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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.


## THE NEW STAR IN PERSEUS.

A sensation has been produced in the realm of stellar science by the recent discovery of a temporary star whose brightness exceeds that of any other object of that class which has been observed in the last three centuries. On February 21 Dr. T. D. Anderson, of Edinburgh, a well-known amateur astronomer, detected this celestial phenomenon in Perseus, a little south of Alpha and east of Beta in that constellation. Although the accounts regarding it are not altogether accordant, it would seem that at its maximum it exceeded Capella in brilliancy, and almost rivaled Sirius. And this culmination appears to have been reached on Sunday morning, February 24. Since that time the star has perceptibly diminished in splendor. During the early part of last week it was of about the first magnitude, and distinctly inferior to Capella, but brighter than its most conspicuous neighbors in Perseus, which are second magnitude stars. A little later even a novice could see that it had faded still farther. Upon receipt of news of the discovery the Harvard photographs of that region of the heavens made for a month previous were examined. The plate for February 19 showed the new star, but with a magnitude of less than 10.5. It also appeared on the plates of February 2, 6, 8, and 18.

It is necessary to go back to the famous outburst observed by Tycho Brahe in 1572 to find with certainty one which surpassed this in brightness. Tycho's star appeared in Cassiopeia, and is said to have equaled Venus at her best. Kepler saw another in 1604, but it is impossible to say whether it beat the new star in Perseus or not. Scarcely more than a dozen temporary stars have been reported since that time, and not one has matched the latest. Indeed, some of them have been invisible to the naked eye, or else, while bright enough to be seen without instruments, were detected only by the camera. The last discovery of a naked-eye temporary star occurred in January, 1892, and was made by the same Dr. Anderson who found "Nova Persei." It was in Auriga, only a short distance from the recent luminous outbreak, and not far from Cassiopeia, the site of Tycho's star. Pickering has called attention to the fact that nearly all of the fifteen stars which he enumerated appeared either in or near the Milky Way, a coincidence that he thought was not without significance.

Astronomers designate celestial developments of this kind "new stars;" but the phrase is misleading. Those who are versed in such matters do not imagine that these sudden appearances represent fresh creations, but suppose that something invisible before has become visible. But even so, the phenomenon presents a mystery of tremendous interest, both scientific and popular, and there has been much speculation as to its cause.

It has been suggested, for instance, that chemical combinations might occur in the atmosphere of an orb which had cooled down from incandescence to a barely luminous condition, and that these combinations would evolve enough heat to produce a vivid light for a short time. Zöllner conceived that a star with a thin crust over its molten mass might meet with an accident that would rupture the covering, and liberate an immense quantity of glowing material. Lockyer's notion has been that two vast swarms of meteoritic particles, flying in different directions, meet in space, and are made to glow by friction. Others have believed that two suns or stars, once hot and brilliant but since grown cold and dark, come into collision. Should such a thing happen the energy of motion would be converted into thermal energy, and the two bodies might be set on fire.

A theory somewhat akin to these last two was proposed by Wilsing a few years ago. Klinkerfues had previously tried to account for the flash of a certain class of variable stars on the hypothesis that the rotation of a satellite around its primary raised an immense tidal wave of obscuring atmosphere, sweeping it to one side and more fully revealing the partially hidden luminous surface below. Wilsing fitted this theory to temporary stars by supposing that some huge wanderer in space, like a dark sun, passed near enough to another body to produce similar effects, but on a larger scale. Seeliger has shown that tidal action could hardly last more than a few hours, but Scheiner remarks that it might serve as a trigger to liberate forces that would not exhaust themselves for a long time. The Klinkerfues-Wilsing theory commended itself more strongly than any of the others just mentioned to Sir William Huggins, the eminent English astronomer, although it has not been generally accepted.

A hypothesis advanced by Seeliger soon after the appearance of Nova Aurigæ has met with more favor, as it can be better reconciled with observed phenomena. According to this authority, only one solid body is concerned in the business, and this encounters a nebula. Now a nebula is supposed to be an exceedingly attenuated collection of matter, either gaseous or dust-like. Yet when one reflects on the almost inconceivable velocities at which the cloud and dark orb come together he can understand that a good deal of heat must be developed. The friction might be of short duration, and the effect on the invading body would not extend to any great depth, yet for the time being the result might be eminently pyrotechnic. The surface of the dead star would become incandescent, and possibly some of its material be vaporized. At the same time parts of the nebula would also be heated and caused to glow. Thus there would be two sources of light, though the latter would be temporary. There are strong reasons for suspecting that the recent outburst in Perseus represents an occurrence of this sort, and that the star and nebula will disappear from view after a few weeks or months.

