at the expense of clearness of articulation; and, although for many purposes the Gower-Bell iustrument, which is adopted by the Post Office and is now in use to connect together all the sections of the British Association scattered through the town of Southampton, is more practical, nothing for delicate articulation surpasses the original Bell.

The Paris Exhibition of last year, so fruitful in electrical novelties, did not bring forth any marked improvement in telephonic apparatus. It was noticeable chiefly for its practical applications of the telephone, and particularly to the transmission of singing and music to a distance. M. Ader's modification of Bell's receiver is that almost universally used in Paris. It is a

[1] Paper read at the Southampton meeting of the British Association. *Revised by the author.*

very handy, pretty, and convenient form. He utilises a principle which he calls "surrexcitation." A thick ring of soft iron is inserted between the ear-piece and the diaphragm, and this is said to increase the attractive power of the little horse-shoe magnet upon the vibrating iron diaphragm. A simple experimental apparatus of M. Ader's shows that there is some foundaton for this fact: when a thin steel spring is adjusted close to the poles of a magnet without being attracted by them, the near approach of a mass of iron to the spring will cause it to be attracted by the magnet.

D'Arsonval has also modified the Bell receiver. He has placed the coil in a powerful magnetic field of annular form, and has thereby concentrated the lines of force upon the induced coil. He brings the whole coil within the influence of the field. The effects are said to be magnified, and the increased loudness is not accompanied by the usual loss of articulation. Speech is reproduced without any change of *timbre*.

Telephone receivers of the Bell type are all based upon the magnetic effects of currents of electricity flowing around magnets or bars of soft iron.

The rapid and rhythmic magnetisation and demagnetisation of a bar of iron or the increment and decrement of the magnetism of a magnet, will produce molecular disturbances, in its own mass and in the matter about it, that lead to the oscillatory motions of the whole which produce sonorous vibrations that can be made manifest by various devices, and particularly by that patented by Graham Bell.

Other principles of electricity have also been utilised for telephonic receivers.

For instance, Mr. Edison used the electro-chemical effect. The decomposition of a chemical solution in paper or on chalk by the passage of currents through it, produces a modification of the friction of two moving surfaces, which can reproduce sonorous vibrations, and the result is a very loud-sounding apparatus. I myself had the pleasure, in 1880, of submitting to the Royal Society a receiver based on the electro-thermal effects of the current. The passage of a current through wires always heats them and therefore produces expansion. If the wire be made fine enough, the heat is generated and dissipated so rapidly, the expansion and contraction are so quick, that sonorous vibrations are the result. Although I was able to speak through it very clearly, I have not as yet developed this instrument into a practical form. Professor Dolbear has recently utilised the electro-static effects of currents. His receiver is even more simple than that of Bell. Two flat circular discs of metal are rigidly fixed very close to each other in an insulated case of ebonite. When one disc is electrified positively by a charge of electricity, the other is electrified negatively by induction. These two opposite states produce attractions varying in force with the strength of the signals sent, and the result is that, when telephonic currents are transmitted, we obtain sonorous vibrations, and, consequently, the reproduction of speech.

Many other forms of telephone receivers have been devised and exhibited, in fact I have recently seen quite a crop of them; but as they involve no new principle, and introduce no particular improvement, having been brought out chiefly to try to avoid existing patents, I pass them over, and proceed to the next branch of my subject.

Our present Patent Law is, unfortunately, in so disorganised and chaotic a condition, that evasion is often possible, and hence the questionable morality of doing a thing in another way, in order to avoid the incidence of a royalty, is practically encouraged. The possession of a patent is now no guarantee of property: it is granted without any discrimination, and cannot be upheld without tedious litigation and wasteful expenditure before a non-technical and scientifically incompetent tribunal. We therefore cannot hope for any virtue in English inventors or security for real improvements until our law is thoroughly revised. The question is before the House of Commons, and, when wordy agitators have fully exhausted the patience of our legislators, we may hope for some attention to so real and pressing a want.

