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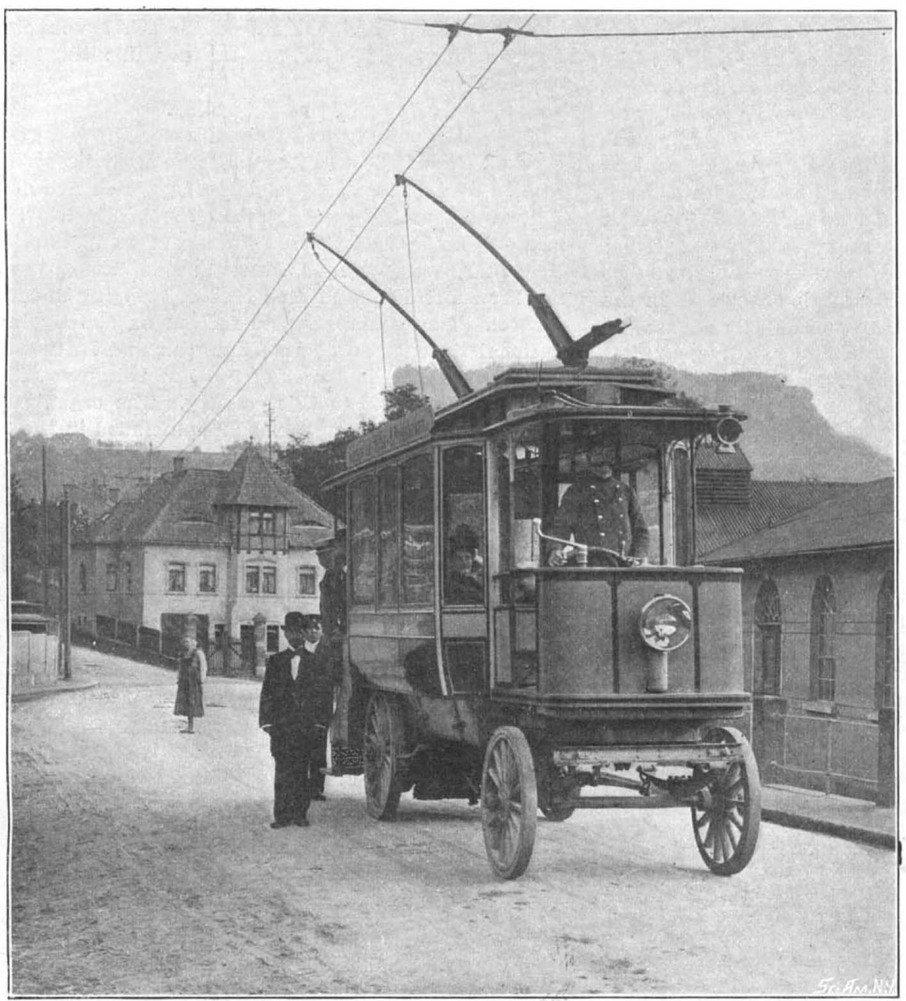
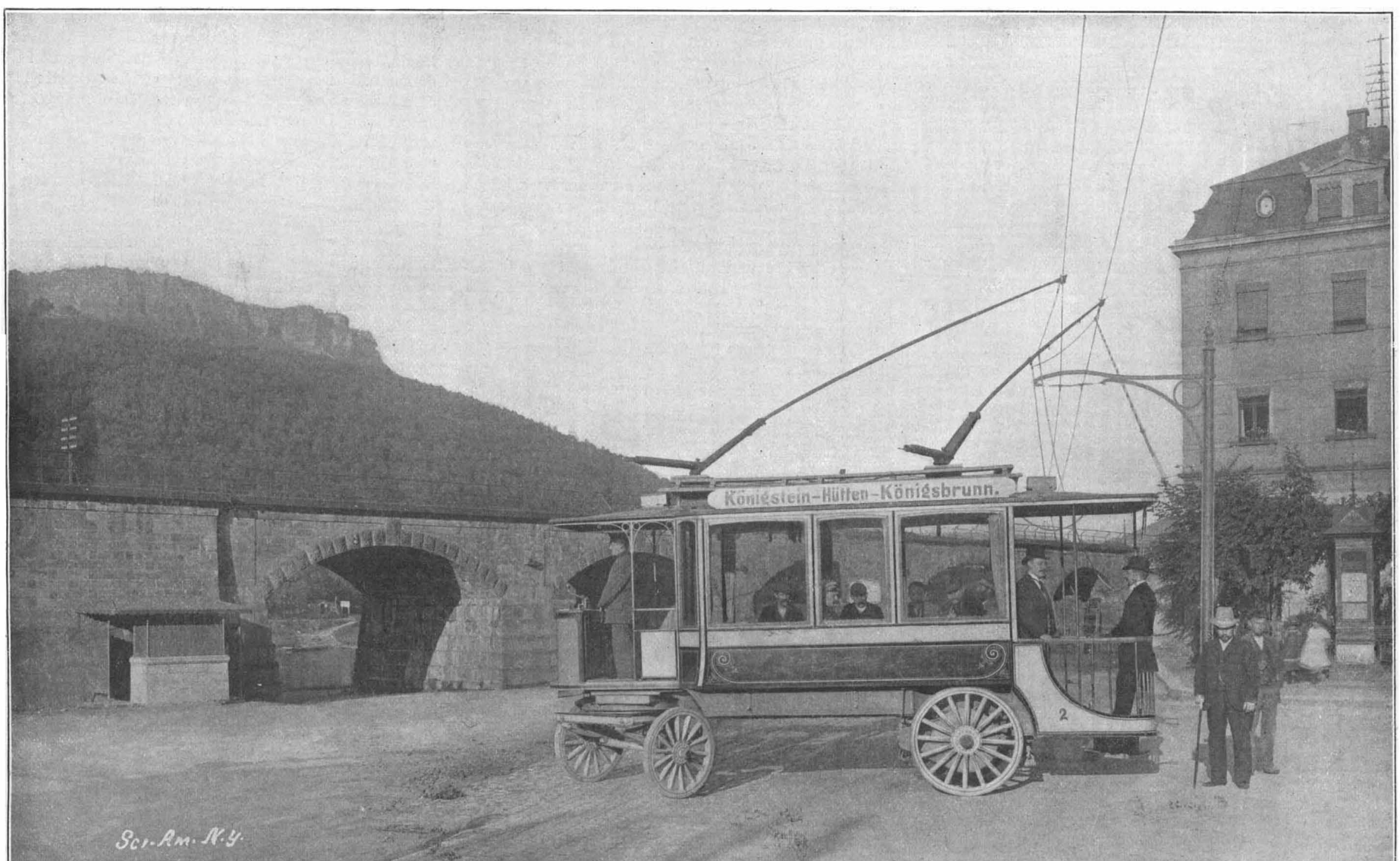


Electrical Trolley Omnibus and Power House.

Electrical Wagon Operated by Auto-Motor Trolley.



Electric Trolley Omnibus Line at Koenigstein.

GERMAN AND FRENCH ELECTRIC TROLLEY WAGONS AND OMNIBUSES.—[See page 6.]

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NEW YORK, SATURDAY, JANUARY 3, 1903.

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.

RETROSPECT OF THE YEAR 1902.

WIRELESS TELEGRAPHY.

If one were asked to name the most important scientific achievement of the year just closed, he would, without doubt, give that distinction to a feat which was performed, in the closing days of the year, on a barren headland on the eastern shores of Cape Breton, where Marconi, a few days before Christmas, exchanged messages of congratulation by wireless telegraphy with some of the crowned heads of Europe. At the close of the year 1901, Marconi had given to the world the first pledge that he would before long make transatlantic wireless commercial telegraphy possible, for he had received on a single wire, suspended from a kite, an agreed-upon signal in the form of the repetition of the letter "S." It was merely a hint of coming possibilities, for the signal was only perceptible by the use of a sensitive telephone. Between that and the transmission of commercial messages was a wide gap, and that the brilliant young Anglo-Italian should have closed that gap within a period of twelve months, and that he should stand to-day prepared to transmit commercial messages across the Atlantic, must be regarded as certainly the most remarkable scientific achievement of the year. Marconi's final experiments were carried out with the same absence of self-advertisement, the same professional dignity, which has characterized his work from the very first. He spent about a month at his Cape Breton station, sending and receiving messages, before he made a final announcement of his success. It was inevitable that in the five years of his brilliant work he should be subjected to those ungenerous attacks that seem to dog the steps of every inventor of an epoch-making device. To read these criticisms, one would think that Marconi had invented nothing at all, and that to the army of imitators or emulators that have gathered in his train, all the credit belongs; and yet the fact remains that he was the first man to show the commercial possibilities of wireless telegraphy, and that he has passed from his first crude experiments to his present marvelous triumph, with a swiftness and a completeness without a parallel in the history of invention. What Stephenson was to the locomotive, Edison to the electric light, and Bell to the telephone, Marconi will be, as long as history is written, to wireless telegraphy. Other systems with more or less claims to utility have been industriously developed by their various sponsors. In this country the DeForest type seems easily to lead its competitors in the practical results accomplished. It has done good work in the naval maneuvers, and it is having a fair amount of general commercial success. Fessenden, moreover, has secured his patents during the year, and has achieved encouraging results, particularly in respect of speed of transmission; while Prof. Pupin's system of selective resonance or tuning, application for patents on which was made as far back as 1894, has now been protected by the Patent Office, and he has concluded arrangements with the Marconi Company by which they are granted exclusive license in this country. Fessenden uses a form of receiver which he calls a "wave detector," that gives promise of much greater rapidity than the old coherer. Indeed, of late, the efforts of experimentalists in wireless telegraphy have been directed especially to the invention of some form of receiver that will be more reliable and rapid than the form with which Branly's name is associated. Branly himself has brought out an improved radio-detector, which is based on the important discovery that any two pieces of metal, provided one of them be polished or oxidized, will serve all purposes of the old Branly tube. In Germany, where the Slaby-Arco system has been adopted by the government, fair results were obtained this year in the army and navy maneuvers; although the Slaby-Arco does not begin to approach the Marconi system in range of transmission. The problem of the future in wireless telegraphy is that of "tuning," or the confining of messages to one particular receiver, to the exclusion of all others. In connection with wireless telegraphy progress mention should be made of the completion, after more than fifty years of growth of the British cable system, of a complete telegraphic connection around the globe. This was achieved by the laying of the British Pacific cable from Vancouver to Australia, which includes one length from Vancouver to Fanning Island of 4,000 statute miles—the longest stretch of cable in the world. Our own transpacific cable is also in process of being laid, and before long we shall be in direct communication over our own wire with our new eastern possessions.

CIVIL ENGINEERING.

The year just closed has seen the completion of one of the largest and most beneficent civil engineering works of this or any age—the great dam at Assouan on the Nile. This structure, together with the barrage across the Nile about 250 miles above Cairo, was undertaken by the British government as one among many schemes for the improvement of modern Egypt. The two works together cost $25,000,000. The dam at Assiout is 2,750 feet in length, and will bring about 300,000 acres under cultivation in middle Egypt. The dam at Assouan, 600 miles above Cairo, is an enormous structure a mile and a quarter in length, with a maximum height, from foundation to crest, of 130 feet. Its construction gave employment to 11,000 natives; and by its completion it has become possible to store one billion tons of water for irrigation purposes in the dry season. The opening ceremonies took place on December 10, in the presence of the Khedive; and it was stated on this occasion by Lord Cromer, that this great work will increase the agricultural earning power of Egypt by $13,000,000 every year; that it will permit the additional irrigation of 1,600,000 acres, and that it will provide an additional revenue to the Egyptian government of $1,900,000 a year.

Most important steps have been taken during the year in clearing away preliminary obstacles to the construction of the Isthmian canal. As matters stood at the commencement of the year, the Isthmian Canal Commission, because of the exorbitant price (over $109,000,000) asked by the owners of the Panama property, had advocated the construction of the Nicaragua Canal, at a cost of about $190,000,000; but subsequently the Panama Company signified their willingness to take $40,000,000 for their properties, and an investigation made during the year in Paris has shown that the titles to these properties are perfectly valid. The only obstacle remaining to be cleared away is that presented by the Colombian government, which seems disposed to make capital out of the present situation, and demands an excessive price for the strip of land through which the Panama Canal is to be constructed. It is probable, however, that before long a satisfactory treaty will be concluded for the purchase of the right-of-way, and preliminary steps toward construction taken.

The Rapid Transit Commission, its engineers, and its contractors, are again to be congratulated upon the splendid record that they have made during 1902 in pushing the Subway toward completion. The work is now in such an advanced stage that it is a practical certainty that trains will be running over the greater part of the route by January 1, 1904. The contract for the $10,000,000 extension from City Hall Park to Brooklyn has been let, and work is under way, three years being the probable time limit necessary for the completion of the tunnel under the East River. Interest in this great work has been redoubled during the past few weeks by the unparalleled congestion which has occurred on the various lines of transportation in this city. The elevated railroads, despite the fact that they have been almost completely equipped with electrical traction, have at times been completely paralyzed, the flood of traffic having swamped even the six-car trains and more frequent service afforded by the new equipment. Similar congestion occurred on the Metropolitan Street Railway system, and there is no question that, unless immediate steps are taken to enlarge the Subway system by the construction of several north and south lines, the great growth of travel in New York city will produce a positive deadlock before many years have passed.

Undoubtedly the most far-reaching civil engineering work dealing with transportation in New York, is the great system of tunnels beneath New York, connecting New Jersey and Long Island, for which the Pennsylvania Railroad Company received a franchise from this city during the closing days of the year. These tunnels will connect, by direct rail communication, New York city and the vast system of roads which at present have their terminals on the west shore of the Hudson River; and will also give new and effective means of suburban transit by rail to the large residential districts lying to the east and west of New York. Another important franchise is that granted simultaneously with the Pennsylvania charter to the New York and New Jersey Railroad Company, whose tunnel will enter New York at the foot of Christopher Street. These two enterprises will doubtless do much to relieve the great traffic congestion referred to above.

During the year, the East River Bridge construction has proceeded with the same exasperating leisureliness which has marked the construction of this greatly-needed work, from the time the contractors for the cables first took it in hand; and the occurrence of a fire at the top of the Manhattan tower seemed at one time to threaten the very existence of the great cables themselves. Fortunately, the damage was relatively slight, and can be repaired at the cost of three or four months further delay. The work of sinking the Brooklyn caisson of the East River Bridge No. 3 has moved along steadily during the year, and the contract for sinking the caisson on the Manhattan side has been let. It is a matter of great regret that more expedition has not been shown in the construction of this bridge, which cannot possibly be ready for public use under five or six years. The question of the construction of the Erie Canal is once more before the public, and it seems likely that the larger scheme involving a 12-foot depth and 1,000-ton barges will ultimately be adopted.

MERCHANT MARINE.