The evidence on which this supposition is based is supplied by the spectroscope. That instrument showed conclusively that in Nova Aurigæ at least two objects were concerned, because there were two different spectra, one superposed on the other. There was the characteristic spectrum of a nebula, and the spectrum of an incandescent solid over which some incandescent metallic vapors floated. The same state of things was also indicated, but less distinctly, in the case of the temporary stars in the Northern Crown (1866) and the Swan (1876). And already the same combination has been imperfectly revealed in the observations of Nova Persei. Incidentally, it may be remarked that the nebular spectrum of the star in Nova Aurigæ lasted much longer than the stellar spectrum, and that when last observed with a telescope it presented the appearance of a ball-like nebula.

The spectroscope betrays motion as well as composition. And Campbell estimated that the two objects involved in the production of Nova Aurigæ moved toward each other at the rate of 550 miles a second! Lockyer is said to have put the combined motion in the new star in Perseus at 700 miles a second. Possibly this is an over-estimate, because Campbell reports that relatively to the solar system the star seems to be nearly stationary.

As yet the distance of Nova Persei from us cannot be guessed. It may be fifty light years away, and it may be a thousand. It has been in existence too short a time for any parallax work to be done with it. But the chief matter of interest is the nature of the event which the object reveals, and not the precise location of the scene.

## AN IMPORTANT TELEPHONE PATENT DECISION.

The United States Circuit Court for the District of Massachusetts has just handed down a decision in the suits of the American Bell Telephone Company against the National Telephone Manufacturing Company, and the American Bell Telephone Company against the Century Telephone Company, for infringement of the famous Berliner patent, No. 463,569, dated November 17, 1891, for microphone attachment for telephones.

A few remarks concerning this patent, and its history and litigation, may be of interest at this time.

As is well known, the transmission of speech by telephony requires two instruments, the first, the transmitter, into which the speaker talks, and the second, the receiver, at which the hearer listens. Mr. Bell's patent of 1876 described an instrument which could be used interchangeably for either of these purposes. In 1878 Mr. Edison and Mr. Blake produced transmitters, both unlike Mr. Bell's, and differing from each other in detail, but operating on the same general principle. They both belonged to the class of transmitters called microphones, the distinguishing feature of which is that the undulations of the electrical current by means of which the sonorous vibrations of the air in the transmitter are caused to be reproduced in the receiver, are caused by variations of pressure between two electrodes remaining constantly in contact, which variations of pressure are caused by the vibrations of the diaphragm of the transmitter.

The Bell company acquired title to both these patents, and enjoyed the exclusive right to the use of said inventions during the life of the respective patents.

About the time that the patent on the Blake transmitter was expiring, the public were astonished to learn that a patent had just been issued to the Bell company, covering in the broadest possible terms the identical microphone transmitter for which the telephone subscribers had been paying rentals in the past, and under which new patent the Bell company would be entitled to exact a continuance of the same rentals for the same instrument for seventeen years longer.

An examination of the files in the Patent Office, then for the first time accessible to the public, showed that the application for this new patent had been filed by Emile Berliner, June 4, 1877, and had become the property of the Bell company in 1878, and had been controlled by that company to the time of its issue.

The extraordinary delay in the issue of the patent (the application being all the time under the control of the Bell company), coupled with the manifest interest of that company to prolong its monopoly by means of that delay, prompted the United States, in 1893, to bring suit against the Bell company and Berliner to set aside and cancel the said Berliner patent. On January 3, 1895, the United States Circuit Court entered a decree setting aside and canceling said patent. On appeal to the United States Circuit Court of Appeals for the First Circuit, that court, on May 18, 1895, reversed the decree below, and directed a dismissal of the bill of complaint. Thereupon, the United States took an appeal to the United States Supreme Court, and on May 10, 1897, that court rendered a decision affirming the decision of the United States Circuit Court of Appeals.

The suits just decided by the Circuit Court were brought to enjoin the defendants from making, using, or selling telephones embracing or containing a microphone attachment substantially as claimed in the said Berliner patent. The court, on the 27th inst., dismissed the bill of complaint, holding the Berliner patent to be void, and anticipated by the Edison and Bell inventions.

The Bell company will undoubtedly take an appeal, and the public will await with interest the ultimate decision which will confirm or destroy the Bell company's monopoly.