Transmitters.—The great novelty and peculiarity of Bell's telephone was that the receiver and transmitter were similar and reversible. Sonorous vibrations of air impinging on an iron disc caused it to vibrate in front of a magnet around one pole of which a portion of an electric circuit was wound. These vibrations of a magnetic substance in a magnetic field produced currents of electricity in the coil of wire on the magnet, varying in strength and direction with the sonorous vibrations, which, proceeding along a wire to a distant station, there varied the magnetic strength of a similar magnet so as to vary its attractive force on a similar disc, by which it reproduced the motions of the first disc, and thus, reproducing the sonorous vibrations of the air, repeated speech. The currents, however, were very feeble; much energy was lost *en route*, and the effect scarcely attained a practical standard. Mr. Edison showed how to strengthen these currents. Taking advantage of a peculiar property of carbon which was supposed to vary in electrical resistance with the amount of pressure brought to bear upon it, he caused the vibrating disc which was spoken against to press upon a button of carbon, and so to vary the strength of a current of electricity passing through it. This varying current, passing through the primary wire of an induction coil, set up in the secondary coil more powerful currents than the Bell instrument produced, and caused louder and more marked effects at the receiving station. Professor Hughes went a step further. He found a combination of materials that were directly affected by sonorous vibrations, which he called a "microphone," and he proved that the effect of the carbon transmitter of Edison was not due to any influence of varying pressure on the mass of the carbon, but was a phenomenon of loose contact. He found a new fact in nature, and he startled the scientific world by introducing an instrument which did for minute sounds what the microscope had already done for minute objects. By the light thrown on the theory of the instrument by Hughes, Edison's carbon transmitter has been so improved by Blake, Hunnings, Moseley, Anders, and others, that little apparently remains to be done. The telephone as a speaking instrument is now well nigh perfect. It is quite possible to swear to a friend's voice at 100 miles distance. The difficulty of making the telephone a practical instrument under all circumstances is not due to any defects in the instrument itself, but to disturbing influences external to it, and consequent on its surroundings. The very pefection and sensitiveness of the apparatus itself are its chief enemies.

The true action of the microphone, or carbon-transmitter, is very little understood: it introduces into a closed electric circuit, through which a current is flowing, a resistance which, varying exactly with the sonorous vibrations impinging upon it, causes the current to undulate in a way exactly analogous to the varying sound waves. This effect is generally assumed to be due to a greater or less intimacy of electrical contact between two semi-conducting surfaces abutting upon each other; but there is now little doubt that it is due to effects of heat generated by the passage of electricity between two points in imperfect contact, whose relative distance is variable. Carbon is the best material for the purpose—first, because it is inoxidisable and infusible; secondly, because it is a poor conductor; and, thirdly, because it has the remarable property of having its resistance lowered when it is heated—the reverse of metals. This observation is due to Mr. Shelford Bidwell.

The resistance of microphones is very variable: some give 10^{ω}, while others give 25^{ω}, and some even 125^{ω}. The best transmitters that I have worked with (Moseley's) give an average of 20^{ω}.

Attempts have been made to apply mathematical analysis to the determination of the best form and arrangement of microphones, but at present the microphone defies mathematics.

Theory would lead to the conclusion that a carbon-transmitter should have the lowest possible resistance, but practice does not confirm that idea.

Theory again asserts that the resistance of the secondary coil of the induction coil should be equal to that of the line it works, but practice proves the very reverse. On a line giving nearly $1,800^{\omega}$ resistance, the best effects were produced with a secondary wire of only 30^{ω} resistance. The fact is, that the conditions due to heat in the microphone, and to self-induction in the induction coil, are very complicated, and are not yet sufficiently understood to bring the phenomena they affect within the region of mathematical analysis.

Accessories.—I do not intend to speak here of the bells, calls, switches, etc., used in carrying out telephonic operations: there has been nothing that is particularly novel introduced, or that was not previously used in telegraphy. In fact, the whole operations carried on in connection with the so-called "exchange" working are simply telegraphic, and are still in a somewhat tentative condition.