Unquestionably, for the United States, the great event of the year in the merchant marine was the consummation of the steamship combine, by which five of the largest transatlantic companies, the White Star, Dominion, Leyland, Atlantic Transport and American-Red Star, were merged into a single company with not far short of one million tons of shipping under its control. The combination is formed on strictly international lines, with a joint American and British control, the General Manager of the line being an American with residence in this country. The organization is such that the various companies included in the consolidation preserve their autonomy, and every respect is shown their national and local surroundings. The avowed object of the combination is to afford better transatlantic service at decreased cost, with more uniform rates, and a better distribution of traffic over the American and Canadian seaports. This merger, which is the most important event that has happened in the history of the American merchant marine, has greatly increased our prestige, bringing it up to the point which it held prior to the great civil war. The year 1902 is of special interest, moreover, in this connection, because it marks the growth of American shipping to the standing which it held in 1861, the total tonnage in that year of our shipping being 5,539,813 tons, and in 1902, 5,797,902 tons. The shipbuilding industry is in a healthy state, 1,491 vessels of a gross tonnage of 461,831 tons having been built in this country during the year. We have so recently, in our special Transportation number, given the full details of the present standing of our merchant marine, that the reader is referred to that issue for further information. During the year, both the largest vessel in the world and the fastest vessel have been launched, the "Cedric," of 37,870 tons, being about 1,000 tons larger than the "Celtic," and the "Kaiser Wilhelm," with a proposed speed of 23½ knots, and a probable sea speed of 24 knots, being the fastest afloat. A notable event in the competition for the speed record of the Atlantic is the arrangement entered into between the Cunard Steamship Company and the British government, by which the former are to receive a heavy subsidy in consideration of their constructing two vessels which will be the largest and fastest in the world. The contracts for these vessels have recently been let, one to the Fairfield Company, on the Clyde, and the other to Vickers, Sons & Maxim. They are to be 750 feet long by 75 feet broad, and with 50,000 horse power are to show a sea speed of 25 knots an hour. This will be a great increase in size and speed over the "Kaiser Wilhelm II.," which is 706 feet long by 72 feet beam and 23½ knots speed.

Apart from the construction of a few very fast ocean steamers by the German, and now by the English lines, the tendency is toward the construction of extremely large cargo passenger ships of moderate speed, say from 14 to 17 knots an hour. It is found that the cost of carrying freight is steadily reduced as the size of the ship is increased; and as there seems to be no limit to the application of this rule in theory, it becomes an interesting question just how large the ships of the near future will be built. At present it seems that the only limit will be that of depth of channels and length of dock accommodation.

STEAM ENGINEERING.

In the field of steam engineering, the most notable progress has been in the development of the steam turbine; indeed, it is safe to say that this form of motor is destined to work the most radical innovation that has been seen in steam engineering since the introduction of high-pressure steam and multiple-expansion engines. Every year in the history of the turbine serves to demonstrate more fully its good qualities, and to justify the faith of its inventor in its ultimate substitution for the reciprocating engine in the majority of the uses to which the latter is now put. In the present stage of its development, its advantages may be summarized as follows: On small units doing continuous service in a power station, it has shown a steam consumption of under 13¾ pounds per indicated horse power per hour; while in a larger unit it has shown as low as 10.17 pounds per indicated horse power per hour. It has been found that in plants already built, or now under construction, the steam turbine requires only about 80 per cent as much space as is necessary for a vertical engine of the same power, and only 40 per cent of that needed for a horizontal engine. In one case the volume of masonry foundation required for a turbine was found to be only one-ninth as great as that for a vertical, and one-fifteenth as great as that for a horizontal engine, while the cost of the building to house the same was only about one-half that of the horizontal or vertical. The turbine plants that have been in operation during the past few years have shown high economy and call for practically no repairs. In marine work the turbine has repeated, in the new river passenger steamer "Queen Alexandra," the good results shown in the "King Edward." On her trial trip this vessel made 21.63 knots an hour. Compared with passenger steamers of similar size, but having reciprocating engines, the installation of turbines has shown a gain per indicated horse power in favor of the turbine steamer of 20 per cent. Its compactness and absence of vibration have led to its introduction on steam yachts; one, the "Resolution," has been built and is running in this country, and three others have been built in Great Britain. In a paper recently read before the British Association, Mr. Parsons stated that the adoption of the steam turbine for large battleships, cruisers, and transatlantic liners will be attended with greater proportional advantages even than those shown in smaller vessels. Outside of the steam turbine there has been no radical change to record in steam engineering during the past year. Steam pressures for water-tube boilers remain at from 250 to 300 pounds per square inch, and for Scotch and locomotive boilers, at about 200 to 225 pounds.

OIL FUEL.

Intimately related to steam engineering is the question of the use of oil fuel, which, on account of the enormous development of the oil fields of Texas and Borneo, has become one of the burning questions of the day. The production of successful oil burners has resulted in the application of oil fuel to locomotives and marine transportation on a rapidly increasing scale; the locomotives of the roads that pass through the oil fields being in some cases almost exclusively operated by oil, while there are lines of steamers in which the use of oil fuel is also nearly exclusive. The most important tests in this country were those carried out on the steamship "Mariposa," in a report on which Rear-Admiral Melville expressed his conviction that by future experimental work the engineering features of the problem would undoubtedly be solved, so as to render the fuel satisfactory to commercial interests, if not for use in the navy. The experience gathered during the year, however, does not warrant the belief that there will, for some time to some, be any general substitution of oil fuel for coal.

AERONAUTICS.

The history of aeronautics during the past twelve months has been fraught with tragedy, and each disaster has served to write large the ultimate doom of the balloon-supported airship. On May 12, during a trial of his "ship," there was an explosion of the balloon due to ignition of the gas by the motors, and Severo fell from a height of some 1,500 feet. A few months later De Bradsky met with a similar fate, both himself and his engineer being instantly killed by the collapse of their balloon. Santos-Dumont, however, still survives, and in spite of the fiasco of his visit to America, where he failed to make his much-advertised ascent in his airship, he is now at work in Paris on yet another balloon in which he proposes to make a trip, in consideration of somebody offering a prize of the moderate proportions of $50,000, from Paris to London. The most successful trip of the year was accomplished in a combination aeroplane and balloon by Stanley Spencer, who, in September, traveled some thirty miles over London in an airship of his own construction. Great interest is attached to the conditions of the races for the capital prize of $100,000, offered by the management of the St. Louis Fair. Two hundred thousand dollars are appropriated altogether, and in addition to the capital prize, $50,000 have been appropriated for minor prizes, and $50,000 for the general expenses incidental to the competition. Just at present the balloon airship has the field pretty much to itself, and by its doubtful successes and undoubted failures it is clearing the way for the development of the more scientific and more practical aeroplane, some form of which is certain ultimately to be adopted as the only practical means of air navigation; but we are many years distant from that event at present.

RAILROADS.

In our Transportation number we have dealt so fully with the question of railroads that there is little to be said just here. The increase in size and weight of locomotives continues, showing no signs of diminution. The latest of the heavy locomotives is a huge freight engine built by the Baldwin Company for mountain service, with high-pressure cylinders 19 inches in diameter, low-pressure cylinders 32 inches in diameter, and a common stroke of 32 inches. This engine carries a boiler with a 6-foot 6¾-inch barrel, and a firebox 108 by 78 by 80 inches, the total heating surface being 5,390 square feet. The engine alone weighs 267,803 pounds, and the tractive effort is 31 tons. In American passenger locomotives, the heating surface has risen to 3,533 square feet, and the tractive effort to 32,000 pounds. Compounding is making much slower progress in this country than abroad, where the four-cylinder system operating on either a single or two axles is winning increasing favor and showing excellent results. The fastest long-distance train in the world is hauled between Paris and Calais by a four-cylinder compound, the distance of 184½ miles being covered in three hours, or at a speed of 61½ miles an hour. The longest fast run of any express train is that made by the Twentieth Century Limited between New York and Chicago, which covers the distance of 980 miles in twenty hours, or at the rate of 49 miles per hour. The rapid increase in the speed and weight of express trains of late years suggests that when electric traction becomes a serious competitor to trunk roads, the locomotive men will be prepared to make a very strong bid to retain their hold on the situation.

ELECTRIC TRACTION.

One's thoughts naturally turn from the steam railroad to its younger sister, the electric road; and here the rate of progress has been phenomenal. In this city we have seen the opening of the great Manhattan power station with its eight units of 8,000 rated and 12,000 maximum horse power each, the total horse power of the station being 100,000. An even larger station, in respect of its maximum output, is that of the New York Edison Company, where, when the whole plant is completely installed, there will be gathered in a single engine room no less than sixteen engines of 8.000 maximum horse power and capable of a combined output of over 125,000 horse power. Work is also under way on another 100,000 horse power station in New York city which will furnish power for the Rapid Transit Subway. This plant will consist in part of reciprocating and in part of turbine engines, three of the units consisting of 4,000-kilowatt turbines of the Parsons-Westinghouse type. In this connection it may be mentioned that the turbine will play an important part in the electrical equipment of the London Underground railroads, four 5,000-kilowatt turbines being now under construction for the Metropolitan District Road, and three of 3,500 kilowatts for the Metropolitan Road. Speaking of London, now that the development of electric traction is under way, that huge metropolis is making the change on a truly wholesale scale, some $200,000,000 being required to carry through the various extensions which the construction syndicates have in hand. The most important question in electric traction during the year has been the development of the alternating current motor. The Berlin-Zossen trials, in which a speed of just under 100 miles an hour was obtained, were brought to a close by the unsuitability of the track for such high speeds; but a new locomotive has been constructed with a view to the reduction of axle weights, in which the transformers carried on the car have been abandoned, and a 10,000-volt alternating current is boldly applied directly to the motors. Further experience has been gained with the three-phase Valtellina road, 66 miles in length, and as far as can be learned the results have been thoroughly satisfactory. On this line, a three-phase alternating current of 3,000 volts is used directly at the motors. In this country great interest attaches to a new interurban road which is to be operated with alternating current throughout. This is the Washington, Baltimore, and Annapolis Electric Railway, with a total length of 55 miles. Alternating current will be generated at 15,000 volts, and it will be transformed at suitable stations to single-phase current of 1,000 volts, which will be sent out on the trolley wire for use directly at the motors. Another American development in this direction is the Arnold system of electric traction, in which single-phase alternating current will be used at the motors; while a peculiarity of the motors themselves is that both armature and field are capable of revolution either separately or together. Two engines are attached to armature and field in such a way that they may be used either for compressing air for storage in a reservoir, or for utilizing this compressed air in driving the car. Great Britain has taken up the matter of trunk line electrical traction in earnest, one company, the North-Eastern, being now engaged in the electrical equipment of 35 miles of double-track road, 4 miles of single-track, and 2 miles of four-track road. In this country the New York Central has professed its intention of equipping electrically its suburban roads that enter New York city, and the engineers who have this work in hand have made a series of most elaborate tests of the comparative efficiency of steam and electric traction for this service, using General Electric motor cars in competition with New York Central suburban locomotives. The result showed that electric cars accelerate much more rapidly than locomotives, and that they maintain a high average speed with lower maximum speeds, thus consuming less energy for a given run.

AUTOMOBILES.

The year past has witnessed a great increase in the popularity of automobiles, and there is every indication that with the inevitable decrease in the price of the smaller machines, bringing them within the means of the general public, the automobile will enjoy a popularity probably as great as, and certainly more lasting than, that of the bicycle. A visit to any of the large automobile shows, or even a casual inspection of the machines that one meets in the public highways, proves that the many experimental and unsatisfactory types which have sprung up like mushrooms during the past few years are being weeded out, leaving a few standard types, with easily-recognized characteristics which are likely to become permanent. Internal combustion motors continue to hold the undisputed lead as a drive for all classes of machines, while in this country the steam-driven and electric machines are strong competitors. Gasoline remains the popular source of power for internal combustion engines, although great progress is being made in Europe with the alcohol-driven automobile. Except for racing purposes, there is a reaction of sentiment against the ponderous 40 to 60 and even 70-horse power machines of the previous year, and even for racing there is a tendency to place restrictions upon weight. The beneficial effect of these restrictions was seen in several of the important races of the year, when light and compact racers, of moderate horse power, had no difficulty in holding their own with the more massive machines.

NAVAL AND MILITARY.

In naval and military affairs the past year has not been marked by any startling developments, either in ships, armor or armament. The naval building programmes of the year show that the tendency toward battleships of huge displacement continues, the new "Connecticut" in our navy being of 16,000 tons maximum displacement, and the new "Prince Edward" class of the British navy of 16,500 tons displacement. Except in our own navy, the very highest value seems to be placed upon speed, both in battleships and cruisers, the battleship "Vittorio Emanuele," of the Italian navy, carrying two 12-inch and twelve 8-inch guns, having a speed of 22 knots an hour, and the British armored cruiser "Good Hope," which is now carrying the Colonial Secretary to South Africa, having shown a speed of over 24 knots an hour on a four-hour trial. As compared with these speeds, our new armored cruisers of the "Tennessee" type have only the same speed as the Italian battleship, and two knots less than the British cruisers, while the "Connecticut" is to have a speed of 18 knots. At the same time, what we have sacrificed in speed we gain in power, the batteries of the "Connecticut" and "Tennessee" being greatly superior to those of the "Vittorio Emanuele" and the "Good Hope." For the first time in the history of our new navy one of our battleships has made on trial 18 knots an hour, this being the speed shown by the new "Maine." It is significant that in a vote taken among several of the most eminent naval designers of the world, the 22-knot Italian battleship, above referred to, received the first place, outranking even our own powerfully armored "Connecticut." The question of whether more armor and guns and less speed, or more speed and less armor and guns, gives the most effective battleship for future warfare, is an entirely academic one, which will never be settled except in the stress of actual conflict. In ordnance, there has been no marked advance chronicled during the year, the types of 1900 and 1901 having been carried to a point of efficiency at which the Ordnance Bureaus seem to be content to let them rest for a while. The same is true of armor, Kruppized plate remaining to-day the best all-round plate in the world. So, too, with smokeless powders. There have been improvements, but they have been merely in matters of detail of manufacture. In our army, however, there has been produced a new rifle of much greater velocity and general efficiency than the Krag-Jorgensen. Indeed, its ballistic results are superior to those of the Mauser, whose best points it embodies. That white elephant of our military Ordnance Department, the 16-inch gun, has been taken to Sandy Hook, where the problem of sinking so many thousand dollars in providing a temporary mount for testing confronts the Proving Ground authorities. In view of the fact that we have a naval 12-inch gun of half the weight, and, in nearly every respect, superior efficiency to this 16-inch gun, it is evident that no more of the type will be built. Perhaps it is safe to say that the submarine boat has been attracting more attention during the year, in naval matters, than any other new form of development. There is no question that the trials of the "Adder" and "Moccasin," while they have by no means met all the conditions that naval men require, have decidedly improved the standard of the submarine as such in naval circles.

THE BARBER-COLMAN KNOTTER.

BY IRVING U. TOWNSEND.

