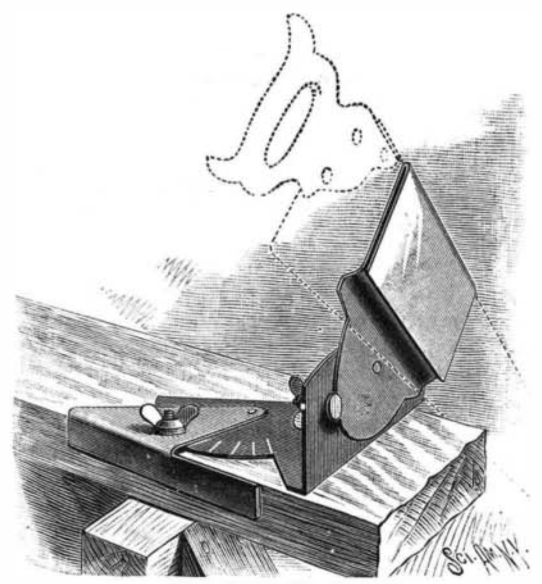
AN IMPROVED SAW GAUGE.

A saw gauge which can be readily applied to a block or board, and held firmly in place thereon to accurately guide the saw in the desired direction, is illustrated herewith, and has been patented by Mr. Edward S. Nixon, of Chattanooga, Tenn. In a flanged base plate, adapted to rest against the side or edge of any article



NIXON'S SAW GAUGE.

to be sawed, is mounted a set screw, against which rides the semicircular edge of a scale-marked and pivoted guide-holding plate, which can be fixed at any angle by the set screw. To the upright portion of the guide-holding plate is pivoted a saw guide, also held by a set screw at the desired inclination, and so that it can be lowered as the cut progresses, while the saw will be continually embraced by the parallel sides of the guide, and thus saw accurately in a plane at right angles to the edges of the board or block. In making light gauges it would not be necessary to make the tilting joint for the upright part of the guide, which could be made integral with the other portion of the guide. The saw used is a common hand or panel saw, and the device is well adapted for cutting miters and octagon or other shapes. The metal of which this gauge is made is light, and the construction so simple that it can be readily constructed by any good tinner.

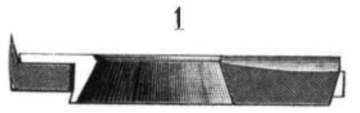
Color Blindness a Brain Affection.

Professor Ramsay believes that the particular defect giving rise to color blindness lies, not in the eye itself, but in the brain. Certain persons, he points out, are incapable of judging which of two musical tones is the higher, even when they are more than an octave apart. Yet, as such persons hear either tone perfectly, the defect is not one of deafness. He accordingly argues that in such persons the brain is at fault, and thence proceeds to the assumption that it may be equally true that the inability to perceive certain colors is not due to a defect in the instrument of sight by the eye, but to the power of interpreting the impressions conveyed to the brain by the optic nerve. If this is the case, the problem is no longer a physical one. It falls among those with which the mental physiologist has to deal.—*The Medical Press.*

AN IMPROVED HORSESHOE PAD.

Making the pad of a horseshoe with a beveled flange projecting down inside the shoe to prevent balling, and with a division or joint at its front end, whereby the pad may be expanded to suit the size of the hoof, is a patented invention of Mr. William A. Taylor, of Washington, D. C., and is illustrated herewith, Fig. 1 showing a horizontal section from front to rear of the shoe. The pad is moulded of soft rubber, the exterior of the shoe fitting around the downwardly projecting flange, which extends about a quarter of an inch below the shoe. The flange serves to hold the pad in place while the shoe is being nailed through the body of the pad, and by pressing against the ground tends to prevent slipping. The rear portion of the pad is made continuous, affording a solid bearing surface, while the flaring central opening allows snow to be easily knocked out, thus preventing balling, and the division in the middle at the front allows the pad to be easily expanded to the required dimensions.