## THE SLABY SYSTEM OF WIRELESS DUPLEX TELEGRAPHY.

From an ill-understood curiosity wireless telegraphy seems at last to have become an important and valuable branch of electrical science. Much of the credit for this evolution is due to Prof. Slaby, of Charlottenburg, and to his indefatigable collaborator, Count Arco, both of whom have systematically investigated the phenomena of the Hertzian waves and formulated laws by which these phenomena can be explained. As a result of their labors, the uncertainty and whimsicality of wireless telegraphy have disappeared. Much that was formerly considered indispensable in the ethereal transmission of electrical waves has been proven unnecessary, and even disadvantageous.

The balloon at the upper end of the transmitting wire, supposed to serve the purpose of increasing the capacity; the peculiar plates at the receiving station, formed like butterfly-wings, and likewise designed to increase the capacity; the careful insulation of the receiving wire from the earth; and other details of the old system have been rudely thrown aside. Nothing more is heard of the law that the distance to which messages can be transmitted is proportional to the square of the length of the transmitting and receiving wires. That there is a definite relation between distance and length of wire or height of mast may well be assumed; but that relation, whatever it may be, plays no very important part in Slaby's system, since the tension to which the coherer is subjected is augmented by means different from those hitherto known.

The waves sent forth by a transmitter loop are augmented by a condenser. An induction coil is connected with the upper end of the loop, and is so wound that it permits the passage of low-frequency currents, but checks the high frequency currents generated by the discharge of the condenser. At the moment of discharge the loop acts as a single vertical wire. By varying the nature of the induction-coil and the condenser, waves of any length can be sent forth. At a lecture delivered before the German Emperor, waves varying in length from 140 to 600 meters were utilized.

In direct opposition to Marconi, Slaby grounds his receiving-wire. An ordinary lightning rod is used instead of a mast. If the length of the receiving wire be exactly one-fourth the wave length, a node is formed at the connecting-point with the earth, and the maximum amplitude of the alternating tension appears at the upper end. Evidently the coherer should be attached to the point of greatest amplitude; but such an arrangement is impossible in practice. The difficulty is very simply and ingeniously overcome by connecting with the receiving-wire at the earth-node

a horizontal auxiliary wire of equal length. At the free end of this horizontal wire the wave-amplitude is equal to that of the upper end of the main wire. To the free end of this auxiliary wire the coherer is attached. The auxiliary wire need not be extended in a straight line; it can be wound to form a coil.

If the main receiving-wire, which is usually a lightning-rod, and which cannot, therefore, be readily lengthened and shortened, be subjected to the action of electrical waves of greater length than the wire can receive, it is necessary merely to lengthen the auxiliary wire in order to receive the message. In this manner a nodal point can be formed in the auxiliary wire, so that the receiving-wire may be subjected to electrical impulses by which it would not otherwise be influenced. The auxiliary wire in Slaby's system is of the utmost importance; for by its use the receiving apparatus will be affected only by certain waves. Thus Prof. Slaby has succeeded in overcoming one of the most glaring deficiencies in wireless telegraphy—the impossibility of secretly transmitting a message to one station alone.

In order to increase the effect of the waves, a peculiarly wound induction coil is placed in the circuit between the coherer and the auxiliary wire. The coil Prof. Slaby terms a "multiplier." By means of this instrument a trustworthiness and certainty of operation have been attained which are as gratifying as they have been conspicuously lacking in previous methods of ethereal telegraphy.

Not the least interesting feature of Prof. Slaby's invention is the possibility of receiving two messages simultaneously at a single station—an end which has been attained largely by means of the auxiliary wire of variable length already mentioned.

## A TRIUMPH OF INGENUITY AND A PATENT WITH A HISTORY.

When we consider the inventions of the latter end of the Nineteenth Century we are sometimes impressed by the enormous amount of inventive skill which is required to put all the parts of a complicated mechanism into that juxtaposition which enables them to perform properly their delicate offices in harmony. Many inventive minds capable of conceiving great ideas in their generalities are lacking in that knowledge of mechanical minutiæ which alone would qualify them for putting their ideas into practice. When a person combines these two qualities the full triumph of inventive genius may then be attained. One of the most remarkable examples of the union of large ideas and broad principles underlying a complicated train of mechanical operations, together with a most elaborate working out of movements and details, is exhibited by the Paige typesetting machine, invented by James William Paige, of Hartford, Conn., now of Chicago. The machine, which sets, justifies and distributes foundry types with wonderful speed and precision, is probably the most complicated piece of mechanism ever devised, and it is gratifying to know that the present owners of the patent have presented it to Cornell University, where it will, for all time, remain as a monument to the painstaking care of an inventor who spent seventeen years of his life perfecting it. The machine as it stands has 18,000 active elements, including 800 journal bearings. While the work produced was of the first grade and the machine was successfully operated by The Chicago Herald, the cost and complexity rendered it impossible for use on a commercial basis, machines costing one-seventh or one-eighth as much performing work which was entirely satisfactory and without any of the risks of a breakdown which would be always present in a machine having 18,000 parts. The machine is described in detail elsewhere. It will be interesting to trace the history of an invention and a patent which for size and complexity is the most celebrated upon record.