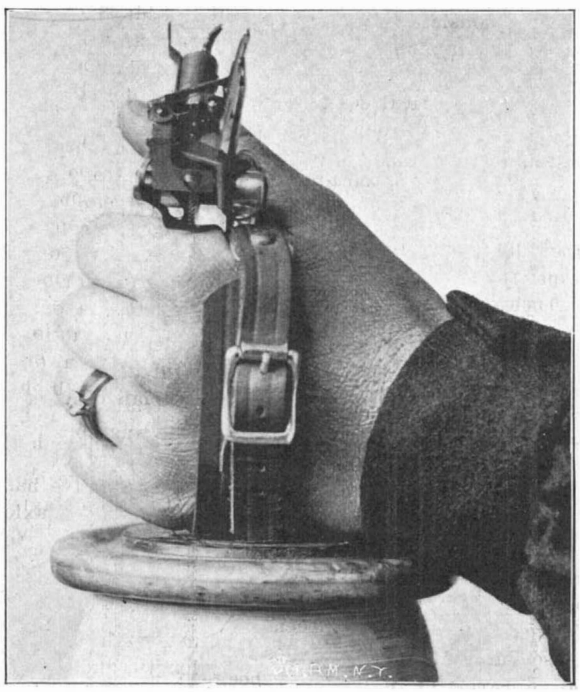
The operation of spooling consists in transferring the thread intended for the warps of the woven fabric from bobbins to spools, a spool usually holding the contents of seven or eight bobbins. The ends of the threads wound on the various bobbins are joined together by knots, so that the thread when wound upon the spool is continuous. The spools are arranged in long banks or tiers, one operative having charge of a single tier. The thread frequently breaks while being wound, so that much of each operative's time is occupied in piecing broken ends. The operative is usually a girl, who becomes very expert in rapidly tying with her fingers what is called the spoolers' knot. Hand knotting is objectionable on account of the uncertainty of the knots tied, their size, and the length of the ends left by the operative. Hence, for fifty years, there has been a demand for a practical mechanism for doing this work. The attention of inventors has been actively directed to the solution of the problem for twenty years. Among the devices invented is an apparatus of James H. Northrop, the inventor of the well-known Northrop loom. This was patented in 1885, and consisted of a standard, adapted to be attached to the frame of the spooling machine, and carrying a rotatable spindle having blades by which a knot was formed, much as in certain types of harvesters. In using this apparatus, the ends of a broken thread were drawn out until they could be placed in the blades of the knotter, there being one for each tier of spools, and the spindle was then manually rotated and the knot tied. This device never came generally into use, for the obvious reason that the thread ends to be united were usually at a considerable distance from the knotter, and it was easier and required less time for the operative to use her fingers to tie the knot. Among other devices tried and cast aside, was a knotter slidably mounted upon the spooler frame.

THE BARBER-COLMAN KNOTTER.

ANOTHER VIEW OF THE KNOTTER.

Mr. Howard D. Colman, of Rockford, Ill., a young but brilliant inventor, conceived the idea of mounting a mechanical knotter upon the hand of the operative in such a way as to be manipulated when desired by the thumb or one of the fingers, but leaving them free when the knotter should not be in use.

The accompanying illustration shows the knotter as now constructed. It is a wonderfully ingenious, compact, and well-constructed mechanism. It comprises a rotatable tying-bill having a shearing and clamping jaw, and a movable stripper for grasping the threads, drawing the knot tight, and pulling it from the tying-bill. In some cases the stripper mechanism is omitted and the tension of the threads is relied upon to draw the knot tight. The knotter is provided with a shaft adapted to be rotated by the thumb fork. Rigidly mounted upon the standard is a cylinder having attached to it a hooked guide. Upon a shaft within the cylinder is the tying-bill composed of two jaws with shear edges, one pivoted to the other and operated by a cam surface within the cylinder. The tying-bill shaft is rotated by a sector cam gear upon the main shaft. In operation, the two thread ends are placed across the guide, the tying-bill (which is turned into an upright position), and the stripper. The stripper, which draws the knot tight after it is formed by the rotation of the tying-bill, is moved toward and from the latter by the cam gear. It is so timed in action as to pull upon the threads after the knot has been formed and the ends severed close to the knot, and while the severed ends are still held by the jaws of the tying-bill. The stripper finally pulls the thread ends from the tying-bill and the knot is completed. The whole operation requires only four or five seconds, or even less time, and is performed by a single movement of the thumb after the threads have been laid in position. Instead of operating the knotter digitally, it may, although worn upon the hand, be operated by power through a flexible shaft. In such case a thumb lever is adapted to operate a friction clutch for engaging the knotter mechanism with the driving means.

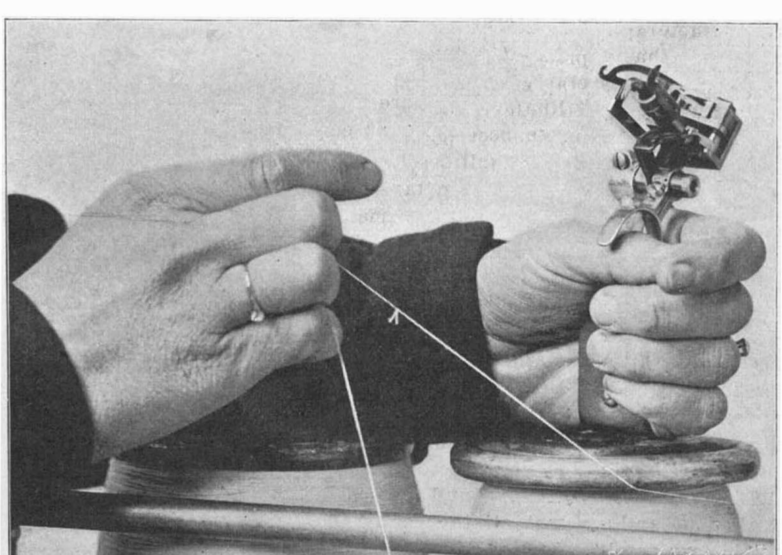


HOW THE KNOTTER IS STRAPPED TO THE LEFT HAND.

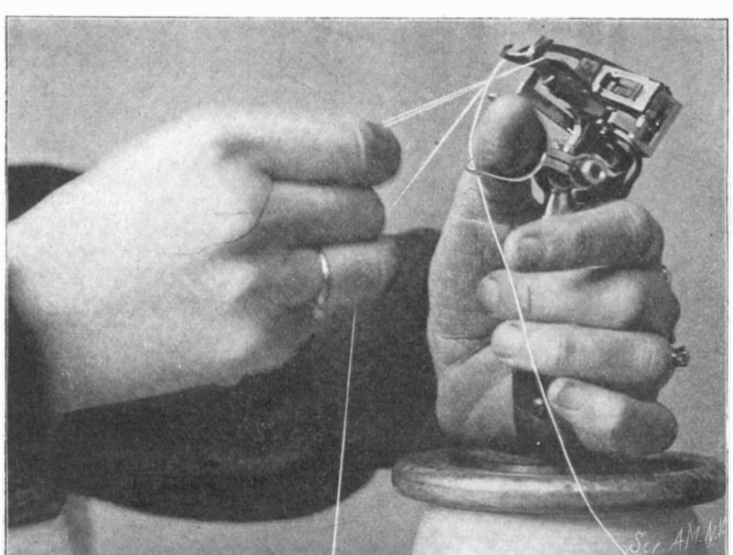
The effect of the knotter is to increase the speed of spooling on account of the rapidity with which it ties, and to increase the capacity of the weaving room owing to the very tight, closely trimmed knots. A novice soon becomes an efficient spooler when armed with one of these knotters.

So compact is the mechanism that, although of many parts, its operative portions occupy only about two cubic inches and the entire device weighs but three and one-half ounces. It ties a smaller, firmer knot than is tied by hand, and the ends of the threads are cut shorter than when the knot is formed by the fingers of the operative. It is mounted on the left hand in such a manner that, although constantly worn, it does not interfere with the free use of the fingers and the thumb of that hand.

The speed of the average operative is by the use of the Colman knotter increased about twenty per cent over hand tying, so that about one dollar per week is added to the wages of each. The operatives at first objected slightly to the use of the machine, but after its advantage in earning capacity had been demonstrated, they adopted it readily and even eagerly.



AFTER THE KNOT HAS BEEN TIED.



REEVING THE THREAD THROUGH THE MACHINE.

Wreckers for Submarine Work.

In the Contemporary Review, Dr. Carlo Iberti gives much startling information concerning the inventions of a certain Signor Pino, who has invented a submarine boat, not for destruction, but for the recovery of treasures from the deep. It is stated that 180 ships are sunk on an average during every month in the year, and lie with their cargoes at the bottom of the sea. Evidently Dr. Iberti has not heard of American work in the same direction. The Lake submarine boat has been successfully used. For the benefit of our readers we give a brief abstract of what Dr. Iberti has to say of the Pino boat:

"In order clearly and exactly to realize the value of the invention under notice, the following facts have to be considered: 1. That every kind of operation for the salvage or recovery of ships or objects can be done with great ease by means of this small boat of about three meters diameter. 2. That it has been tested to a depth of 150 meters, and that the inventor, who has descended in it to the sea bottom at least 140 times, has successfully worked at a depth of 130 meters. 3. That two persons can work in it on the sea bed for twelve hours continuously without needing to return to the surface for air. 4. That every object lying in the sea is clearly and distinctly seen from it, at any depth, through windows of a special crystal. 5. That the boat (which can be set in motion or stopped instantaneously) ascends or descends at will at a speed of 3½ meters per second. 6. That it will stop and remain perfectly immovable at any depth, in perfect equilibrium, and for any length of time. 7. That it walks on the sea bed, moving freely on an ingenious single wheel, propelled by an electric-driven screw."

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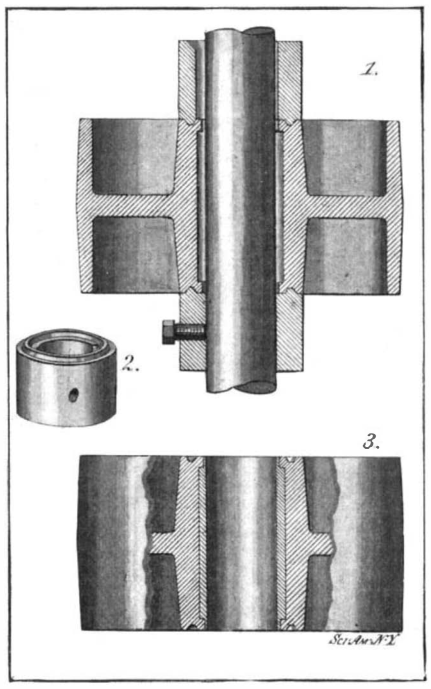
BABBITTING DEVICE.

Our readers are well aware of the fact that in order to provide a better wearing surface in the hubs of loose pulleys, idlers, etc., Babbitt metal bushings are often used. Since this metal does not appreciably contract or expand when subjected to varying temperatures, the bushings are ordinarily cast in the hub about the shaft, and used without subsequent turning or boring. The most important requirement of this process is that the pulley be held in proper central position relative to the core or shaft. Provision for this is made in a device invented by Mr. John N. Schumacher, of 634 Washburn Avenue, Chicago, Ill. This device is illustrated in the accompanying engravings. Fig. 1 shows the pulley and shaft held in proper position preparatory to the babbitting process. Two collars are fitted on the shaft, one at each end of the hub, and are securely held in place by set screws, as shown. Each collar is provided at one end with an annular rib adapted to fit snugly into a corresponding recess or seat in the hub of the pulley. The upper collar, which is shown in Fig. 2, is provided with a pouring channel leading to the bearing recess in the hub, and a vent channel is formed in the collar on the opposite side. With the several parts in the position shown in Fig. 1, the Babbitt metal is poured in through the pouring channel, then it flows into and fills the recess around the shaft, while the lower collar prevents the escape of the metal from the recess. Air can escape from the recess through the air vent, so that the metal forms a homogeneous bearing, as shown in Fig. 3, thereby avoiding undesirable blowholes. By having the ridges on the collars engaging seats on the ends of the hub, the latter is held in perfectly true position relative to the shaft.



BABBITTING DEVICE.

THE FESSENDEN WIRELESS TELEGRAPH SYSTEM.

BY A. FREDERICK COLLINS.

The long and thorough course of investigation instituted by Prof. Reginald A. Fessenden, during his work for the U. S. Weather Bureau, in an attempt to find a detector of electric waves more sensitive, accurate, and rapid than the ordinary coherer, has culminated in a new system of wireless telegraphy.

The disadvantages of the ordinary coherer are manifold and have been discussed in all their phases during the past two years, while its good features may be summed up in the statement that it combines, to a remarkable extent, a certain degree of sensitiveness with a sufficient range of variability of resistance to operate a relay; but for rapid telegraphy, syntonic telegraphy, and telegraphy over extreme distances, in this very quality lies its greatest fault.

The magnetic effect of electric oscillations on a bar of iron or steel has been known a great many years, and based on this principle of magnetic permeability Fessenden designed his first detector, as described in the SCIENTIFIC AMERICAN of October 4, 1902, and for which the inventor obtained letters patent; but his *chef-d'œuvre* is a detector at once simple in construction, sensitive to feeble radiation, and rapid in its self-restoring qualities.

The detector is shown diagrammatically in Fig. 1, and is called a "current-actuated, wire-responsive device." It consists of a silver wire one-tenth of an inch in diameter and having a platinum core about three one-thousandths of an inch in diameter, drawn down until the external diameter of the silver wire is about two one-thousandths of an inch in diameter and the platinum wire is about six one-hundred-thousandths of an inch in diameter.

A short piece of the platinum-cored wire is bent into a U-shaped loop, Fig. 1, and its terminals attached to the leading-in wire, 2; the tip of the U-loop is immersed in nitric acid and the silver dissolved away from the platinum, the object of this procedure being to reduce its heating capacity to the lowest possible value. Further, to facilitate the radiation of heat, the detector is inclosed in a silver shell, and this is held in position by means of the glass brace, 4, attached to the leading-in wires. The shell, 3, in turn is inclosed in the glass bulb, 5, which is finally exhausted. The resistance of the U-loop detector varies from 30 to 600 ohms, and is exceedingly low considering the enormous resistance of a coherer. The device shown in Fig. 2 is arranged to hold eight detectors, so that in case one is burned out or otherwise disabled, a new detector is brought into service by merely turning the key, 6. In tuning this system to its complementary station, Fessenden does not employ the usual capacities in the form of condensers or inductances in the form of coils; by arranging a number of parallel wires in a box containing sufficient oil to cover them, and by means of a sliding contact, the capacity and inductance may be proportioned so as to obtain a sine wave, which is necessary to give good resonance effects. The complete sending and receiving system is shown in the diagram, Fig. 3, and the photographs, Figs. 4 and 5. In the diagram, 7 represents the antenna, having a large capacity, i.e., formed of a number of vertical wires in which the ratio of inductance capacity is smaller than in a single wire; 8 is the induction coil generator, having its spark-gap at 8*a*; a switch, 9, is arranged in the circuit of the induction in the place of the key ordinarily employed to make and break the primary current. The key, 10, throws the open-oscillator circuit out of tune when messages are being transmitted, for the coil is then kept continuously in action. This is done by means of the finger with which the key 4 is provided, and which is pressed into contact with one of the wires, 11, thus forming a shunt around a portion of the tuning-grid, 12; the contacts, 13 13, are movable and connect each pair of wires, so that the ratio of capacity to inductance per unit of length is the same, as nearly as possible, for all portions of the oscillator circuit. These movable contacts consist of bars having grooved wheels, the former being mounted in spring arms, shown in Fig. 3, fastened to adjusting blocks, and by this arrangement the contacts are held into electrical connection with the wires, 11, 11.

The receiving circuit includes the antenna, 7, the condenser, 14, the tuning grid, 15, constructed upon the same principle as that described in connection with the transmission circuits, and the detector, 16; and these are connected in series with one another, but in shunt with the spark-gap, as shown in Fig. 3.