1



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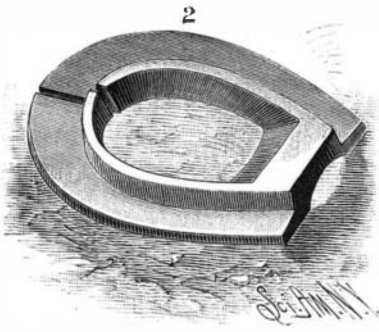


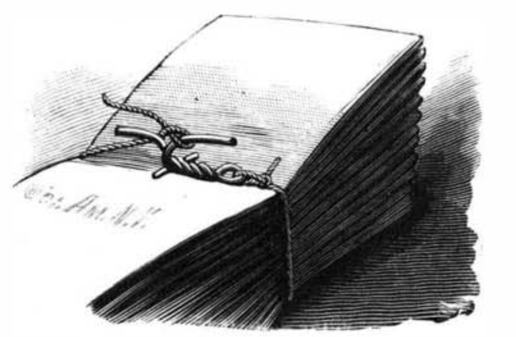
TAYLOR'S HORSESHOE PAD.

Cheap Stationery.

It is a mistake to suppose that cheap stationery is a matter of economy, says the Appleton, Wis., *Post.* It should be borne in mind by every business man that his letter paper is his representative to many people who have never seen him, and who are likely to form their judgment of him, to a large extent, by the qualities of his proxy. A man who uses poverty-stricken stationery stands in a bad light to those he addresses himself to. For the sake of economizing a few cents he gratuitously prejudices himself in the opinion of many people who may be of importance to him; for good stationery is like a good suit of clothes, and so long as men continue to judge from appearances, they will find both of value to them.

AN IMPROVED CLEAT.

A device designed to afford a quick and secure tie, using one end of an attached string or tape only, is shown in the accompanying illustration, and has been patented by Mr. Charles P. Hawley, of No. 510 West 153d Street, New York City. It is preferably made of one piece of wire, bent to form a loop or eye, to which the tape or string is fastened, and then bent up and twisted to form a shank, with outwardly extending diverging arms integral with the shank, a guide bar being attached across the body at the bottom near the neck. The cleat may also be made of any size, and of one, two, or more pieces.



HAWLEY'S PORTABLE CLEAT.

A COMBINATION TOILET IMPLEMENT.

A combination of a pair of scissors and nail file, wherein each is perfect in itself, making an article which can be conveniently carried in the vest pocket, is illustrated herewith, and has been patented by Mr. Charles P. Hawley, of No. 510 West 153d Street, New York City. A right-angular lug is provided on the rear of the eye of the scissors adapted to receive the thumb, forming a shoulder to which the file is hinged. The file is split horizontally to about its center, to form two portions, one portion being bent upon itself to form an eye by which the file is hinged to the shoulder, and the other portion acting as a spring against the shoulder to hold the file closed or partially or wholly opened.

HAWLEY'S COMBINED SCISSORS AND FILE.

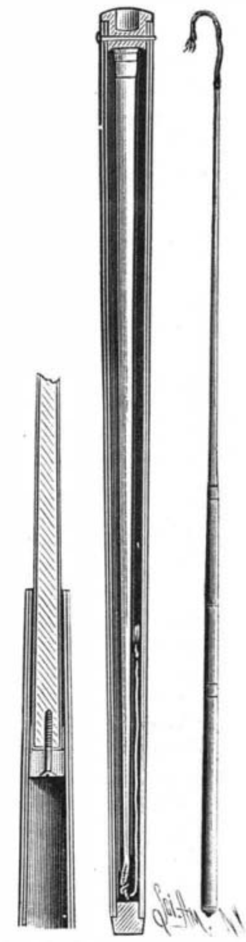
Both implements being commonly employed in dressing the nails, they are, when thus combined, at once in immediate hand for use.

THE *Railroad Gazette*, referring to the numerous patents on car couplers, and the difficulty experienced by the railroad officials in determining the lines of the future standard Janney type coupler, quotes the sayings of a facetious master mechanic. He suggests that car coupler inventors should turn their attention to an automatic locomotive engineer—one who would never look on the cup when it is red, never lose time, never have leaky flues or a hot box, and never misread orders, have a collision, or stick in a snow bank. He says he feels sure such an invention would attract the attention of our great railroad monopolists and fulfill a long felt want, especially if it could be warranted to run 200 miles after a nickel had been inserted in the slot.

"CHEESERINE" is the latest fraud in England. It has a suggestion of cheese, as American oleomargarine suggests butter.

A COMBINED WHIP AND CANE.