Long-distance Speaking.—I have said that the difficulty in speaking is chiefly due to the environment of the wires employed. Were we to erect a wire from Land's End to John o' Groats, upon lofty separate poles and away from all other wires, there would be no difficulty whatever in speaking between those two places. Conversation has been held in America over 410 miles; in Persia it has been effected between Tabreez and Tiflis, 390 miles apart; in India, over a distance of nearly 500 miles; in Australia, of 300 miles; but in all these cases it was done either at night or under exceptional circumstances, and in all cases the wires were over-ground. Had they been underground or submarine, the case would have been very different. Conversations have been held between Dover and Calais, between Dartmouth and Guernsey, and between Holyhead and Dublin, but I know of no case where any persons have spoken through more than 100 miles of submerged cable. The reason of this diminution of speaking distance is due to the electrostatic capacity of the telegraph line, which absorbs the minute quantity of electricity that makes up the currents employed for telephonic purposes.

In every submarine cable, before a signal can be made at the receiving end, the whole cable must be charged up with electricity, and if there be not sufficient electricity sent in to effect this purpose, practically no signal appears at the distant end. With telephone currents on long cables the whole of the electricity is, as it were, swallowed up—that is, none appears at the distant end, or, if it does appear, it is rolled up in one continuous wave, bereft of those rapid variations that reproduce sonorous vibrations. The newspapers said that the sound of the bombardment of Alexandria was heard at Malta; but, in the first place, the experiment was not tried, and, even if it had been tried, it could not have succeeded. The use of underground wires very seriously impedes telephonic extensions, and with our present apparatus and present knowledge we cannot readily speak over greater distances than 20 miles.

Disturbances.—But there are other disturbing influences at work of more serious import.

When two or more telephone wires run side by side, what is said on one can be overheard on all the others; and when a telephone wire extends alongside telegraph wires, every current on the telegraph circuit is repeated in the telephone, leading to a hissing, frying, bubbling sound that is not only very irritating, but which on busy lines entirely drowns speech. When music is transmitted on one wire, it can be heard equally well on all wires running parallel and contiguous. This is due to induction and to leakage.

(A.) *Induction.*—Induction is a term employed to designate the peculiar influence which electrified and magnetised bodies exert upon conducting and magnetic masses in their neighbourhood. If two wires run side by side for some distance, every current of electricity sent upon one wire will produce two currents in the contiguous wire, the one at the commencement and the other at the end of the primary current of electricity. The greater the intensity, and the more sudden and abrupt the commencement and the ending of the inducing current, the greater effect it has on the induced wire. Those instruments, consequently, which reverse their currents the most rapidly and suddenly, produce the greatest disturbance. The powerful alternative and intermittent currents used for certain electric light systems are death to telephones: they cause an incessant roar that renders speech an impossibility. There are some apparatus in telegraphy that require very powerful currents to work them, which are equally detrimental. Many attempts have been made to cure this evil.

1. The sensitiveness of the receiver has been reduced to lessen the influence of the disturbing currents, and the strength of the telephonic transmitting currents has been increased so as to overpower the induced currents.

2. The influence of one wire on the other has been screened off by inserting metal coverings in connection with the earth between them.

3. The suddenness of the rise and fall of the inducing currents has been modified by the insertion of condensers or electro-magnets.