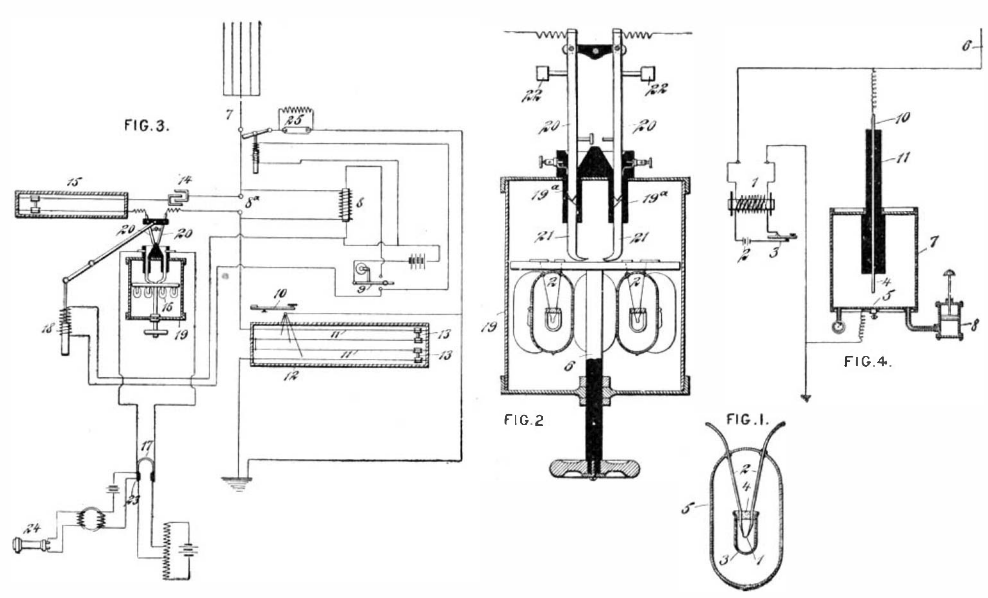
Instead of the usual Morse register, a pair of head telephones, 17, is employed to translate the received impulses into the regulation dots and dashes. In the circuit with the receiver are two cells having a slightly different E. M. F., and connected to oppose each other.

These constitute the essential parts of the Fessenden system, and all other devices shown are auxiliary ones for the purpose of protecting the instruments from lightning discharges, to facilitate the switching of currents, or for the purpose of obtaining call signals. For instance, the detector, 16, is cut in or out of the receiving circuit by the operation of a solenoid, 18. The turntable carrying the detectors is inclosed in a metal case, 19, Figs. 2 and 3, the leading-in wires passing through tubes of insulite, 19*a*; the rods, 20, are movable and extend through the insulating tubes and form contacts with the rods, 21. The weights, 22, are used to draw the contacts, 21 and 20, into connection when the solenoid is rendered inactive.

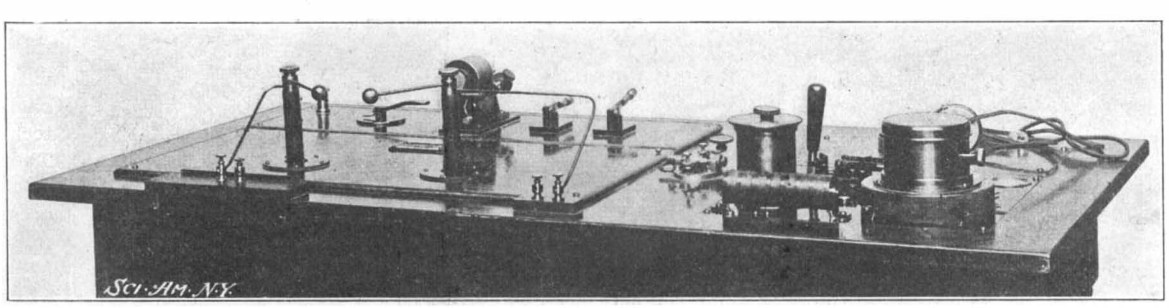
The detector employed for calling is made less sensitive than those for receiving messages; this is done by making the loop, 14, longer and thicker than usual, so that it will retain its heat longer, when the effect of the oscillations will be rendered cumulative, and the call may then be made by telephone, ballistic galvanometer bell, or other responsive device. To render the call more decisive, a microphonic contact, 23, i. e., an appliance on the coherer principle, with the transformer, 33, and an indicating mechanism, 24, is inclosed in the circuit.

Fessenden employs a lightning arrester, formed of filings made from an alloy of 95 per cent of gold and 5 per cent bismuth, placed between terminal conductor plugs ⅛-inch in diameter; it is represented in 25, Fig. 3. To further exclude extraneous wires and the potential differences created between the antenna and the earth, and to which are due false signals, especially in this type of apparatus, the system of circuits shown in Fig. 3 is used. It consists of two circuits, each of which is tuned to the other as well as with the apparatus of its complementary station. When sending, the two circuits are operated in parallel.

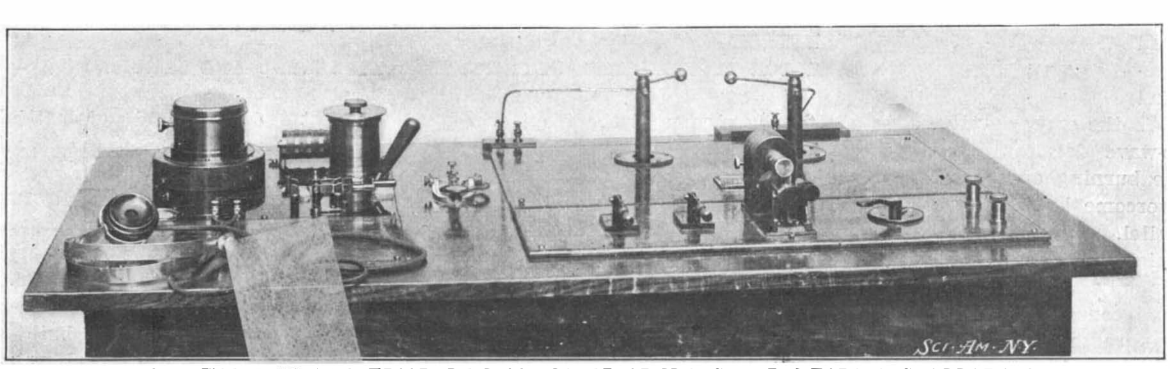
The accompanying photographs show the practical construction of the Fessenden apparatus, and are front and rear views respectively. Much of the apparatus, including both the transmitter and the receiver, is incased in the table; thus the induction coil is hidden from view,



DIAGRAMS ILLUSTRATING THE FESSENDEN SYSTEM OF WIRELESS TELEGRAPHY.



FESSENDEN COMBINED SENDING AND RECEIVING APPARATUS, REAR VIEW.



FRONT VIEW OF THE FESSENDEN COMBINED SENDING AND RECEIVING APPARATUS.

but is of the Queen make, the adjustable vibrator, the oscillator balls, the adjustable mica condenser, and the interlocking switches are placed on the surface of the table for convenience of manipulating, as is the reversing lever, the case inclosing the wire detectors, and the key.

Another invention of Fessenden's of more than passing interest, is shown in Fig. 4, and has for its object "the maintenance of a certain definite relation between the resistance, inductance, and capacity of the oscillator system, regardless of the potential employed, and securing such a relation between the sparking potential—i. e., the potential required to break down the film of air forming the gap—and the radiation."

To accomplish this result, the spark is made to take place in compressed air, and its functions may be followed by referring to the numerals in the figure; 1 represents an induction coil of the ordinary type, 2 the source of current, 3 the key, 4 one terminal of the spark-gap and the opposite is formed by the plate 5; 4 and 5 are connected to the antenna and earth respectively, as in all fundamental systems; 7 is a cylinder connected to the pump 8 and by which air or gas may be kept at a constant pressure in 7.

Now when the spark is made to traverse the air-gap between the terminals 4, 5, the coefficients of the oscillator circuit, namely, its inductance (L), capacity (C), and resistance (R), must conform to the formula $R^2 > 4\,L/C$. In wireless telegraph practice it is necessary, in employing a spark-gap of free air, to diminish the striking distance between the balls to a centimeter or less, for the reason that unless this is done the conditions of the above formula are not fulfilled, and then R^2 becomes *greater* instead of less than $4L/C$, and the current instead of being oscillatory becomes unidirectional; but when the Fessenden's compressed-air spark-gap is employed, the oscillator balls may be separated considerably beyond that prescribed by theory, and the same effective radiation produced, without resorting to an apparatus of larger dimensions, by merely increasing the density of the dielectric formed by the insulation of air.

A phenomenon is produced by this arrangement that is new in physics and exceedingly interesting, e. g., if a spark four inches in length is caused to pass between the terminals 4 and 5 at a given potential when the pressure of the air in the cylinder is equal to that of the atmosphere, and then if the air is compressed to fifty pounds per square inch above atmospheric pressure, the striking distance of the spark will be diminished to one-fourth of an inch—assuming the potential of the changing current remains the same—and there will be no appreciable increase in the radiation of electric waves, although the shunt resistance of the spark gap is reduced to one-sixteenth of its former value; but when the compression of air in the chamber represents sixty pounds there is at once a marked increase in the effective radiation, and at eighty pounds the energy emitted in the form of waves is nearly three and a half times greater than it was at fifty pounds, and the emission of waves becomes practically proportional to the electromotive force employed to change the oscillator. If the improved potential is doubled, the effective radiation is also doubled, and so on, the described curves showing that when a certain critical pressure of the air is reached, the effective radiation of electric waves is increased proportionally as the potential is increased.

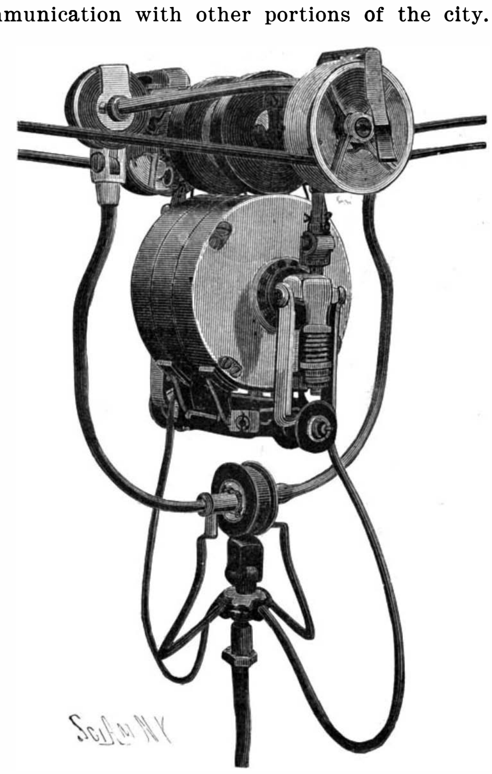
These are but a few of the many facts embodied in the thirteen patents which were recently issued to Fessenden, but serve to illustrate his system and method. The subject in all its phases is so broad and the literature so limited that these patent reports read like a new romance.

Among the most recent tests made by the Fessenden interests were those for the navy. The system is now being placed on the market by Messrs. Queen & Co., the instrument makers of Philadelphia, and bids fair to be one of the foremost systems, both domestic and foreign, for wireless telegraphy. In the early development of the Fessenden electric-wave detector, some difficulty was encountered by the burning out of the loop. This has been entirely overcome by putting a hundred loops or more in parallel. This does not decrease its sensitiveness, as might appear at first sight, because though each loop is only heated up one-hundredth as much as before, and consequently only changes its resistance one one-hundredth as much as before, yet there are one hundred of the loops instead of only one, and each current being changed one one-hundredth as much, there will be one hundred times the amount of current and therefore the total change is exactly the same as it would be with a single loop.

ELECTRIC TROLLEY WAGONS AND OMNIBUSES.

BY FRANK C. PERKINS.

The peculiar character of the streets of many German and French cities renders it often impossible to install electric tramway systems. With the development of the automobile, however, a means has presented itself of placing these thoroughfares in better communication with other portions of the city. The



THE AUTOMOTOR TROLLEY.

systems of transportation to which we refer may be regarded as a combination of the electric car and the omnibus, for the vehicles derive their motive power from an overhead current, but do not run on steel rails.

Two such systems of electric trolley omnibuses have been proposed. One bears the name of its inventor, Mr. Max Schiemann, and is exploited by Siemens & Halske, of Berlin, and the other is known as the Lombard-Gerin system. The Schiemann system has been operated on a line extending from Königstein-Hütten through the romantic valley of the Biela. The length of the line was originally 2.8 kilometers, but it has been extended 9 kilometers, and now operates between Königstein-Hütten and Königsbrunn. The roads are very good, so that a speed of 12 kilometers per hour is easily maintained. Auto-omnibuses, motor-cars, and trailer cars are used, the first being employed for the transportation of light express matter and the latter for the hauling of coal and the like. Steering is effected by means of the front wheels of the first car of a train, since it has been found that the wheels of the second car will track after those of the first. The trolleys employed have a sliding contact, one trolley being placed at each end of the bus or motor car.

In passing an ordinary conveyance the omnibus is simply steered to the right or to the left a possible distance of about three meters from the trolley line. In passing another omnibus coming in an opposite direction, it is of course necessary, under the circumstances, to remove the trolley poles from one conveyance while the other moves along. The motor-cars used to haul the freight trailers weigh four tons each and have a carrying capacity of one ton. Each trail car weighs 1.5 tons empty and 5 tons loaded, from which it follows that the total weight of the loaded trains is 10 tons. The seating capacity of an omnibus is about 26 persons. The cost of construction is about $800 per kilometer.

With the Lombard-Gerin system, readers of the Scientific American are not unfamiliar. The system utilizes two overhead wires; one positive and one negative. Instead of driving the vehicles entirely by motors connected up with the axle, an auxiliary device called an "automotor trolley" is used which runs along the overhead wires. In other words, the vehicles are towed along by a self-propelled motor trolley. The towing trolley is driven by a 3-phase induction motor suspended between two conducting trolley-wires. The motor is carried in a frame which also has bearings for the two trolley-wheels. Motion is communicated to the trolley-wheels by the revolving field of the motor.

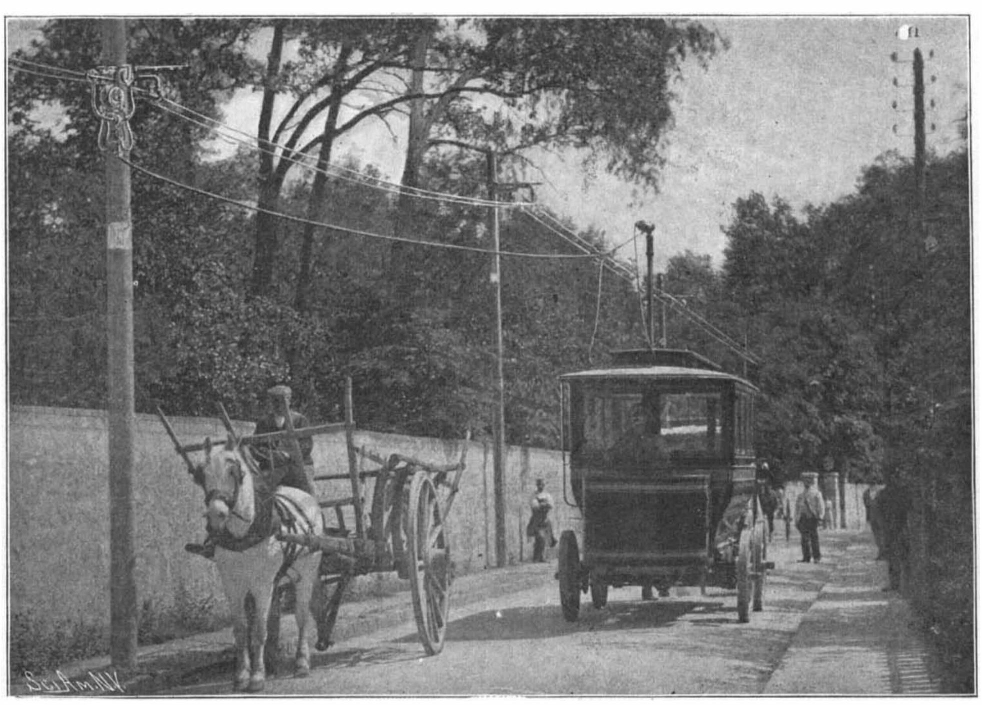
The current is fed to the trolley-motor from the omnibus motor, which latter may be regarded as a combined rotary transformer and direct current motor. The trolley motor travels with a speed somewhat in excess of that of the car itself. From this peculiar arrangement of causing it to lead the way, as it were, the Frenchmen have termed the auto-trolley "the blind man's dog."