A construction designed to give greater strength, simplicity, and convenience than is usually obtained in a combined whip and cane is illustrated herewith, and has been patented by Mr. Owen Godward, of Salem, Ohio. The handle is a tapering, tubular body, preferably of iron, covered by suitable wrapping, such as ordinarily used on whip stocks. When used as a cane, the handle completely incloses a tapering whip section, of whalebone or other flexible material, covered with a suitable wrapping, the whip section being adapted to be drawn outward until its inner larger end binds snugly in the smaller open end of the handle, the whip section being held firmly in place by a screw passing through a frictional block which adheres closely to the metallic tubular body. The larger end of the handle is closed by a detachable plug, the outer end of which has a socket to receive the neck of a rubber or other suitable block when the article is used as a whip, the neck of the block also fitting the smaller open end of the handle to serve as a ferrule when the article is used as a cane.



GODWARD'S WHIP AND CANE.

Leather Board for Shoes.

The use of leather board in shoe manufacture is one of the shoddy features of the business. One kind is used for tapping and for veneering taps. The material is made to look like leather and to cut like leather. A thin split of true leather makes a veneer that satisfies the demands of the buffing machine.

The best board is made of such board stock as jute, manila, and the like, and this is used for counters, or boot and shoe heel stiffenings and for box toes. When properly treated and manufactured, these counters do good service. When leather board is backed with a leather split and moulded into a stiffening, the product is a union counter. Even chair seats are made from this board. It is worth five to twelve cents a pound.

A cheap leather board, worth three cents a pound, is used for inner soles, shanking, filling, and so on. Steel shanks are also covered with this, and inner soles, backed with cotton duck, are made of it. This is used, not to cheapen the cost of making the shoe, it is said, but to save the time of gathering and arranging leather scraps.—*Paper World.*

IMPROVED TONGS FOR HANDLING NAILS.

A hand implement or tool for handling nails in quantity is shown in the accompanying illustration, and has been patented by Mr. Andrew Wood, of Washington, Ky. The crossing levers or handle portions of the tongs are extended to form jaws composed of a number of internally notched or serrated tines, the levers being pivoted to each other in close proximity to the bent tine portions. By this means an easy lift and secure hold of the nails in large quantity is obtained, the leverage being proportional to the length of the handles, on which both hands may be used, while the notched or toothed construction of the tines prevents the slipping or dropping of the nails.

WOOD'S NAIL TONGS.

The Fathers of the Steam Navy.

The claim of Mr. Wm. Elliott Griffes, in the biography of the late Matthew C. Perry, that the commodore was "the father of the steam navy," has excited some comment among the older officers of the navy, and among old engineers in general. The biographer, perhaps with the best intentions, imparts the idea that Commodore Perry really designed the machinery of the Missouri and the Mississippi—a claim as unjust as it is unwarranted. These were the first great steamers the country ever had, but their success in management does not belong to Perry. They were sister ships. The former had inclined engines, according to the patent of the principal engineer of the navy (Mr. C. W. Copeland), and the latter had side lever engines. Both engines were designed by Mr. Copeland.

Robert Fulton, in 1814, built for the navy the first war steamer ever owned by any government. She was called the Demologos, but was afterward called Fulton the First. Fulton was appointed engineer, by the Navy Department, for this purpose, and was therefore the first person who ever held that title in the navy. She was originally intended to throw hot water as well as shot. She blew up while receiving ship at Brooklyn, in 1829, killing Lieutenant Breckenridge and 47 others, and wounding as many more.

Lieutenant W. W. Hunter, who invented the Hunter submerged propeller, has also been called the "father of the steam navy." His propeller was used in the Union, Alleghany, Water Witch, and in the revenue cutter Spencer, none of which was successful. The machinery of these vessels was designed by Mr. William Ellis, engineer, at the Washington Navy Yard. The Alleghany was rebuilt as a screw steamer, and the Water Witch as a paddle wheel steamer.

Commodore Perry was a vigorous advocate of the paddle wheel; Lieutenant Hunter urged the Hunter submerged propeller (like a paddle wheel mounted on a vertical axis, working partly in and partly out of the sides of the vessel), while Commodore Robert F. Stockton earnestly urged the advantages of the screw propeller. Stockton first induced Ericsson to come to this country. They met with but little favor at the hands of the old Board of Navy Commissioners, and finally Stockton built the Princeton at his own expense, the machinery from the designs of Ericsson, and the hull by Lenthall. She was an eminent success.