4. Counterbalancing or neutralising effects have been set up by counter-induction apparatus.

But all these plans, and many others, have been proved either only partially successful or wholly abortive; the only effective mode of curing the evil at present practically used is to employ a complete metallic circuit so contrived that the two wires are in very close proximity to each other, or that they twist round each other, so as to maintain a mean average equality of distance between themselves and the disturbing wires. When we have the two wires of a circuit kept at the same mean distance from the disturbing causes, however near they may be, the influence on each must be identically the same, and as the one is used for going and the other for returning, the similar influences must be opposite in direction, and they must therefore neutralise each other. This plan, which was originally devised for underground wires by Mr. Brooks, of Philadelphia, was found to be absolutely true in practice, and the Post Office, having laid down many hundred of miles on this system with perfect success, invariably constructs its circuits both underground or overground in this way. It is, of course, more expensive than a single wire, but the great gain—the absolute freedom from overhearing, the privacy and the absence of crackling—is well worth the extra cost. Wires in submarine cables are invariably laid up with a twist, so that no special contrivance is needed on such wires, and in underground wires not laid up together as cables, they are as a rule, so close to each other that twisting is unnecessary; but for overground purposes twisting is essential, and special arrangements have to be carried out. Professor Hughes showed how this was to be done, and Messrs. Moseley carried it out practically in the neighbourhood of Manchester. The plan adopted by the Post Office for *two* and for *four* wires is shown by the diagram. It is simply and easily carried out, and entails no practical difficulty whatever.

In the neighbourhood of Manchester there are over 400 miles of overground double wire twisted on this plan, working efficiently and thoroughly. I have spoken to a friend 76 miles off, through wires that were erected on poles carring busily-occpied telegraphic currents, without disturbance or difficulty.

(B.) *Leakage.*—The double-wire system is only absolutely effective so long as the insulation is good. The moment insulation fails, connection with the earth is made, and then we have disturbing causes due to currents flowing through the ground, which are increased in proportion to the deterioration of the insulation. Hence, good insulation is essential to telephone working.

The discovery of the telephone has made us acquainted with another phenomenon. It has enabled us to establish beyond doubt the fact that currents of electricty actually traverse the earth's crust. The theory that the earth acts as a great reservoir for electricity may be placed in the physicist's waste-paper basket, with phlogiston, the materiality of light, and other hypotheses. Telephones have been fixed upon a wire passing from the ground floor to the top floor of a large building, the gas pipes being used as a return, and the Morse signals sent from a telegraph office 250 yards away have been distinctly read; in fact, if the gas and water systems be used, it is impossible to exclude telegraphic signals from the telephone circuit. There are several cases on record of telephone circuits miles away from any telegraph wires, but in a line with the earth terminals, picking up telegraphic signals. When an electric light system uses the earth, it is stoppage to all telephonic communication in its neighbourhood. The whole telephonic communication of Manchester was one day broken down from this cause, and in the City of London the effect was at one time so strong as not only to destroy telephonic communication, but to ring the bells. A telephone circuit using the earth for return acts as a shunt to the earth, picking up the currents that are passing, in proportion to the relative resistances of the earth and the wire. The earth offers resistance, and consequently obeys the law of Ohm; hence it is not only essential for a telephonic system that the earth should not be used on any electric light system, but it is also desirable that the earth should be eschewed for telephonic purposes. Thus, the double-wire system adopted by the Post Office and by the Société Génerale des Telephones of Paris, not only cures the ill effects of induction, but it materially diminishes the disturbing influences of earth conduction. The four-wire system of the Post Office effectually checks leakage from one wire to the other—cross contact, as we call it in England—for each wire of the same current is always on a different supporting arm.

A telephone circuit when in connection with the earth gives distinct evidence of every visible flash of lightning, however far off the thunderstorm may be. No difference in time has been observed between seeing the flash and hearing the crash.

It is said that, if a telephone be connected between the gas and water systems of a house, distinct evidence of every flash can be heard. There have been several cases of persons being knocked down while experimenting during a thunderstorm, but no personal injury has been sustained, although the apparatus itself is frequently damaged. In England, at present, we have not found the damage done sufficient to justify the employment of lightning protectors. The use of double wires diminishes the danger to a minimum. On the Continent and in America, however, telephones are invariably protected by lightning arresters where one wire only is used.

There are certain natural currents flowing through the crust of the earth. They are called "earth" currents, and at times acquire such considerable energy, that, with a telephone pressed to each ear, I have been told, although I have not experienced it, that the noise made is as though "your brains were boiling." This is due to the intermittent currents produced by the polarisation of the earth plates.

