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."