Commodore Perry would serve in none but the paddle steamships, and disapproved of the Princeton *in toto*. Indeed, he once made a written report that paddle wheel steamers of the Collins line, with parts of machinery and boilers above water, "could have guns mounted on them, and would be first-class war ships." Perry had a great appreciation of the engineers. He "always had his ship chock full of them, generally nine to ten assistants; and when he went to Japan, about a dozen. Four would have been enough," said an old engineer in the navy. Commodore Perry would not allow any orders to be given to the engineer department of the ship except by himself. "Even when he was commodore, on board his flagship, he would himself give the orders concerning the machinery to the chief engineer." The chief engineer communicated directly with him. The commodore kept the firemen and coal heavers distinct from the ship's company. He called on the engineers for all sorts of things. Some were making drawings for him, some were employed on his reports, others collected information for him. When he visited shore in a foreign port, he sometimes took the chief and half a dozen assistant engineers with him, who examined things and made notes for him. His good treatment of his engineers was not precisely of the kind to excite their affection for him, for he seemed to think he owned them, as he did his steward and his secretary. In this spirit, he would not allow any one else to give them an order. His favorite ship was the Mississippi, perhaps because she was the largest after the destruction of the Missouri. Returning to the machinery of these two ships, it was probably the finest of its day. An able engineer recently said if it was to-day desired to build a paddle wheel engine of like power, with jet condensers and the same pressure they used, it was doubtful if a single detail could be changed with any advantage whatever.

Mr. Copeland, while principal engineer of the navy, also planned the engines of the Saranac, Michigan, Susquehanna, the second engine of the San Jacinto, and the engines of the Niagara after he left the navy. The Saranac and San Jacinto were alike in hull, and were built to test the relative merits of the paddle wheel and the screw propeller. The San Jacinto's engine was designed by the engineer-in-chief, Mr. Haswell, and that of the Saranac, as we said above, by Mr. Copeland. With hulls and boilers alike, the test of type of propellers and engines was considered fair. Owing to a defect in the design the San Jacinto was greatly inferior as a steamship to the Saranac, though her machinery was quite under the water, while that of the latter named ship was quite exposed. The original engine was then removed from the San Jacinto and a new one, built by Merrick & Towne, of Philadelphia, from the specifications and designs of Mr. Copeland, was substituted. The San Jacinto then became quite the peer of the Saranac as a steamship, with the great advantage of having her machinery masked by the water. It appears then that the spirit of steam was first infused into the navy by Fulton; that though great credit is due the dead Perry, Stockton, and Hunter, yet history should write the names of the living Ericsson and the living Copeland in letters of gold among the fathers of the steam navy.—*Army and Navy Journal.*

Volapuk.

For some years past, and much more frequently of late, there have been references in English and Continental journals to the Volapuk, world's speech, or universal language, and it would seem as if in some quarters there is a growing inclination to take its pretensions seriously. A small volume recently published by Messrs. Whittaker & Co., containing the grammar and vocabularies of this invention in an English form, enables us to acquire some idea of the design and its merits. The originator is Mr. Johann Martin Schleyer, of Litzelstetten, Baden, Germany, and his work, which was first introduced to the world in 1880, has been translated into English by Mr. W. A. Seret, of Glasgow, who describes himself as "certificated teacher of the universal language." This gentleman tells us that Volapuk "has already gained a firm footing in Germany, Switzerland, Holland, Hungary, Italy, France, Sweden, and especially in Austria, and in Syria and Arabia, having been introduced also into Russia, South America, Asia, and the north of Africa."

We have no means of knowing what is to be understood by the "firm footing" alluded to, but it is certainly something far removed from everything approaching general adoption. But, as we said, it has evidently approached the stage when people begin to ask about it; the English Philological Society has discussed it with something like approval; one of those fierce Englishmen who perpetually write to the *Times* from Continental hotels has felt called upon to denounce it, and the leading journal itself has devoted a column of somewhat heavy banter to it. A defender of the language has since written from Paris, declaring that there are already some half million people corresponding in or still learning Volapuk, and announcing that a congress of Volapukists is to be held in Paris in 1889.

Mr. Schleyer's object seems to have been to provide a scientific, systematic, and easily acquired language, not to supplant others, but to furnish all nations with a ready means of communication, suitable especially for commercial correspondence by letter and telegram. No one who studies his scheme can help admiring the ingenuity of many of its parts and the scrupulous rigidity with which a rule once laid down is maintained. It seems cruel to have to add even one extra straw to the vast education which it appears is necessary nowadays for a commercial clerk who wishes to hold his own against the dreaded German; but a knowledge of Volapuk is a much more fearsome thing in sound than in reality. A few hours' study will enable any one with some philological knowledge to master its fundamental rules; and with a dictionary he could then translate either into or from Volapuk without much further difficulty.