The Lombard-Gerin system has been tried on a line extending from the village of Samois to Fontainebleau, a distance of about five kilometers. On this line the car or omnibus is driven by a double motor operating at a tension of 500 volts direct current. The time taken for the journey is about twenty minutes. The total energy used is 543 kilowatt hours or 64 kilowatt hours per car kilometer.

It is stated that the low expense of equipment for a line of this character renders it of particular value for country districts, where an expensive track construction would be prohibitive on account of the small amount of traffic.

The Compagnie de Traction par Trolley Automoteur gives the ratio of expense to receipts as 58 per cent and quotes the following as the expense of operation for this kind of line:

The electrical energy, at 25 centimes per kilowatt hour, amounts to 1,355 francs on 25 centimes, or 0.161 centime per car kilometer. The repair expenses of the carriages are given as about 776 francs, or 0.092 centime per car kilometer; and the working of the omnibuses with one man per vehicle is given as 456 francs, or 0.054 centime per car kilometer; while the general expenses amount to 307 francs and 55 centimes, or 0.036 centime per car kilometer. This makes a total expense of 2,895 francs or 0.343 centime per car kilometer.



THE LOMBARD-GERIN MOTOR TROLLEY LINE BETWEEN FONTAINEBLEAU AND SAMOIS.

An English Idea of a Safety Lamp.

A prize of £50 or $250 was offered at the Grocers' Exhibition at the Agricultural Hall in London recently for a safe lamp for burning kerosene, that is, for those who use lamps as missiles.

The lamp was not to cost more than 1s. 3d. at wholesale. The kind of lamp which is looked upon in London as a "safety lamp" is interestingly set forth in the following abstract from the Petroleum Industrial and Technical Review:

The desire of directors was to produce a cheap lamp, which could be sold even in the poorest districts, and which could be used with the maximum of safety, and one which required the minimum of technical knowledge in handling. They did not require a lamp which needed the inventor sold with it in order to enable it to act; they wanted to find a lamp that would be safe when a man came home drunk at night. One of the most serious problems of London was as to how they could protect those afflicted with drunkenness against themselves. Therefore, they wanted to find a lamp which, if thrown by a drunken man at his wife or children, would automatically put itself out, so that the man, if he unfortunately inflicted any injury on his wife, should not, at the same time, burn down his house and set fire to his children.

Among the latest aspirants for flying machine honors is Father Felix M. Lepore, of the Mount Carmel Italian Church, near Denver, Col. He has, he says, sufficient money to build a ship after his design which has been supplied by capitalists whom he has interested. His airship is bullet proof, he claims.

Correspondence.

Typesetting on an Ordinary Typewriter.

To the Editor of the SCIENTIFIC AMERICAN:

A correspondent inquires in your last week's issue why a typewriting machine could not be invented that would write matrices suitable for casting printing surfaces, and thus do away with hand composition and expensive typesetting machinery.

If your correspondent were a printer, he would see at once that the lines would have to be justified, or made of equal length. If he thinks that can be done on a typewriter without running it through the machine twice, let him try it. At any rate, a letter-by-letter impression in any sort of matrix must be a failure, from the impinging of the "shoulder" upon the neighboring letter; in other words, the impression of each letter would spoil the preceding one, and each succeeding line would crowd the one before it out of shape. In matrix-making, the entire impression must be made at once, and it is not likely that this condition can ever be changed.

I think, however, that the gentleman is near the right track. The days of high-priced type-setting machinery are numbered. The subject is an important and fascinating one. Let me suggest a line for inventors to work upon.

Some years ago a machine called a "printing typewriter" was invented. The lines written by this machine look as though printed from types, being sharp, clear, black, spaced according to size of letter, and by means of a system of rewriting are perfectly justified as in ordinary typework. (I am in no way pecuniarily interested in this invention, and now have no idea where the machine could be found.) Cannot a cheap and rapid process of photo-engraving be devised for forming printing surfaces by reproducing this machine typography? A special adaptation of the halftone process to plain black-and-white effects, and there is the whole secret. The successful exploitation of this idea would bring about a great reduction in the cost of printing. Half a dozen such typewriters, with the necessary accompanying materials, could "write up" the SCIENTIFIC AMERICAN each week, the whole typographical outfit costing probably a few hundreds of dollars.

Let the inventors go to work.

LINDSAY S. PERKINS.

Department of the Interior,
Washington, D. C., December 20, 1902.

Why Typesetting Cannot be Accomplished on an Ordinary Typewriter.

To the Editor of the SCIENTIFIC AMERICAN:

Mr. L. A. Bonnet's suggestion, in your last issue, that plates for printing be prepared from plastic sheets on a machine analogous to and costing but little, if any, more than a typewriter, would deserve serious consideration were it not for the fact (to which he himself alludes in the course of his remarks) that it is practically impossible to produce in that way plates having an even type surface. If I am not greatly mistaken, it was the National Typographic and Printing Company that exhibited at the Centennial Exposition in 1876, at Philadelphia, a machine intended to do this very thing, and which it failed to do. The company afterward submitted it in its crude state to Ottmar Mergenthaler for a solution of the difficulty. This he admitted his inability to accomplish; but assured them that while he could not make *that* machine work, he could make a machine that would. From that moment commenced a series of experiments that will ever be memorable in the history of mechanical achievements. I was present at the small shop in Baltimore when Mergenthaler's first machine was tested, and have yet a line of type cast from my own manipulation of the keyboard. It is hardly necessary to say that it bore scarcely any resemblance to the present machine, beyond also having a keyboard. In it the letter faces or matrices were sunk by steel dies into the edges of a series of brass rules or strips tapering in thickness from a capital W to the thinness of a period. Those were arranged to hang vertically, side by side, by fine chains (regular jewelers' fine chain, for want of time to make anything better) over a series of grooved pulleys, the thick and the thin ends alternating, and each provided with a suitable counterpoise. When, by working the keyboard, these rules or strips had been some raised, some lowered, so as to bring the line-forming letters in line, the whole series was firmly clamped together so as to form one compact mass, and then lowered to a close contact with the mold, of which it then formed the sixth side. A touch of the lever admitted the fluid metal, and the line was cast. No distributing mechanism was required, each rule automatically returning to its proper position on being released. This was the acme of simplicity, and had it been possible with it to secure that exact evenness of type surface without which good printing cannot be done, Mergenthaler need probably have gone no further, and millions of dollars would have been saved to the company. But it was not; and the inventor reluctantly abandoned the continuous for the separate matrix, only succeeding after years of most patient effort and intelligent research.

From the very nature of the plan suggested by Mr. Bonnet it is evident there would be a twofold difficulty at the outset. The impressibility of the matrix material would hardly be constant, hence the same stroke would not twice in a hundred times produce the exact depth of impression; and the varying surfaces of the type would require each a different force of impact. Now, these are the very obstacles which millions have been spent to remove, and spent in vain. One may then be pardoned for a little skepticism in regard to the typewriter system of printing plates.

WILLIAM GIUSTA.

Washington, December 21, 1902.

Another Method of Killing Hawks.

To the Editor of the SCIENTIFIC AMERICAN:

In your November 1 issue appears an article, "Novel Method of Killing Hawks," attributed to the Yankee ingenuity of a north Louisiana farmer, whose method is rather unique, and suggests to my mind a more successful experience by a Jefferson County, Tenn., farmer, residing eight miles from Morristown, Tenn., who, desiring to protect his birds and poultry from ravages of the hawk, conceived the idea of using a steel trap instead of a scythe blade set upon a pole, such a trap as is used by fur hunters in taking small animals, such as the muskrat. The pole supporting the trap on its top was set up at the end of a hedge, with the result that during the summer of 1901 he caught twenty-eight hawks and owls. While I do not remember the exact number of each kind caught, nor the time in which they were all taken, should any reader of the SCIENTIFIC AMERICAN desire exact and authenticated data in substantiation of the foregoing, it will be furnished upon application to the undersigned. He was no "Yankee," either.

J. E. HICKMAN.

Knoxville, Tenn., November 5, 1902.

Do Mussels Move?

To the Editor of the SCIENTIFIC AMERICAN:

In your paper of November 1, I notice an article with the heading "Do Mussels Move?" I had an opportunity some years ago to observe the fresh-water mussel (*Unio margaratiferus*) in a small lake in Maine. The water of the lake was being quite rapidly drawn down, and I came upon a little strip of sandy beach upon which were several grooves leading down into the water. On examination I found them to be about half an inch deep, possibly three-quarters of an inch wide, and in the lower end of every one was a mussel standing on edge, with the hinge uppermost; and careful observation, continued for half an hour or more, convinced me beyond a doubt that the furrows were plowed by the mussels in their endeavor to keep themselves submerged. Some of these furrows were a foot in length, and I calculated that the rate at which the animal advanced could not be much, if any, more than an inch per hour, though possibly it may have been slightly more rapid.

I have seen the scallop, which is very common on the coast of Massachusetts, throw itself up from the bottom, and with a lateral, side-to-side motion, swim a foot or more, going over a low tuft of seaweed or eelgrass in the way. J. O. THOMPSON.

November 18, 1902.

THE HEAVENS IN JANUARY.

BY HENRY NORRIS RUSSELL, PH D.

The magnificent group of the winter constellations appears to great advantage in January. At the usual time of our survey—nine o'clock in the evening, in the middle of the month—Orion, the finest of them all, is nearly due south, about half way up to the zenith.

Those who are familiar with this group of stars will notice that the great red star Betelgeuse (or Alpha Orionis) is much brighter than it was last year. This star has long been known to be irregularly variable, but it rarely changes as markedly as at present.

A few years ago it was about as bright as Aldebaran, and last year, though somewhat brighter, it was distinctly fainter than its neighbor Regel. But now it is fully equal to Regel, if not to Capella—which would make it the brighest star, next to Sirius, in all our sky—and is more than twice as bright as it was a few years ago.

The line of Orion's belt points upward toward Aldebaran, and downward to Sirius. Above the latter is Procyon, and Castor and Pollux are higher still east of the zenith, while Capella is almost exactly overhead.

Perseus lies to the northwest of Capella, with Andromeda below, extending down toward Pegasus, which is low in the west. Aries is southwest of Perseus, and Cetus and Eridanus fill up the great region below.

The only conspicuous constellation in the east is Leo, which has not yet fully risen. Cancer and the head of Hydra lie between this and Procyon. Ursa Major is coming up in the northeast. Draco and Ursa Minor are below the pole-star, and Cassiopeia above it on the west.

The stars shine brilliantly enough on these clear winter nights, but it is probably not generally known that they are actually so bright as to cast shadows.

To be sure, we cannot see such shadows in the open air, but the reason for this is that the diffused light of the other stars, the Milky Way, and the general background of the sky (which is far from dark), completely drowns out the shadow cast by any particular star.

We can, however, easily get rid of most of this diffused light by going indoors. By closing all the windows of a room except one, and blocking up its aperture so that only a square foot or so is left clear, we may cut off almost all the diffused light. Under these conditions, the light of Sirius can be easily distinguished. If a sheet of white paper is placed in the path of the star's rays, the shadow of any object may be cast upon it and examined. It is advisable to have the screen as far as possible from the window, in order to diminish the diffused light. It is also well to have the window open, as the glass cuts off a considerable percentage of the light. The room must, of course, be quite dark, and as little light as possible should enter from the terrestrial sources. A street-lamp outside, or a light in an adjacent house, may make it quite impossible to see the faint light of the stars. One other precaution should be mentioned. The observer should remain in the darkened room for ten or fifteen minutes, so that his eyes may attain their greatest sensitiveness.

Though the light of other stars is naturally much fainter than that of Sirius, it is easy with a little practice to distinguish shadows cast by Capella, Regel, Procyon, and similar stars. Certain interesting features of these observations may be discussed in our next article.

THE PLANETS.

There are now four planets at once in the evening sky—Mercury, Venus, Jupiter, and Saturn—and several conjunctions take place during the month, though unfortunately some of them are too near the sun to be observed.

Mercury is evening star throughout the month. He is at his greatest elongation on the 17th—rather nearer the sun than usual, but correspondingly bright—and should be clearly visible in the southwest, shortly after sunset.

He is in conjunction with Saturn on the 5th, but both planets are too near the sun to be well seen. The conditions are better at the time of his conjunction with Venus on the 25th. He is 3½ degrees north of Venus, and Jupiter is only about 7 degrees away to the eastward. The three planets should make a fine group, best visible at about 5:15 P. M.

Venus is also evening star, but is too near the sun to be well seen till near the end of January, at which time she sets about an hour and a half after sunset.

She is in conjunction with Saturn on the 9th, with Mercury on the 25th, as already noticed, and with Jupiter on the 30th. On this last occasion the two brightest planets of our system are within a degree of one another, and the combination will be worth looking at, especially as the crescent moon will be near by.

Mars is in Virgo, and is rapidly becoming brighter as the earth overtakes him. On the 10th he passes near the star Gamma Virginis, at a distance of about a quarter of a degree. At this time he is due south a little after 5 A. M.

Jupiter is evening star in Capricornus. Saturn is too near the sun to be seen, passing through conjunction on the 21st, and becoming a morning star.

Uranus is morning star in Ophiuchus, and Neptune is in Gemini, visible all night, though not without a good telescope. His position on the 15th is right ascension, 6 hours, 7 minutes, 23 seconds; declination, 22 degrees, 18 minutes, north. Unless one has a very good star map he can only be identified by his motion.

THE MOON.

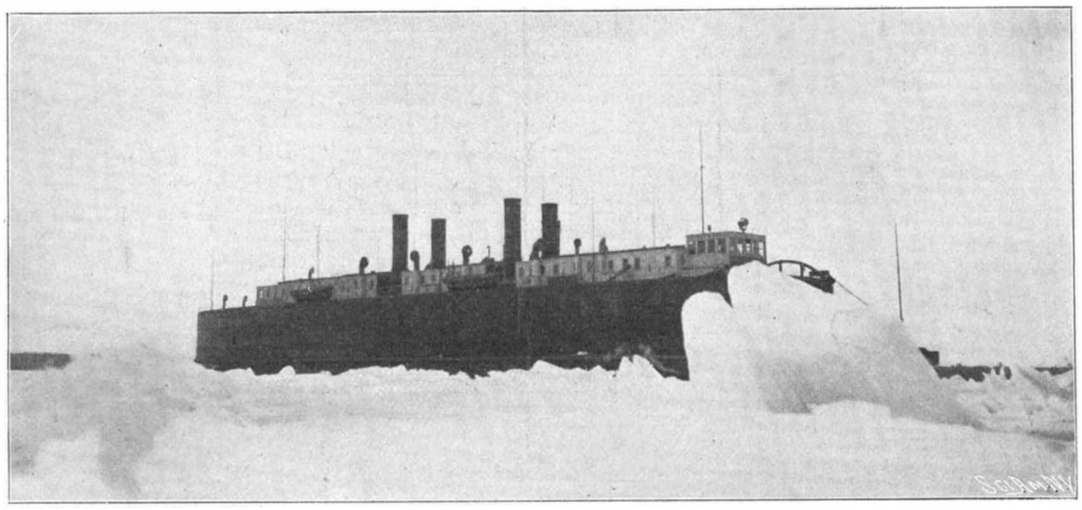
First quarter occurs at 5 P. M. on the 6th, full moon at 9 A. M. on the 13th, last quarter at 7 A. M. on the 20th, and new moon at 11 A. M. on the 28th. The moon is nearest us on the 12th, and farthest away on the 25th. She is in conjunction with Jupiter on the 2d, Neptune on the 14th, Mars on the 18th, Uranus on the 24th, Saturn on the 27th, Mercury on the morning of the 29th, and Venus and Jupiter on the evening of the same day.