There are three patents which were issued simultaneously on October 15, 1895. The first patent had 31 sheets of drawings, 28 pages of specification, and 130 claims; the second patent had 163 sheets of drawings, 46 pages of specification, and 146 claims; the third patent, of which Mr. Charles R. North, of Chicago, was joint inventor with Mr. Paige, had 81 sheets of drawings, 49 sheets of specification, and 172 claims, and referred particularly to the justification of the type. This made a grand total for the three patents of 275 sheets of drawings, 123 sheets of specification, and 613 claims. The largest patent, No. 547,860, is really a volume in itself, and the drawings are very handsome and include in the 163 sheets 471 figures and 1,075 figures of reference.

The application was filed August 19, 1887, with the customary government fee of $15. The file was signed for allowance by James Q. Rice, examiner, on March 22, 1895. The notice of allowance was dated March 26, 1895, and the final fee of $20 was paid September 23, 1895, and the patent issued in due course on October 15. The first official letter was dated on March 15, 1888, or about seven months after the case was filed. The second official letter was more than two years later, on May 5, 1890; other official letters were dated April 14, 1891, and July 18, 1894. The long waits between the official letters show the enormous amount of work which had to be done by both the attorneys and the Patent Office before the various actions were taken. Mr. Giles S. Rafter did practically all the work of examination of the application in the Patent Office, and we are indebted to him for much of our information. The patent attorney and the draughtsman went to Hartford, where Mr. Paige was then living, and where he had his machine, and prepared the application. It is said that the attorney's fee was $10,000 for the patent to which we refer, and the draughtsman received $2,000 for his services. The application as presented included 204 sheets of drawings, but during the course of the application through the Patent Office the number of sheets were cut down by eliminating all the illustrations that were deemed unnecessary. This was done with a view to save as far as possible the expense of issuing the patent. Mr. Paige changed attorneys and the whole case was rewritten. Subsequently Mr. Paige removed to Chicago and established a factory for manufacturing the machines. His new attorney in turn rewrote the case, and the patent as issued is the result of his labors. There is something tragical about this case, for one of the examiners who worked upon it and who signed the first official letter in 1888 died in 1890 or 1891, and the patent attorney who originally prepared the papers died insane, and Mr. Charles H. Richardson, who was acting examiner, and who signed the third official letter, also died insane, but as he had little to do with handling the case it is not thought that the application was responsible for his misfortune.

When the Patent Office considered the application for the large patent, it was suggested on behalf of Mr. Paige that the assistant examiner go to Chicago and examine the application in connection with the machine. The Paige people were notified that they would either have to bring the machine to Washington or pay the examiner's expenses to go to Chicago to examine the machine, and as it would have cost from $6,000 to $7,000 to bring the machine to Washington they naturally preferred to pay the assistant examiner's expenses. The then Commissioner of Patents, Seymour, peremptorily refused under a rule to permit the examiner to go, but the examiner suggested that this was an extraordinary case and asked permission of the Commissioner to bring the case to his room for inspection. This was done, and the papers and drawings were about all that the man could carry, and the Commissioner consented to send Mr. Rafter to Chicago. The latter spent five or six weeks in Chicago, being engaged part of the time in the attorney's office and part of the time in the factory examining the machine. The machine as originally built was 18 or 20 inches too long, and while Mr. Rafter was in Chicago Mr. Paige had a large corps of draughtsmen with a chief draughtsman at $10,000 per annum, and four assistant draughtsmen engaged in reorganizing the machine to reduce its length, as desired. They had a large vault in which the working drawings were kept, and it is estimated that it contained about 10,000 sheets, 3 by 3 feet, of working drawings of the machine in hand. At that time they had in the factory one complete machine, and one machine in course of construction. The former was kept behind a dozen locked doors. Mr. North, the joint inventor, was a skilled mechanic, and was one of Mr. Paige's workmen who had been helping him in developing the justifying apparatus. The government was naturally put to very heavy expense besides the actual expenses of examining the case. It is estimated that it consumed about $1,000 of time of the various Patent Office officials before maturing into a patent, and when issued the usual rule had to be followed of providing copies for sale at the regular price. As the text was about $2.60 a page and 93 cents a page to reproduce the drawings, this, combined with the cost of paper and printing, made the cost of the first edition over $6 a copy. The larger patent is as big as a good-sized book, and the three together make an imposing volume.