Volapuk is based upon English, as the language most widely spoken; but it must be admitted that the reduction of English to rigid regulations has a compromising effect on such poetic beauty as it may have contained before. For instance, "man" is adopted for "man," "son" for "son," and "blod" for "brother;" but the Volapuk rule for making the feminine is to prefix the masculine noun with "ji" (pronounced *she*); we have, therefore, *ji-man* for woman, *ji-son* for daughter, and *ji-blod* for sister. To give another example of how words are built up in this artificial language according to definite rules, we may quote the word *gud*, which is the substantive form representing goodness. The adjective is formed by adding *ik* to the substantive, and the adverb by adding *o* to the adjective. *Gudik*, therefore, means good; *gudiko*, well; *gudikum* is better; *gudikun*, best; *gudon*, to make good; *gudikumon*, to make better, to improve; *gudikunon*, to make best, or as good as possible. The verbs are subject to great inflections, and can be made to express a great deal by prefixes and suffixes. Thus, *lof* is the root of the verb to love; *ailofon* means a loving that will have been constant; *lofofsok*, those women love themselves. *Lem* is a bargain or purchase; *lemon* is to buy; *lemob*, I buy; *lemobs*, we buy; *alemobs*, we bought; *elemobs*, we have bought; *eilemobs*, we have bought constantly. *Sel* is a sale; *selon* is to sell; *selob*, I sell; *selobs*, we sell; *selol*, thou sellest; *selols*, you sell; *poselols*, you will sell; *liposelols*, will you sell?

We give these examples to show something of the system of building up words, and also to indicate how, possibly, Volapuk may prove of value for foreign telegrams. It is probable, at all events, that some commercial firms will think it worthy of further investigation.

The probability of English becoming the world's language is growing more rapidly year by year. It is estimated that when Shakespeare wrote, his language was spoken and understood by only about 5,000,000. The best judges now calculate that at least 100,000,000 talk and understand it, and vast populations in India, China, Japan, and elsewhere are acquiring it for business and social purposes. The race of which it is a native tongue is growing faster than any other in the world; and with the printing and circulation of literature, the danger has departed of the language becoming broken up into various dialects, as Latin was a thousand or fifteen hundred years ago. But it is possible that even among ourselves, as well as in communication with the great countries where English is not understood, something like this scientific language may serve a useful purpose. In that view we have thought well to offer these remarks concerning it.—*Chemist and Druggist.*

[SCIENCE.]

The Reis Telephone.

Some who have experimented with the Reis telephone declare that they have never been able to hear a transmitted word. Others have heard some words and sentences; but these have always been weak and irregular, so as generally to discourage one in a short time, especially now, when through the improvements in telephones it is possible to reproduce words both loudly and regularly. Experimenters, therefore, have been impatient with Reis' apparatus, and seldom have done anything with it, except make some hasty tests for some phase of the great telephone controversy.

The inefficiency of the Reis telephone has, by a kind of common consent, been admitted to be altogether due to the imperfect mechanical operation of the transmitter, by which the making and breaking of the current when it is in operation is such as not to properly follow the actual vibratory movements of the diaphragm when the latter is moved by speech vibrations; that at best it can deliver to the line only the fundamental rate of the vibration, leaving out the characteristic overtones which are supposed to be necessary to the successful transmission of speech. This judgment as to the mode of operation of the transmitter has been derived wholly from what has been heard by one listening at the receiver; for there is to-day no known method by which it may be determined whether or not a transmitter has the proper motions, except by listening at the receiver. That is the test. Hence it has been concluded that if speech was not properly delivered in a receiver, the trouble must be with the lack of proper movements of the transmitter. Yet it is mechanically possible for the transmitter to move properly, and the receiver to be so much overloaded, so to speak, that the latter fails to be heard on account of the extra disturbance.