Under the pressure of heavy orders, all records were broken during the month of October at the works of the Pressed Steel Car works, when 3,000 cars were turned out, the average for the 27 working days in the month being 111. The daily average for the past four months has been 107 cars. This company is having a plant built at McKee's Rocks for the manufacture of car trucks.

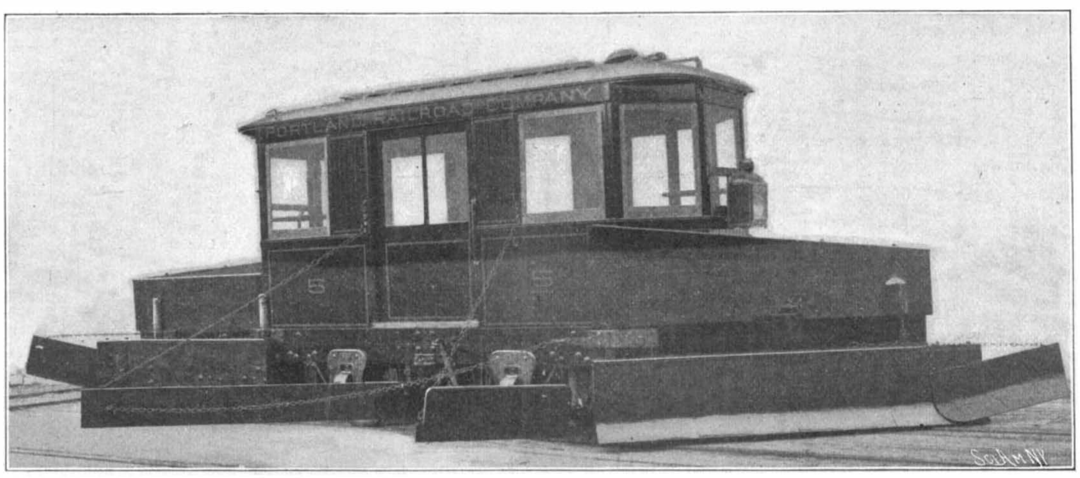
WINTER OBSTACLES TO TRANSPORTATION.

BY WALDON FAWCETT.

As American railroad traffic has increased in volume and the exigencies of operating conditions have rendered essential a rigid adherence to schedule in the movement of both passenger and freight trains, the problem of keeping the tracks sufficiently clear of snow and ice to guard against possible interruptions of or delays to traffic has increased in importance. Of late years much thought and the expenditure of large sums for special equipment have been devoted to the speedy removal of nature's barriers to traffic, and as a result a really marvelous degree of efficiency has frequently been attained in keeping lines of communication open under adverse circumstances.



A SAULT STE. MARIE ICE-BREAKER.



A TYPICAL SNOW PLOW USED ON THE ELECTRIC ROADS OF THE EXTREME NORTHWEST.

In the eastern part of the United States railroad tracks are seldom covered with snow to a depth exceeding two or three feet, and may usually be cleared by the employment of a wedge-shaped iron snow plow of the simplest form. Such plows vary in size from the mere scraper, little larger than the cow-catcher to which it is attached, to the ponderous plows in use by the Pennsylvania Railroad in the mountainous districts, and which almost equal in size locomotives of ordinary dimensions. In the case of all of these plows, the mode of operation is the same. The plow is forced forward by one or more locomotives, and by sheer force of impact makes a furrow, throwing the snow to either side of the track.

In the West, where snow constitutes a much more serious obstacle to railroad traffic than is the case in the East, the types of plows employed in the East proved inadequate. The first substitutes introduced were wooden shields of sufficient size to virtually overshadow the locomotives which pushed them. Then came the heavier device known as the "gouger"—a strongly-built box car with an immense flat scraper at its head, set sufficiently low to enable it to run under and into the snow like a wedge, and supplemented by wings set upon hinges and designed to assist in widening the opening made by the prow. The gradual increase in size of the "bucking" type of plow, as it was commonly denominated, continued until its culmination in what is known as the Congdon plow, a machine which requires the combined services of two or three of the largest locomotives for its successful operation.

With these plows it was the custom to "charge" snow drifts by backing the plow and engines a distance of one or two miles, and then hurling the entire mass forward at a speed which approximated sixty or seventy miles an hour when the huge ram struck the drift. Of course, this was a decidedly hazardous method of procedure, inasmuch as many drifts contain masses of solid ice in the center, and indeed the element of danger involved was strikingly evidenced some years since at Truckee, Cal., when a train of eight locomotives propelling a large plow charged a solid drift, with the result that the plow was completely crushed, every one of the locomotives was more or less damaged, and over half of the men comprising the aggregate train crew were disabled.

Experiences such as this quickly demonstrated to the Western railroads that some more effective and less costly method of battling with the snow must be evolved, and the rotary snow plow was devised. The rotary plow, although of very heavy construction, involving a weight of about one hundred tons, is based on a very simple idea. A large, staunchly-constructed car with armored sides carries in front an immense steel wheel fitted with blades somewhat resembling the propeller blades of the ordinary steamer. This wheel, which is about twelve feet in diameter and is set in a shield, is actuated at high speed by a steam engine within the car. In a chamber at the rear of the wheel, and connected with it, is a fan from which communication is effected by a spout, capable of adjustment to either right or left.

The operation of the rotary plow in a snow drift might be compared to the manipulation of a gigantic auger, and the snow removed from the track in front of the plow—the "borings," it might be termed—is driven out by the fan just as chips are expelled from a planing mill. A rotary plow will make its way through drifts at speeds varying from two to twelve miles an hour according to the solidity of the barriers encountered; but inasmuch as the snow removed by the plow is hurled a distance of from fifty to one hundred feet, a reasonably wide path is cleared. If a drift is encountered of such depth that the rotary plow is entirely buried in the mass, it is necessary to reduce the size of the embankment by hand-shoveling until a level is reached which will permit of the funnel from the fan clearing the snow and providing an outlet for the snow removed by the plow.

An important factor in surmounting winter obstacles to transportation is found in the snow sheds, which are employed to a greater or less extent on almost all western railroads. These sheds are necessarily of the staunchest timber construction, and some idea of the expenditure involved may be gained from the fact that one transcontinental line has on its road a total of thirty-two miles of snow sheds, costing, on an average, $64 a foot, or upward of $11,000,000 in all. In addition this railroad has during some seasons made outlays which have aggregated as high as $1,000,000 a year for the repair and maintenance of the sheds. Another costly means of affording protection from snow blockades is found in the construction on mountain sides of timber "glances," or huge fences of logs designed to divert snow slides from the railroad tracks. Dynamite cartridges are used to break up the miniature glaciers which occasionally form on railroad tracks in the mountainous districts of the West.

Very interesting, by way of contrast, are the methods of combating snow followed by the railroads of Great Britain. In season each of the principal English railroads places upon its payroll an immense force of "foggers," men who in foggy or snowy weather place detonators on the rails, in order to acquaint the engineers with the positions of the semaphores or spectacle glasses, the signal lamps being, as a rule, quite invisible under such circumstances. How heavy an expense is involved by this system be imagined from the fact that the Midland Railroad of England pays as wages to its "foggers" over $50,000 a year, and the one million detonators exploded between September and February of each year cost the company about $15,000 additional. The London and North-Western Road frequently uses as many as 12,000 detonators in twenty-four hours. All of the Scotch lines and the North-Eastern Railway of England own regular snow plows, but most of the other British lines utilize improvised affairs pushed

A ROTARY PLOW IN TWENTY FEET OF SNOW.

THE COLORADO AND SOUTHERN RAILROAD'S ROTARY PLOW AT WORK EAST OF ALPINE TUNNEL.

by two or three locomotives. The regular snow plows are all of the pattern designed for "bucking," the rotary plow being unknown in England. The heaviest English plows do not exceed thirty tons.

A problem kindred to that of snow fighting, namely, battling with ice, is presented each winter to those American railroads in the vicinity of the Great Lakes, the track systems of which are divided by some portion of the inland waterways. For instance, whole trains of freight and passenger cars are ferried across the Detroit River at Detroit, and across the Straits of Mackinac in northern Michigan, while an even longer link is found on Lake Erie, where "car ferries" operate the year round between Conneaut, Ohio, and a port on the Canadian shore opposite. Solid fields of ice are frequently encountered by these vessels, and they are compelled to plow their way through the frozen fields.

The plan employed for breaking up the ice in the pathway of one of these powerful steamers, especially constructed for the purpose, is a modification of the idea exemplified in the rotary snow plows. Propellers are fitted at the front of the vessel as well as at the rear, and the rapid revolution of these screws results in a violent agitation of the water, which, exerting an upward pressure on the expanse of ice, rends it asunder. This same fundamental plan has been adopted in the case of the famous Russian ice-breaking steamer "Ermak," designed to keep open during the winter some of the more northerly ports of Russia, and in the case of the car ferries which form connecting links in the Trans-Siberian Railway, just as do the similar vessels operated by American railroads having termini on the Great Lakes. The largest of these Russian ice-breaking car ferries will accommodate but twenty-five loaded cars, while the American ferries of the largest size will each accommodate about thirty-four cars.

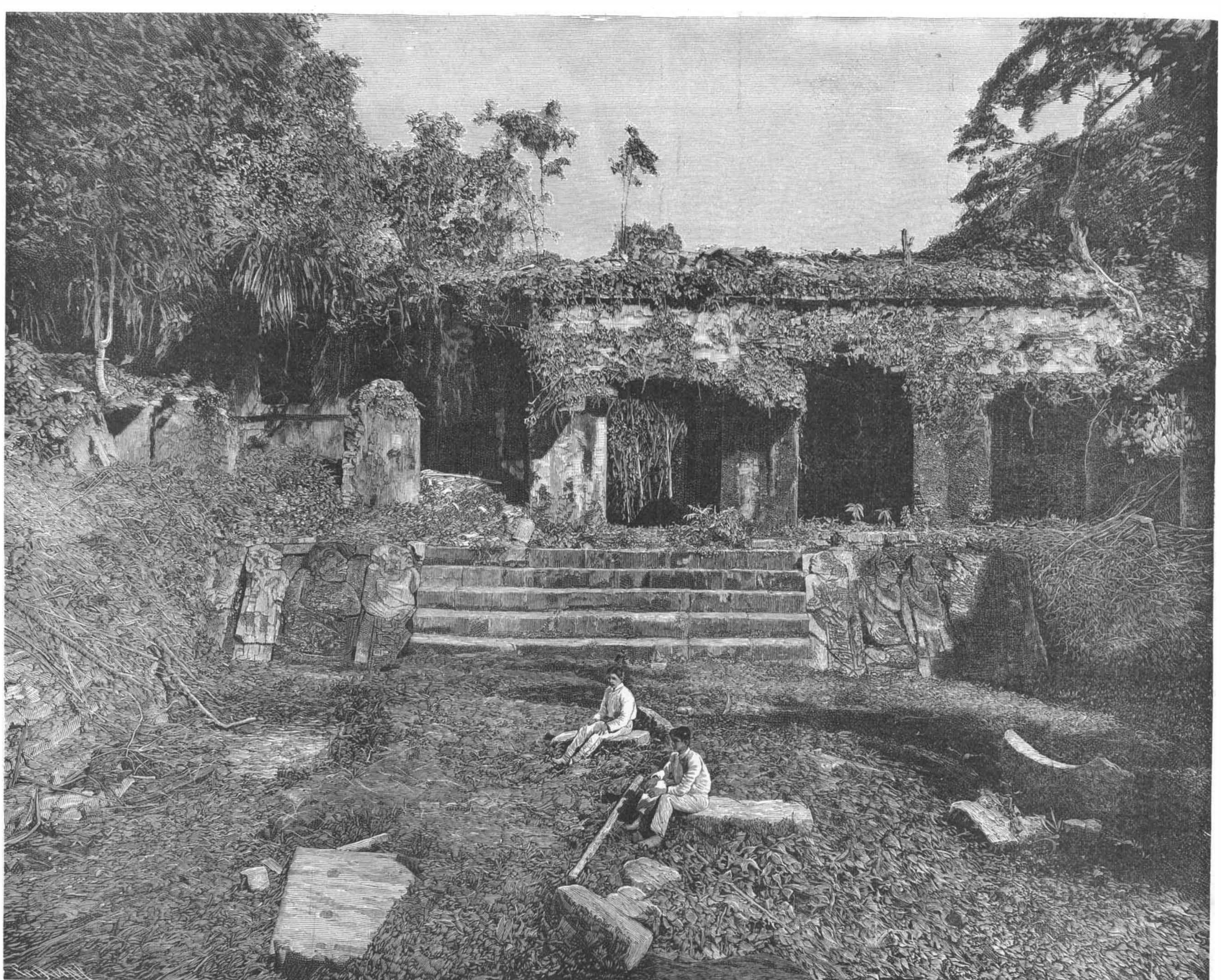
A perhaps more commonplace but not less important phase of the removal of obstacles to transportation is found in the clearing of the streets of a city after a heavy fall of snow. The methods followed in New York city, where any interruption to traffic would be especially disastrous to the commercial interests of the entire country, are especially interesting. As many as 10,000 men have been engaged at one time in removing the snow from the streets of the metropolis. An average snow storm costs the city at least $75,000. When the fall approximates, say, 400,000 cubic yards, as many as 3,600 extra shovelers are employed, and fully 3,000 carts and trucks are brought into service for the removal of the snow. In all large cities the street railway companies are required to remove the snow from the tracks, and usually from the pavement for a certain distance on each side of the track. As a rule, the street railway lines make use of wedge-shaped scraper-like plows, supplemented in many cases by large power sweepers.

A CARVING FROM THE RUINS OF PALENKE.

THE ANCIENT RUINS OF PALENKE.

BY ENOS BROWN.

A traveler who recently visited the famous ruins at Palenke, State of Chiapas, Mexico, laments the changes which time and the elements are gradually making in their appearance and condition. Nothing has ever been done by the Federal Government to preserve these impressive monuments of the highly cultured race who constructed them and of whose history and origin but little is known. The climate of the region in which the ruins are situated is the direct opposite of that of Egypt, inasmuch as the rainfall at Palenke has been known to amount to 200 inches a year. The air is humid and encourages decay and at the same time stimulates the rapid growth of the vines and creeping plants, which are disintegrating the walls and pavements and will eventually level them to the ground. So dense is the foliage surrounding the ruins, that light from the sun is almost totally obscured. The photographer who was employed by the Mexican government to take pictures of the ruins could accomplish his object in some instances only by means of a flash light. The ruins of Palenke are about 200 miles from the port of Frontera and are reached by steamer up the Tabasco River to San Juan Bautista and thence by trail. The group all lie within a radius of 2,000 feet, and consist of nine distinct structures, of which the "palace" is the largest and most central. The ruined buildings consist of temples, pyramids, aqueducts, and edifices whose purpose is not yet ascertained. The temple is the largest of all, and upon it the ancient builders lavished all their art. It includes a court and balconies, as well as great corridors in which tablets in bass-relief are fastened into the walls. Sculptures representing battle scenes and events of the nation's life are carefully depicted. From them the physical characteristics and domestic habits may be correctly ascertained. The dimensions of the "palace" are great. Its length is 238 feet, and breadth 180 feet, and it is elevated on a mound 310 feet long, 260 feet wide, and 40 feet high. The material used was stone, many blocks of prodigious size being used, and all joined together with mortar. As great architectural ability was displayed by the builders of the edifices at Palenke as was shown by the architects who erected those of the Nile. How it was possible for a primitive people to fashion, convey, and sculpture such



THE RUINED TEMPLE OF PALENKE.

immense stones as were employed is the wonder of modern archæologists. It would seem that the same people were the builders of these structures found at Milta, Mayapan, Tula, as well as at Palenke, a race which covered Yucatan and the Southern States of Mexico with mighty temples.