M. Van Rysslberghe has recently spoken between Paris and Brussels upon a wire nearly 200 miles long, which was used at the same time for ordinary telegraphy, but the experiment was made early in the morning (4 a.m.), and was effected by retarding the telegraphic currents, so as to modify the suddenness of their rise and fall, by means of condensers and electro-magnets. I am unable to understand the advantage of any gain in speaking on a wire which is detrimental to telegraphic communication. Speed is of more importance than speech, and we can telegraph much faster than we can speak. In England speed is everything and we eliminate every influence that retards speed—condensers and electro-magnets in telegraphy circuits are out of the question. M. Van Rysselberghe has endeavoured to extend the idea to cure the effects of induction by destroying the main cause of the disturbance—that is, by reducing the sudden rise and fall of the prime telegraphic currents; but to do this means to retard telegraphy, and we cannot afford in England to cripple the one system in order to benefit the other.

I have recently tried an extremely interesting experiment between this place (Southampton) and the Isle of Wight, namely *to communicate across seas and channels without the aid of wires at all.* Large metal plates were immersed in the sea at opposite ends of the Solent, namely, at Porthsmouth and Ryde, six miles apart, and at Hurst Castle and Sconce Point, one mile apart. The Portsmouth and Hurst Castle plates were connected by a wire passing through Southampton, and the Ryde and Sconce Point plates by a wire passing through Newport; the circuit was completed by the sea, and signals were passed easily so as to read by the Morse system, but speech was not practical.

The telephone is very rapidly gaining ground, and, as improvements are effected in its accessories, in its installation, and in its mode of working, its use will still further extend. In Germany it is nsed very extensively for telegraphic business, there being 1,280 stations worked entirely by telephones, but in England it is not possible in the numerous open and public shops employed as Post Offices to secure that privacy which the telephone requires nor have we yet got over our early prejudices, resulting from the errors made through the inability of the instrument in its earlier form to repeat the sibilant sounds. The instruments of the present day (thanks to the improved transmitters), however, transmit "s's" perfectly.

William Henry Preece

SCIENTIFIC SERIALS

Journal of the Franklin Institute, September.—On a newly discovered absolute limit to economical expansion in the steam-engine and in other heat-motors, by R. H. Thurston.—Observations with the platinum-water pyrometer, with heat-carriers of platinum and of iron encased with platinum, by J. C. Noadley.—The microscope in engineering work, by R. Grimshaw.—Tests of double raw hide belts, by J. E. Hilleary.—Greatest ringing bells, by J. W. Nystrom.—Report on European sewage-systems, with special reference to the needs of the City of Philadelphia, by R. Hering.—Emerson's power scales, or dynamometer, by J. H. Lord.—Mechanical modifications of the Bessemer plant necessary to adapt it to the economical working of the basic process, by W. M. Henderson.—Prevention of fires in theatres (continued), by C. J. Hexamer.

Bulletin de l'Academie Royale des Sciences de Belgique, No. 7.—On the seat of thunderstorms and their origin, by W. Spring.—On the compound ethers of hyposulphurous acid, and on some organic bisulphides, by W. Spring and E. Legros.—On the brominated derivatives of camphor, by M. Swarts.—Note concerning the priority of the discovery of a relation existing between dilatability and fusibility, by P. De Heen.

Journal de Physique, July.—On the condition of achromatism in the phenomena of interference, by A. Cornu.—On the same, by A. Hurion.—On the actinic transparence of some media, and in particular on the actinic transparence of Foucault mirrors and their application in photography, by J. de Chardonnet.—On methods for determination of the ohm, by G. Lippmann.—Apparatus for regulating the flow of a gas at any pressure, by J. Ville.

Reale Istituto Lombardo di Scienze e Lettere. Rendiconti. Fasc. xii.-xiii.—New method for determining the relative internal conductivity of metals for heat, by G. Poloni.—On the theory of systems of electrified conductors, by E. Beltrami.—On the pseudofocus of the paraboloid and on the magnetic centre, by G. Jung.—Contribution to the experimental study of hypnotism in hysterics, by A. Tanburini and G. Seppilli.