The Page effect—the magnetic click—may be so strong in a Reis receiver, with a proper current, as to be heard a good many feet distant from it. When the receiver is held against the ear, the sound may be very loud; so much so as to quite drown weaker sounds, if they happen to be present. Especially when these loud sounds occur fifty or one hundred or more times per second, the effect is that of a continuous sound; and as the persistence of hearing is something like the tenth of a second, it follows, *a priori*, that such rates of vibration as from two hundred to a thousand per second might be present, yet too weak to be heard in the presence of such overpowering sounds that have an appreciable persistent effect. These loud magnetic clicks are heard only when there is a sudden break in the current in the receiver. If, then, some way can be devised for preventing these extraneous sounds in the receiver without interfering at all with the transmitter or its "mode of operation," one may experimentally determine whether the Reis transmitter does or does not act mechanically so as to vary the current in correspondence with speech or other sound vibrations. I therefore conceived that, if there was a short shunt circuit between the terminals of the transmitter, some of the current would traverse the coil of the receiver the whole time, no matter whether the circuit through the transmitter was open or closed. The loud clicks would be suppressed without interfering in any way with the "mode of operation" of the transmitter; and, if the latter really did follow the motions of the diaphragm, the variations in the current strength would correspond, and the speech would be heard. This I found to be truly the case: for with a transmitter thus provided with a shunt circuit of about two ohms, which could be switched in or out with a key, it was at once possible to hear a large part of what was spoken when the shunt was in. When it was out of circuit, the sounds were generally inarticulate.

This experiment is an *experimentum crucis*, and proves that the inefficiency of the Reis telephone is much more due to the extraneous sounds in the receiver than to the lack of appropriate motions of the platinum terminals of the transmitter. It proves that the transmitter does and must always have worked in the proper mechanical way, and that the current theory of its mode of operation is not correct. It proves, too, that when carbon is substituted for the platinum terminals, there is an improvement in efficiency, but not in its mode of operation. A. E. DOLBEAR.

College Hill, Mass., Jan. 14.

The Western Union Telegraph Office, New York.

When a person goes into the basement of the Western Union Telegraph building, and desires to inform his wife at San Francisco, 3,000 miles away, that New York is a wonderful place, and deposits a dollar bill for that purpose, he little imagines the extent to which his dollar supports his averment. He little imagines what the dollar does before the message reaches the first telegraph pole out from the building on its way across the continent. None of man's conquests is more amazing than his conquest of the lightning, and none of the strange things he does with it has reached such proportions as his employment of it in the capacity of an errand boy. While this has been growing commonplace, it has all the while been growing more and more amazing, and in the central office of this king of corporations, the Western Union, the process of telegraphy has reached a development such as can be seen nowhere else in the world. The dollar that pays for the transmission of an idea from Hell Gate to the Golden Gate does many interesting things.

It goes in at the receiving window and gets registered, together with the message it represents. Then it proceeds down stairs into the cellar, where it turns the wheels of fifteen mighty engines. One of these, applied to a huge dynamo magnet, draws from it the flame of 600 incandescent lamps, and sends it gleaming through the building. Three others engage actively in the work of enlightening the world. They supply the electric current that courses up and down the continent faster than light itself. They take it from fifteen little dynamo magnets, scarcely thicker than a man's thigh, arranged in rows or "gangs" of five each, and placed in a room scarcely larger than a hall bedroom. If two entire floors of the building were filled with Leyden jars, there would be, may be, 40,000 of them. But the power to be got from them all would be less than that derived from these little dynamos. Four other engines, the largest and most powerful of all, force currents of air through the most extensive underground pneumatic systems in the world. Tubes run from the building up to the branch office in Twenty-third Street, to other branch offices, and to all the principal newspaper offices. If the tubes were large enough to accommodate a man, he could be sent bowling along two miles underground in just ninety seconds with as much ease as if he were a feather.

It is up in the top of the building, however, that the novel sights are to be found. Seated in front of 700 little desks, each supplied with two or more noisy machines that clatter incessantly from year's end to year's end, is an army of young men and girls, the brightest, quickest, cleverest operators to be secured. Everything and everybody appear to be in a grand rush. Little boys and girls tear about as if thrones depended on their being at a given point in the room at the hundredth part of a given second. The continuous musketry of the sharp, rattling machines ever and anon grows heavier and fiercer as gusts break forth on a stormy April day. The very atmosphere seems excited and in a hurry, and well it may, for the air in the room is changed every three minutes. Four huge ventilating fans, driven by a special dynamo engine, carry off 2,000 cubic feet of air every second, and keep the atmosphere in perpetual commotion. A picture of a scene so confusing is difficult to paint. If anything would only stand still long enough to let the mental camera catch its image, there might be hope of obtaining at least a typical impression. But the room puts on as many new phases as the crowd that passes a Broadway corner. Placed well in its center is a little pagoda, an up-raised stand that might make a summer house were it set in a flower garden and overrun with vines. Here a group of little girls sit behind a circular table. Over their heads is gathered in a disk a hundred wires that run hither and thither all over the room, carrying little messenger cars, such as they have in the big stores running to the cashier's desk. Here there are so many of them, and they skim along in so many different directions, darting hither and thither, as if blessed with a head of their own and a perfect comprehension of their own business, which nobody can tell them better than they know it themselves, that one looks upon their intricate mechanism with amazement, and wonders why they don't come together in a general collision. If it be remarkable that they understand themselves, it is more remarkable still that these little girls, who have scarcely entered their teens, should know whence they all come, what they all carry, and where they all go. But with equal deftness and celerity, the children capture them all as they come, take out their cargoes of papers, affix to these a proper stamp, and send them whirling off again, all in the twinkling of an eye. When the messages have been received down on the basement floor, they are sucked through pneumatic tubes up into the operating room, and there seized upon by the little girls in the grand stand. Quick as a flash the addresses are read, and then they are whirled to that part of the room in which the particular operators are seated who work the particular lines over which the message is to go.