A French scientist with a lively imagination and unusual powers of observation credits the "Toltecs" with building these ancient temples, and fixes the seventh century as the period of their erection, but these confident assertions are doubted. Others place the era in which they were built as early as the date of the pyramids of Egypt. However, it seems to be proved beyond a doubt that many centuries before the discovery of America these ruins were in existence. It is not believed that Cortez or those with him knew of the Palenke ruins, though that conqueror must have been close to them at one time. Europeans first heard of them in 1750, but it was not until 1787 that they were explored. The key unlocking the mysteries hidden in the hieroglyphics which are carved on hundreds of tablets may some time be discovered, and the history of a great race of people and their origin be known, but their successors who now inhabit the region have no traditions that can aid the inquirer.

The ruins of Palenke should be preserved, and the Mexican government owe that much to the world. If it were possible to clear the timber away and destroy the growth of vines which is rapidly overwhelming them, these interesting relics might be saved for the future. They have so far resisted the effects of time and physical convulsion, but must eventually succumb to the ceaseless, persistent, and silent assaults of an overwhelming tropical growth.

A CURIOUS MUSHROOM GROWTH.

Prof. F. S. Lamar, who fills the chair of biology at Wilmington College, Wilmington, Ohio, sends us the accompanying picture of a colony of eighty mushrooms growing in a circle, twenty-four feet in diameter. A few had been trampled down by pasturing cattle, so that the picture reveals many a gap which would otherwise be filled.

In the wooded pastures where this circle of mushrooms was found, about four miles from Wilmington College, Wilmington, Ohio, were several other circles, some larger than this one, but not so well preserved at the time Prof. Lamar took the picture. Some of the fungi illustrated measured ten inches across the top.

Prof. Lamar explains this curious phenomenon by stating that since mushrooms derive their nutriment from organic matter, they soon exhaust the soil in which they grow. The spores that fall within this exhausted area must, therefore, perish. Hence, where one mushroom grew one year a group may grow the following. The soil will then become exhausted within this area, and the next year, if conditions are favorable, a circle of mushrooms will be produced. Thus, year after year, the circle will increase in diameter. Rarely, indeed, however, is a circle produced so large and so geometrically perfect as that illustrated.

A CURIOUS MUSHROOM GROWTH.

Prof. Lingle's Study of Life.

About a year ago, it will be remembered, Prof. Jacques Loeb startled the scientific world by his statement that the vital force of life comes from the electric forces and the food which is eaten, and not from heat. Prof. David J. Lingle, also of the University of Chicago, now steps to the fore with an equally startling announcement. He states that it is not only salt, or sodium chloride, which stimulates and causes heart action, but that oxygen gas is often a more important factor in sustaining heart action. While experimenting with a strip of turtle's heart which he was moving from a vessel containing sodium chloride, he noticed that the beating of the strip was greatly increased when it came into contact with the air. Noting this, he experimented with a piece of the ventricle of a turtle's heart. When it ceased to beat he put it in a solution of salt, and then put the strip into a jar of oxygen gas. Here the beating was sustained for seventy-two hours.

News is received from abroad that the Allgemeine Elektricitaets Gesellschaft has formed a combination with the Union Elektricitaets Gesellschaft, capitalized at $85,000,000. The step is the result of a crisis in the German electrical industry. After the sudden rise in electrical industries, it was found that the manufacturing capacity had far outrun the market's demands; it was therefore decided to organize a combination after the American practice. Various attempts were made by the Allgemeine Elektricitaets Gesellschaft to form an organization, but the other companies demanded too high a rating in the combination. With the alliance thus formed there is only one great rival firm left to compete with, and that is Siemens and Halske.

How the Scientific American Frustrated a Perpetual-Motion Fraud.

In the issue of the Scientific American of July 1, 1899, we published an article in which a typical perpetual-motion fraud was exposed. The machine there described was exhibited by one J. M. Aldrich, and on the strength of its wonderful performances he obtained no little money from those who desired to secure an interest in its commercial introduction. But the fact that the motor, so far from running perpetually, revealed a tendency to slow up now and then, raised such suspicion that Aldrich was arrested and detained for some three or four months in a jail. The model was afterward sent to the Patent Office, where the perpetual motion was traced to its time-honored source—a concealed spring.

Prof. G. P. Singer, of Lock Haven, Pa., sends us a clipping from a local paper in which a kindred fraud came near being perpetrated. It was due primarily to the fact that Prof. Singer is blessed with a good memory, and is a careful reader of the Scientific American, that no one in Lock Haven became a victim. From all accounts it seems that a certain Thomas Burnett came to town with a machine, to all intents and purposes, similar to that described in the Scientific American. Burnett exhibited his device to all who cared to see it. Apparently it operated faultlessly; indeed, so faultlessly that there was a movement to form a company for the purpose of exploiting it. But the citizens of Lock Haven were more cautious than some of the victims of Aldrich, and requested Prof. Singer to examine the invention. That gentleman did so. As soon as he saw the device, he recalled the machine described in the Scientific American. Upon returning to his residence he made a search for his papers, and after a three hours' search found the issue for which he was looking. Prof. Singer lost no time in giving his information to the men contemplating the organization of the company. Burnett, when confronted with the copy of the Scientific American, indignantly refused to take his machine apart in order that all might see that there was nothing concealed in the thick wooden base upon which the operating parts were mounted. That night he left the city.

Marconi Sends Messages Across the Atlantic.

It is now authoritatively announced by Marconi, himself, that wireless messages have been transmitted between the Old and the New World. Messages were sent from Lord Minto, Governor-General of Canada, and from Marconi, to King Edward. Messages were likewise sent to the King of Italy, by Marconi and by Commander Martino of the Italian cruiser "Carlo Alberto"; other messages were from Dr. Parkin to the London Times, and from Richard Cartwright of Canada to the Times.

The message to the King of England read as follows:

"To Lord Knollys, Buckingham Palace, London:

"On the occasion of the first wireless telegraphic communication across the Atlantic Ocean may I be permitted to present by means of this wireless message, transmitted from Canada to England, my respectful homage to his Majesty the King? Marconi."

The message to the King from the Earl of Minto read:

"To his Majesty the King, London:

"May I be permitted by means of this wireless message to congratulate your Majesty on the success of Marconi's great invention, connecting England and Canada? Minto."

The following message by wireless telegraphy was received from the King of Italy by Signor Marconi in reply to the inventor's transatlantic marconigram:

"I learn with the keenest pleasure of the great results you have achieved. They constitute a fresh triumph for you to the greater glory of Italian science.

"Victor Emmanuel."

Marconi states that it was about a month ago that he succeeded in transmitting messages from Table Head to Cornwall. First, the messages were all in code and were simple queries, such as "How is this?"

In many respects this achievement of Marconi is fully equal to that of Cyrus Field in opening communication between America and England by means of the submarine cable. But the distance covered by Marconi is greater than that over which the first submarine cable extended, by about 300 miles. So far as practical results are concerned, the Anglo-Italian inventor may well be regarded as the pioneer of commercial wireless telegraphy. Where others have failed he has succeeded.

Where Telephoning is Cheap.

In no country in Europe does the telephone play so important a part in the daily life of the people as in Sweden, and in no country, with the exception of the United States, has the telephone been brought to such a pitch of perfection. There are two classes of telephones in use, the "Riks," or government variety, and the "Allmänna," or general. These latter are subdivided into three further varieties: The "star" telephone, which costs $25 per annum; the ordinary telephone at $2.50 a year for five years after installation, plus $15 per annum for use (after five years, however, the $2.50 a year ceases); the third variety is the "district," which costs only $10 a year. The cost of the Riks, or government telephone, is $14 a year. The toll rates are low. They are as follows:

Up to 60 miles outside Stockholm, 4 cents for every three minutes.

Over 60 to 150 miles, 8 cents for three minutes.

One hundred and fifty to 360 miles, 13½ cents for three minutes.

From 360 to 540 miles, 20 cents for three minutes.

Over 540 miles, 28 cents for three minutes.

It must be understood that these rates apply to Sweden only. In Norway the rates vary according to distance from 8 cents to 56 cents, and in Denmark from 41½ cents to 69½ cents for three minutes' conversation.

Now, with regard to the Allmänna, or "general" telephone. Within a radius of 40 miles of Stockholm these instruments may be used free, but beyond this distance Riks must be used; and to connect with the Riks from your own Allmänna apparatus a charge of 2½ cents is made inside the city, while the ordinary Riks charges prevail outside. Accounts for transfers from one variety of instrument to another are rendered every quarter. The star and ordinary telephones may be used as often as you please, but the district variety is limited to a hundred calls in a quarter, after which 2½ cents is payable for each message. The star telephone is always found in the offices of big shops, so that the user of the ordinary district instrument can transact his business with merchants and tradespeople of every kind without in any way interfering with his own hundred quarterly conversations. Distracted users of the telephone will be interested to know that a reply is always forthcoming from the central station in about ten seconds.

The Current Supplement.

The current Supplement, No. 1409, contains a wide variety of articles of general scientific interest. Day Allen Willey describes the geysers of Yellowstone Park, and illustrates what he has to say with many a striking picture. The English correspondent of the Scientific American continues his discussion of water-tube boilers, his present installment dealing with the Yarrow boiler. Of electrical interest are the articles on electric meters and wireless telegraphy and the theory of the action of the coherer, as well as the storage battery invention. Much that is curious is told in an account of American Indian medical practice. A very full description of the making of oleomargarine will probably be welcomed. Dr. J. Gordon Parker discusses instructively the subject of leather for bookbinding. Mr. F. T. Jane concludes his entertaining account of a fictitious naval battle worked out by means of the war game which he has devised. The usual Trade Suggestions and Selected Formulæ will be found in their accustomed places.

Our Oldest Subscriber.

At this season of the year it is our custom to receive letters from subscribers who are renewing their subscriptions, stating that they believe themselves to be among the oldest living subscribers to the paper. It is an interesting question, and we would appreciate it if all who have been subscribers to the Scientific American for a period of twenty-five years or more would kindly write us to that effect, stating as far as possible the date at which they first subscribed to the paper.

WOOD PAVING IN PARIS.

The paving of the streets of Paris with rectangular wood blocks was begun about fifteen years ago, and, since then, more than twenty-five million francs' worth of work has been done, to say nothing of the sum expended for maintenance and reconstruction. At first, the contracts for such work were allotted to various companies, which, in addition to furnishing the material and putting it in place, were required to keep it

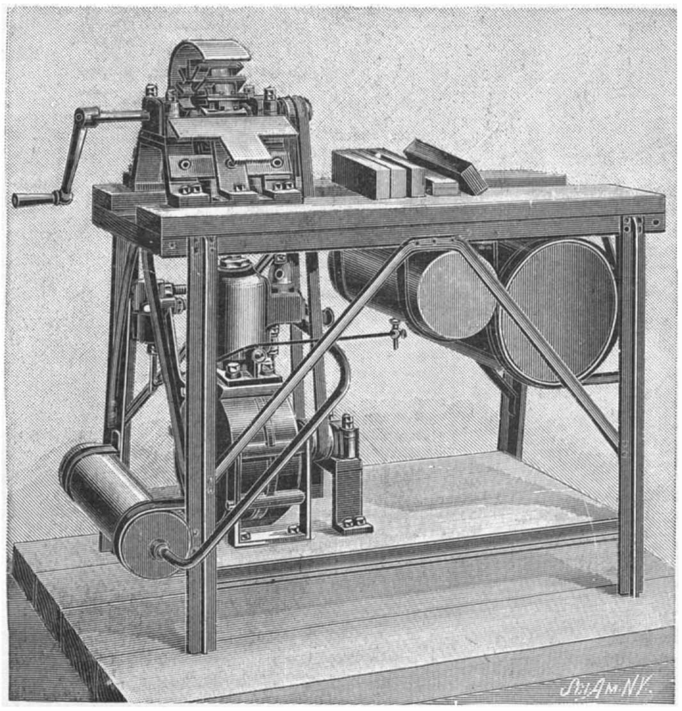


Fig. 1.—GASOLINE TRIMMING MACHINE FOR WOODEN PAVING BLOCKS.

in good order and to give the city an entirely new road at the expiration of the concession. All such privileges will terminate three years hence, and after that the work will be carried on exclusively by the Commission of Public Ways, which has already laid and kept in repair a large number of square feet of wooden pavement.

Now that considerable experience has been had with this kind of pavement, it is possible to estimate accurately its advantages and drawbacks. In a few words, its advantages are smoothness of surface, comfort to pedestrians, and saving in work for horses, while its drawbacks reside principally in the cost of maintenance. A wooden pavement lasts but about eight years. At the end of this time it may be considered as having been entirely reconstructed by the repairs to which it has been continuously subjected.

The city of Paris now owns a large establishment, which is devoted to this industry, and which is in charge of M. Josse, superintendent of the public works. The wood is here cut into blocks by machines actuated by powerful dynamos, and the blocks are afterward injected with creosote before being carried to the places where they are to be laid. The wood employed is of very variable quality. More than fifty varieties, derived from various countries, are used. These may be divided into two principal kinds: First, hard woods, such as Karri (*Eucalyptus diversicolor*), French oak, and Javanese teak; and, second, soft woods, such as the maritime pine of Landes (which furnishes three-quarters of the paving blocks of Paris), northern spruce (which has the inconvenience of being costly), Florida pitch pine, etc. The reliance that can be placed upon soft woods is well known, since they were the first that were employed for the Paris pavements. As for the others, however, they have been used for only a few years past, and it is not as yet known whether they will exhibit an increase in endurance commensurate with their higher cost.

One of the most interesting questions connected with a wooden pavement is its maintenance. This involves the following three operations, which are performed according to requirements: (1) renewal of portions of small extent that are very badly worn; (2) the turning of an entire section of the pavement upside down; and (3) the entire reconstruction of the work. After a paving block has been used for a certain length of time, the extremity of the fibers running toward the surface has been submitted to a crushing due to the passage of vehicles, so that the block can no longer be used in the position in which it is placed. Since, however, the body of the wood is intact, it may readily be seen that the block can be employed again if it be turned upside down. But, inasmuch as the fraying produced by the crushing of the fibers would prevent the blocks from being placed together so as to constitute a homogeneous surface, it is necessary to have recourse to a process of trimming in order to straighten the damaged edges.

Formerly, when but a small number of pieces had to be manipulated, this operation was performed by hand; but, as soon as it became a question of a more extensive repair, the blocks were caried to the factory, where they were trimmed mechanically. Hand trimming is slow, costly, and, as a general thing, badly done. On the other hand, trimming done at the factory always involves a great expense, since the cost of transporting to and from the latter must be taken into consideration; and so it is often difficult to know which of the two systems is the more economical, and the better adapted for certain particular cases.

M. Josse has just devised an arrangement that surmounts all difficulties, as by its use the trimming can be done mechanically upon the spot. For this purpose he has constructed a compact trimmer to be used at the place where the work is in progress. By means of this the blocks are trimmed *in situ* with very great rapidity and with considerable saving in expense, so that wood pavement has entered upon a new era of usefulness since the cost of keeping in repair—its great drawback—is thus very largely reduced.