## A NEW PERMANENT PHONOGRAPH RECORD.

When the phonograph first made its appearance, in 1878, it took a remarkably strong hold on the imagination both of scientific men and of the general public. It was prophesied at the time that public speeches would be dictated and reproduced before audiences in any part of the country; letters would be spoken instead of written, and reuttered in the accents of the sender's own voice; and, greatest of all perhaps, the voices of great singers and noted men would be preserved for the instruction and delight of future generations.

Up to the present time, the instrument has been put to these uses to a very limited extent, to the last one scarcely at all. The wax records ordinarily used are not adapted to the purpose, because they are not sufficiently durable. They are frail and easily defaced, and gradually wear out after being used a few times. There are now, however, two or three satisfactory ways in which phonographic records can be preserved indefinitely, the most interesting of which, perhaps, is described in a recent patent of Mr. Edison's. From an ordinary wax record he produces a very perfect duplicate made of silver with a thin plating of gold. There seems to be no reason why such records will not last for centuries, and a collection of them, preserved perhaps by our museums and learned institutions, should be of the highest value to the future student of history, language and music, more especially as it is possible, by processes already well known, to obtain from them at any time an almost indefinite number of excellent copies.

The reproduction of the voice given by the phonograph is still somewhat disappointing, and leaves much to be desired as a means of studying language; but there can be no doubt that if we had a collection of records made, say, in the age of Elizabeth, and as perfect as those now produced, we would learn much of the speech of the sixteenth century.

Mr. Edison's process is simple but interesting. He takes a copper electroplate of a wax record. This copper relief obtained is then electroplated with silver, the surface of which, next the copper, of course has precisely the form of the original wax surface. The copper matrix is then dissolved away with acid.

In the electroplating process the wax record is revolved under a bell-jar, in a Crookes vacuum, through which an electric discharge is passing between electrodes of gold. This causes a discharge of a vapor or infinitesimal particles of gold, which attach themselves to whatever they strike, forming a continuous coating of excessive thinness, and following the outline of the surface with absolute fidelity. Upon this coating the copper matrix is plated, to form the inside surface upon which the silver is deposited when the wax is removed.

The gold, like the silver, being unaffected by the acid used, remains as a plating on the silver record when the copper matrix is dissolved away. The amount of gold used is scarcely appreciable, and the silver may, of course, be a thin shell, backed up by other material, so that the records are not as expensive as might be supposed from the materials employed.

## THE POLLOK MEMORIAL PRIZE.

From time to time we have called the attention of inventors to a prize of 100,000 francs ($20,000), to be known as the Anthony Pollok Prize, offered by the heirs of the late Anthony Pollok, of Washington, who lost his life in the fatal collision of the steamship "La Bourgogne" with the "Cromartyshire," off Sable Island, nearly three years ago. The prize, it will be remembered, is to be awarded to the inventor of the best device for fulfilling one or all of these conditions, to wit: To prevent collision at sea, to save the ship in case of collision, to save the passengers and crew collectively in case the ship is abandoned.

Previous experience has shown that many devices and apparatus offered could not be practically relied on in case of accident, owing to the limited number of the crews of merchant vessels. It has therefore been decided to exclude devices designed to save individuals separately, such as life belts, waistcoats, buoys, etc.; such apparatus which encumber the decks so as seriously to interfere with the carrying capacity both as to passengers and freight, or such as could not be readily adapted and used on ships now in general service; all improvements or modifications of inventions already recognized as insufficient for the purpose of saving the passengers and crew collectively, such as lifeboat davits, oil-throwing devices, etc.; rafts of all kinds which must be mounted, assembled or inflated at the time of the accident; and hatch covers, deck houses, etc., which are designed to float automatically when the ship sinks.

The devices and inventions may be presented in full size ready for trials, or models and drawings showing all details may be submitted.

The competition will be opened at Havre on September 9, 1901.

The jury, whose names will be published later, will consist of men whose competency is unquestionable and will have power to prescribe tests and trials. All possible facilities will be offered to the inventor; but all expense must be borne by him. The exposition of devices entered in the competition will be held at Havre under the auspices of the Chamber of Commerce of that city. No charge will be made for space, or for the care of the exhibits. If the exhibit be marked "Prix Anthony Pollok" no duty will be exacted by the French customs officials.

The devices must be delivered free of charge at Havre between August 1 and September 1, 1901, and addressed "Concours Prix Anthony Pollok. Capitaine S. Dechaille, Directeur du Service des Signaux et du Sauvetage de la Chambre de Commerce, Havre, France."