It takes nearly a thousand operators to accomplish a day's business in the Western Union. Some of this work is in the day time and some at night, and others do nothing except relieve the regular staff, while, in relays of fifty or seventy-five, they go up-stairs for luncheon. Thus there is no pause in the eternal rattle of the machines. The problem of perpetual motion is solved in that room as much as it ever can be solved. The messages that come into the office are treated pretty much in the same way as those that go out. The operators who receive them write them out on blanks and send them whizzing off in a jiffy to the little girls in the grand stand. When they are stamped for identification, they are dropped down through a sliding tube to the basement floor. A mirror at the bottom enables one to see directly through six stories and catch glimpses of the pig-tails and curly bangs up in the lofty grand stand. As the messages drop they are taken out, slid through steam rollers that copy them and drop them on a revolving endless belt, that takes them off to the routing clerks and the messengers. System is always simple, even in its most complicated forms. That is what system means. And yet the number of things that are done to a message in order to insure its rapid and accurate reception and delivery can but excite wonder.

Of course there are a great many secrets passing through that operating room—secrets that speculators in Wall Street would consider it well worth their while to know. Many a fact that has come over the wires from Chicago, addressed to some prince of the realm of speculation at twelve o'clock, if known an hour later to any important stock broker, would be held by him in high commercial esteem. This fact has not escaped the observation of operators who keep a business eye open, nor is the Western Union Co. blind to it. Arrangements have occasionally been made, in times of public excitement, between operators and men of speculative tendencies, for the quick transfer of messages designed to have important effects on public affairs. There are many occasions when the certain knowledge of an event—a presidential proclamation, a government concession to or demand upon one of the subsidized railroads, or of any such thing affecting the values of securities—should it come to the ears of a speculator even half an hour before it was made public, would enable him to make a fortune. The secrets of the wires are the richest kind of secrets, and the greatest care is taken to keep them inviolable. This is one of several reasons why the operators are not permitted to take their lunches outside of the building. A restaurant is fitted up for them on the topmost floor, provided with an extensive bill of fare, which is scheduled, according to the company, at cost prices. A sharp espionage is kept upon the movements of all employes. At the door of the big room stands an old, white-haired sentinel, whose forty years of telegraphic experience in all parts of the country has made him familiar with every one in the business. If a visitor calls, he either knows him at once or knows that he is not a fellow craftsman. At all times of unusual public excitement, when Wall Street is in a fever, extraordinary vigilance is exercised over all persons who call on the operators. They are always compelled to send in cards. These are taken first to the manager or his assistants. The person called upon is notified, and if he desires to see the visitor, he goes out into the hall. The opportunities for long or private conversation here are meager. A constant succession of chief operators and other authoritative persons is passing by at momentary intervals. If secrets are being divulged, the chances are that some part of them will be overheard, or suspicion aroused by some other circumstance. In that event the visitor is followed. It is not often that important secrets have contrived to get over this wall of scrutiny and care.

To the uninitiated it is a great puzzle how the dangers of lightning are averted where there are so many conductors of electricity as in a telegraph office. More than 2,000 different wires come into the Western Union building, and run more or less directly to the desks of the operators. Even when these electric attractions are wanting, most people confess to a certain feeling of insecurity when the elements rage and wake up terrifying flashes of forked fury. Nearly half the operators are young women, and they may be expected to share the general sentiments of their sex concerning this uncertain and wicked-looking force. But science has provided an answer to this, as well as to almost all other puzzles which stand in the way of human progress. Every wire, as it enters the building, passes through the bottom of a long narrow board, and then again through it at the top. This board is a lightning arrester. If the current is heavy, its first effect is to deprive it of much of its force. Should even this fail to deprive the current of its fatal power, and it passes on to the top of the board, it touches a spring which drops instantly and shuts off all connection with the operating room. This spring is called the plush magnet, and beyond it no overcharge of lightning, whether proceeding from a storm or from contact with other wires, can possibly go. Absolute security from outside electrical influences is thus insured. The wires proceed directly from the street to the switchboard in the operating room, where they are stopped. The wires attached to the machines in the room all run to this board, and connections are established there with the through lines.