Fasc. xvi.—New microtelephonic system, by C. Fornioni.—The crystalline group of Albigna and Disgrazia; stratigraphical and chemico-lithological studies, by E. Bonardi.—On syphilitic reinfection, by A. Scarenzio.—Luni-solar influence on earthqrakes, by A. Serpieri.—Contribution to the general physiology of smooth muscles, by E. Sertoli.—The plague of Milan in 1576 and Cardinal Borromeo, by A. Corradi.

Atti della l'Accademia dei Lincei; Transunti. Fasc. xiv.—On the circulation of blood in the human brain, by S. Mosso.—On the microscopical fauna of the Zanclean limestone of Palo, by S. Terrigi.—Internal equilibrium of metallic piles according to the laws of elastic deformations, by S. Allievi.—On the graduation of galvanometers, by Signor Canestrelli.—On the influence of hygroscopic condensation on glass in determination of the density of aqueous vapour, by Signors Macaluso and Grimaldi.—The action of oxygenated water on the system, by Signors Capranico and Colasanti.—On two isomeric acids, santonosic and isantonosic, by Signor Cannizzaro.—On some products of transformation of glutaric or normal pyrotartaric acid, by Signor Bernheimer.—Action of nascent hydrogen on pyrrol, by Signors Ciamician and Dennstedt.—On some derivatives of hexahydronaphthaline, by Signor Agrestini.—On two volumes of autograph drawings of the two brothers Cherubino and Giovanni Alberti, by Signor Cannizaro.—New Carthagenic inscription to Fanith and Baal-Hammon.—Ephemerides and hydrometric statistics of the River Tiber during 1881, by Signor Betocchi.—On the anatomy of leaves (continued), by Signor Briosi.—On the first phenomena of development of *salpa*, by Signor Todaro.—Statistics of the popular banks existing in Italy in the end of 1880, by Signor Bodio.—First outlines of a statistic of the conditions of life of operatives, by the same.—The diminution of illiterates in Italy, by the some.—On the Comet Wells, by Signor Respighi.—On the total eclipse of May 7, 1882, by the same.

SOCIETIES AND ACADEMIES

Sydney

Linnean Society of New South Wales, June 28.—Dr. James C. Cox, president, in the chair.—The following papers were read:—Half century of plants new to South Queensland, by the Rev. B. Scortechini. This paper was to some extent a continuation of a previous paper by the same author, and contained the results of further researches on the flora of that part of the country. Among the plants enumerated were many hitherto regarded as strictly tropical, while others had not previously been observed in such warm latitudes.—Contribution to a knowledge of the fishes of New Guinea, by the Hon. William Macleay, F.L.S., &c. This paper gives a list of 120 species of Percoid Fishes collected by Mr. Andrew Goldie at Port Moresby and Cuppa-Cuppa, in New Guinea. They are, with few exceptions, species which have been described by Dr. Bleeker as being found on the northern shores of that island and throughout the Netherlands India Archipelago generally. The new species described are *Serranus Goldiei*, *Serranus magnificus*, *Genyoroge bidens*, *Mesoprion rubens*, *M. parvidens*, *M. Goldiei*, *Diagramma Papuense*, *Lethrinus aurolineatus*. The remainder of Mr. Goldie's collection is to form the subject of a future paper.—A monograph of the Australian Aphroditacean annelids, by Mr. W. A. Haswell.—Two papers were read by Mr. E. P. Ramsay, F.L.S., Curator of the Australian Museum, one containing a description of a new species of *Phlogœnas* (*P. Salamonis*) and of a new species of *Dicrurus* (proposed to be called *D. longirostris*) from the Solomon Islands; the other containing a description of a new species of *Coris* from Lord Howes' Island.—Prof. W. J. Stephens exhibited a few specimens of a lost *Euca-*