There are 20,000 cities and villages in the United States to which the Western Union runs its wires, and naturally the task of making rates between each of these places and all the others is a grave problem. Four hundred millions of rates must be made, and every agent must know them all. When the company was confined to the space between Buffalo and Chicago, the process of arranging a tariff was comparatively simple. But when a boundless continent became its domain, the subject was no longer insignificant. The present method is so plain that the wayfaring man, though a fool, has no excuse for erring therein. The whole country is blocked out on a map in squares of fifty miles each, and the rate is fixed between each and all of these squares, and printed in a book that is newly revised and issued every six months. The public is greatly indebted to the competition of the smaller companies which from time to time have sprung up as rivals within certain territories to the Western Union for many additional simplifications of this system.

In the East there is but one tariff rate, and between adjoining States a similar arrangement usually exists. These smaller companies have been nearly all swallowed up in the Western Union, but their usefulness to the public in compelling reductions is not slight. The average business done in the main office of this giant monopoly is about 1,400 messages. As many as 2,800 have been sent out in a single day, and as 180 other offices are open in this city, these figures tell only a small part of the story. But they serve well to show the immense development of an art and a trade that sprang into existence within the memory of men still young, and which, were they suddenly lost to human knowledge and craft, would leave the world in strange and dismal darkness.—*New York Tribune.*

The Milling Machine.

At the recent meeting of the Society of Mechanical Engineers, a paper was read by John J. Grant, and entitled, "The Milling Machine as a Substitute for the Planer in Machine Construction."

The author called attention to the importance of using the milling machine, and that manufacturers were coming to recognize this fact, due largely to the diminished cost of using it, as compared with that in the use of a planer. He asserted that every part of a locomotive now finished by a planer could be better done by a milling machine, and at a half to one-tenth the cost, and producing work nearer to interchangeability. In order to settle the question in his mind, he made the following experiment. One hundred pieces of cast iron 16 in. long, large enough to finish 1½ in. by 1 in., used for lathe racks, were given to the man in charge of the milling machine, and an equal number of the same pieces to the man in charge of the planers. The cutter used on the milling machine was simply a plain spiral cutter of 2¼ in. diameter by 2 in. in length, costing to make in the shop, including stock, labor, and shop expenses, $2.10. This cutter was sharpened but once, and that after the completion of the job, which consisted in roughing the four sides of the 100 pieces. Two milling machines were used, one for roughing and one for finishing cuts. The cutters required grinding at the end of the job, and so were chargeable to it; the time required to grind them was 22 minutes. The wages of the boy running the machine were 9 cents per hour. The total cost for finishing the 100 pieces on the milling machine was, including shop expenses, estimated at 35 per cent of labor, $5.09.

The cost of the same number of pieces finished on the planer was as follows:

24 hours 35 minutes each machine, at 25 cents per hour..	$6.03
Grinding and setting tool 19 times, 1 hour 21 minutes....	0.33
Shop expenses, 35 per cent........................	2.22
Total..................	$8.58
Balance in favor of milling machine..................	3.09

In the above test, the author claims that the planer was acting at its best and the milling machine at its worst. The latter makes its best showing in irregular work, where the planer requires the constant attendance of skilled workmen, while the milling machine can employ a much cheaper grade of attendance.

He summed up the advantages as follows: Exact duplication of work; rapidity of production, the cutting being continuous; cost of production, as several machines can be operated by one workman, and he not a skilled mechanic; and cost of tools for producing a given amount of work.

Artificial Incubation in Egypt.

One of the oldest industries in Egypt is artificial egg hatching, principally engaged in by Copts. There are said to be 700 establishments of this nature in the country, and the production of chickens from the ovens is estimated at from 10,000,000 to 12,000,000 annually. The season for incubating lasts through three months of the early summer. The country people bring eggs to the proprietors of the "farroogs," and give two good eggs for every newly hatched chick.