The trimmer, which has been in use for a few months past at Paris, consists of two parts, a cutter and a motor (Fig. 2). The former consists of a wide notched wheel upon which are fixed 16 movable blades, one in each notch. Each of these blades is rectangular, and is adjusted to the body of the wheel by means of two screws, so that after it has become blunt, it can be very easily dismounted and sharpened mechanically, according to the amount of wear that it shows. These blades are very cheap, since they are made simply of steel plate cut to the dimensions required, and do not have to undergo any special shaping.

The cutter is mounted upon a table that serves as a bench for the workman, who places the block to be trimmed in front of the blades. The trimmer is driven by a small electric motor direct connected to the axle of the tool, and controlled by a starting rheostat. The expense of operating that is quite small, since the electric power employed is only 880 watts, 8 amperes, at 110 volts—corresponding to a little more than one horse power.

The difficulty is to find the electric wires and to tap them for the current. At Paris this is not everywhere of the same nature, so that it is often necessary to interpose resistance in order not to exceed the proper density of current for which the motor is constructed.

On the other hand, it is sometimes very troublesome to connect the apparatus with the conductors from which it is desired to obtain the supply of electricity. All these circumstances have led to the installation of an arrangement that seems to be very practical, and which, moreover, has given excellent results. Instead of the use of electricity as a motive power, recourse is had to a small De Dion-Bouton gasoline motor placed under the work-table of the apparatus and inclosed in a case with hinged panels. The iron plate of which this is made is perforated, so as to permit of a circulation of air and thus prevent a rise of temperature (see Fig. 1, in which the case is supposed to be removed).

Fig. 3.—MACHINE FOR TRIMMING PAVING BLOCKS.

The transmission is effected by a belt, so that there is no danger of any violent shocks being transmitted to the motor when some hard substance on the block happens to hit the cutting blades.

The carbureter, which is of the usual type, receives the gasoline from a three-gallon tank, which contains sufficient to run the motor about eight hours. The apparatus requires supervision, however, since the cooling of the cylinder and explosion chamber is done by cold water contained in a ten-gallon tank that must be refilled every three hours.

A later development of this machine is shown in Fig. 3. The apparatus is extremely simple, consisting of a De Dion motor of three horse power with its gasoline receiver and water cooling tank, driving a rotary cutter which is mounted directly on the shaft. The motor is brought up to speed by the crank and chain-wheel seen in front. The cutter has sixteen blades of steel 0.32 inch thick, very hard and specially tempered. It can trim about 400 blocks an hour upon one face. It is driven at 2,000 revolutions per minute. The blades have to be changed every two days. Before the cutter is a metal shelf or support which presents the block to the cutter, and its position is calculated so that the faces when cut will be always perpendicular. An automatic oiler with a constant feed assures a perfect lubrication without requiring any care from the operator; this fact is quite important on these high-speed motors. The motor is water-cooled in this case, and the large water tank with the pipes are seen on the left. Near it is the gasoline reservoir. The city of Paris has ordered a number of these out-

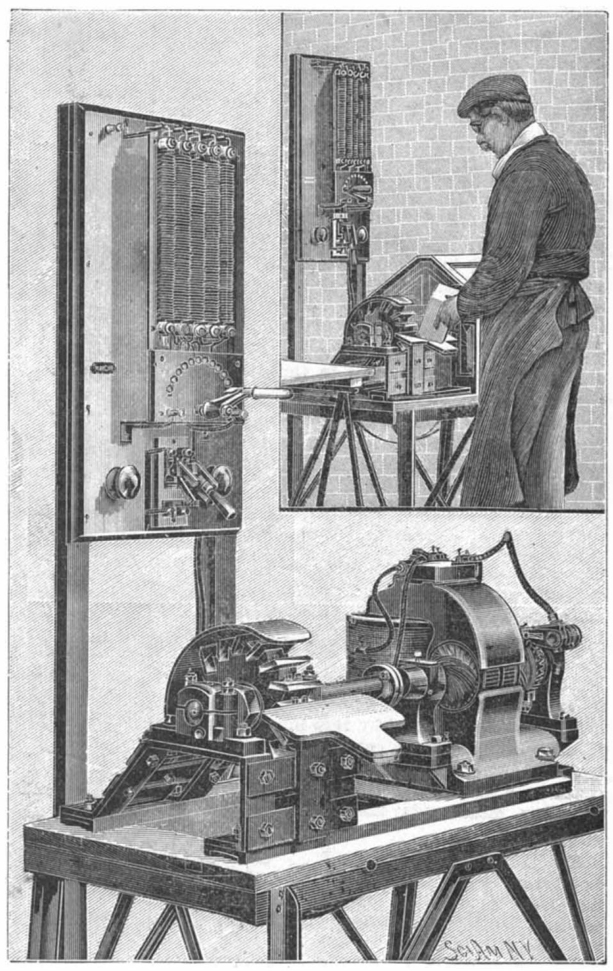


Fig. 2.—ELECTRIC TRIMMING MACHINE.

fits, because of their superiority over others. For portions of the above article we are indebted to La Nature.

Annual Meeting of the American Association for the Advancement of Science.

The Fifty-second Annual Meeting of the American Association for the Advancement of Science, and the first of the "Convocation Week" meetings, will be in session by the time this issue is in the hands of our readers. The meetings will be held in Washington, D. C., December 27, 1902, to January 3, 1903; the meeting of the Executive Committee of the Council on Saturday, December 27, and the opening session of the association on Monday, December 29, in Lafayette Theater. The Arlington Hotel has been selected as "Headquarters."

Owing to the rapidly increasing dimensions of vessels, it has become imperative for the River Clyde to be straightened, deepened, and widened in the vicinity of the various shipbuilding yards, in order to facilitate the launching of large vessels. The project has been contemplated for some time past, but it will have to be undertaken immediately, as the two new Cunard liners, which are to be the largest vessels afloat, are to be built upon the Clyde, if possible. Construction in the Clyde yards, however, can only be carried out by improving the river, to obtain the necessary launching accommodation.

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

FERTILIZING-VINE CUTTER.—J. M. BARNES, Fresno, Cal. Mr. Barnes' invention is an improvement in vine cutters for use in cutting up the vines in a vineyard after pruning, so that such vines can be used for fertilizing purposes. In operation the prunings are thrown in a windrow between the growing vines, and the machine is driven over the prunings, cutting them up into short pieces which are thrown back upon the ground to serve as fertilizer.

STALK-CUTTER.—J. T. KIZER, Senatobia, Miss. Improved means are provided in this invention for cutting corn and cotton stalks, pea vines, and sorghum, and any other grass or vines in drills. In its general nature the invention comprehends a novel construction of runner-frame and laterally-adjustable cutters, especially adapted for cutting the stalks planted in drills and to pile the cut or severed portions into every other middle row or trench.

Miscellaneous.

PHOTOGRAPHIC TIMER.—E. HARROLD, Leetonia, Ohio. A device for furnishing readily from certain known conditions, an exact statement of the proper duration of photographic exposures is provided in the present invention. It consists of a chart on which are marked certain graduations which are applicable to any condition of the weather, at any time of the year, and for any of the prominent makes of plates.

CAN.—L. C. SHARP, Omaha, Neb. This can is struck or drawn up of two sections of sheet metal, the sections being of approximately equal depth and joined together at the middle of the can. The joint or seam comprises a tearing strip which when torn away permits the separation of the can in two sections.

OIL BURNER.—G. F. ROBERTSON, Beaumont, Texas. The oil-burner is particularly designed for burning crude oil, especially such as is found in the Texas oil fields. The burner is provided with a basin, having inner and outer front plates inclined reversely to each other and forming an upwardly tapering front. The oil is supplied to the surface of the inner inclined plate, while steam is discharged from the nozzle or discharge pipe upon the outer inclined plate in such manner as to efficiently operate upon the flame and give forced draft directly into the basin and in the direction of the boiler.

BOTTLE-CLOSURE.—G. J. ADAMS, Brooklyn, N. Y. This invention relates to improvements in closures for bottles and similar packing devices for containing tooth powder or other toilet preparations. The closure comprises two cap members with openings designed to register upon turning one cap relatively to the other. The tops of the caps are resilient, so as to maintain a close connection when the movable cap is turned, thus preventing an accumulation of powder between the top plates of the cap.

BILL-COLLECTING BOOK OR FILE.—G. J. SCHWARTZ, Natchez, Miss. An inexpensive contrivance is provided by this invention which is adapted to fold so completely that it may be neatly carried in the pocket. This device contains a number of pockets in which bil or other memoranda may be filed alphabetically.

FOUNTAIN-SPITTOON.—J. C. BLAIR, Louisville, Ky. Dr. Blair's invention is an improvement in that class of fountain spittoons in which water is discharged from a device adapted to rotate within the bowl. The improvement relates to the construction of the rotatable attachment proper and its antifriction bearings, also to the construction and arrangement of parts whereby the water descending the side of the bowl is thrown up at the center so as to wash the hub of the rotatable attachment.

CORN-POPPER.—J. R. WINTERS, Clinton, Mo. A special construction of lid is employed in this corn-popper through which small unpopped grains may be discharged after the popping operation has been completed to separate the popped from the unpopped corn.

CAN.—C. A. DOOLITTLE, Omaha, Neb. The purpose of the present invention is to provide a jacketed can which may be constructed with extreme cheapness, and yet will serve to securely hold the liquid contents and present a neat and attractive appearance.

INTERLOCKING BOARD.—M. W. WOLFE, New Lexington, Ohio. The invention relates to carpentry and provides improvements in interlocking boards, such as are used for car roofs, floors, ceilings, sidings, decks of vessels and the like, whereby leakage is prevented and shrinkage is reduced to a minimum.

STIFFENING STRIPS FOR GARMENT-WAISTS, CORSETS, ETC.—A. M. WEBER, New York, N. Y. The invention relates to a new article of manufacture, which may be employed as stiffening or binding strips wherever stiffness may be desired. It consists of a flat strip cut from a rattan switch or reed, which is re-enforced by means of stiff wires suitably held against the reed and covered by a woven fabric.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**
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Coin-operated machines. Willard, 284 Clarkson St., Brooklyn.

Inquiry No. 3604.—For machinery for making garnet paper.

Dies, stampings, specialties. L. B. Baker Mfg. Co., Racine, Wis.

Inquiry No. 3605.—For a water wheel overshot or breast wheel made of iron.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 3606.—For a machine for spreading cloth on cutting tables.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 3607.—For manufacturers of punched steel belt fasteners.

We make novelties in all kinds of metals. Any quantities. Metal Stamping Co., Niagara Falls, N. Y.

Inquiry No. 3608.—For makers of small articles in turned and carved wood.

Patented articles, principally of cast iron, made and introduced. Atlantic Foundry, Philipsburg, N. J.

Inquiry No. 3609.—For information as to Mr. H. N. Hill's new electric instantaneous hot water apparatus.

Let me sell your patent. I have buyers waiting. Charles A. Scott, Granite Building, Rochester, N. Y.

Inquiry No. 3610.—For makers of long-handled wood dusters.

Kerosene most absorbing chemical composition (no asbestos) can be manufactured at low cost. *Chemist*, Box 773, New York.

Inquiry No. 3611.—For makers of a crack filler for floors.

For Machine Tools of every description and for Experimental Work call upon Garvin's, 149 Varick, cor. Spring Streets, N. Y.

Inquiry No. 3612.—For malleable iron castings weighing about 3¾ lbs. each.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 3613.—For low-priced folding bedstead.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 3614.—For makers of machinists' screws.

We manufacture anything in metal. Patented articles, metal stamping, dies, screw mach. work, etc. Metal Novelty Works, 43 Canal Street, Chicago.

Inquiry No. 3615.—For manufacturers of knitting machinery.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 3616.—For magnetic chucks for milling machines.

Inventors wishing to sell their patents or to have them manufactured on royalty will find it to their interest to correspond with me.
J. C. Christen,
Main and Dock Sts., St. Louis, Mo.

Inquiry No. 3617.—For makers of electric clock alarm bells for colleges and schools.

Gasoline Automobile Batteries. William Roche's "Autogas" used properly will carry vehicle twice as far as any other battery of same weight. William Roche, inventor and manufacturer, 42 Vesey Street, New York, N. Y., U. S. A.

Inquiry No. 3618.—For makers of articles of hard compressed paper pulp.

The Columbia hay knife beats any knife on the market. Cuts 8 in. wide and 2 ft. deep at one stroke. Invented and patented by C. Blaser, Berwick, Kan.

Inquiry No. 3619.—For compressed air apparatus for cleaning carpets and rugs.

Inquiry No. 3620.—For a stationary wire fence machine.

Inquiry No. 3621.—For manufacturers of portable cottages.

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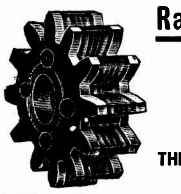

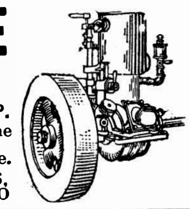

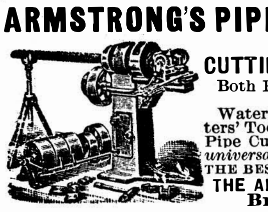

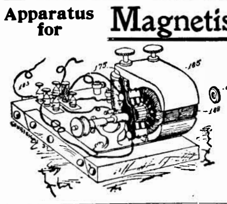

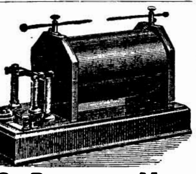

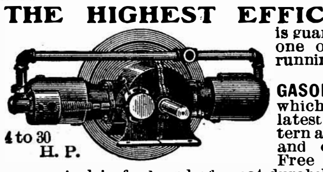

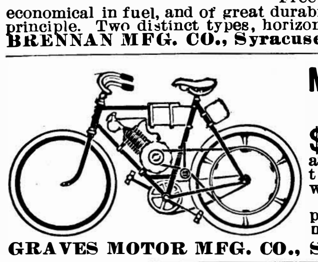

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Propelling vessels by steam turbines, C. A. Parsons 716,468
Pulley power and motion transmission, J. W. Cole 716,520
Pump, J. Maurer 716,731
Pump, P. H. Deis 716,830
Pump, air or steam operated, F. Heil.... 716,839
Punching and printing machine, J. H. Shepherd 716,586
Purse or bag frames, catch or lock for, E. E. Witte 716,799
Purse or bag frames, holding catch for, B. vom Eigen 716,397
Puzzle, C. W. Fraim 716,697
Rail joint, S. O. Dougherty 716,831
Railway signaling system, W. Locke 716,562
Railway switch, automatic, A. G. Lawrence 716,443
Railway switch protector, J. C. Dicks.... 716,686
Railway tie, metallic, J. H. Chance 716,667
Range and broiler, electrical cooking, M. Bayno 716,365
Reamer, J. N. Lapointe 716,438, 716,439
Reflector, incandescent lamp, J. Taussig.... 716,595
Refrigerating compartments, regulating apparatus for, R. W. Rollins 716,480
Register, J. H. Warner 716,795
Releasing apparatus, emergency, J. F. Bjurlund 716,659
Roller coaster, Jontz & Gault 716,427
Rolling mill roll polishing attachment, Markwort & Jones 716,565
Rotary cutter, J. Ettinger 716,694
Rotary engine, J. W. Pickel 716,470
Rotary engine. S. S. Whitaker 716,503
Rotary engine, Springer & Robbins 716,589
Rotary engine, W. J. Mackle 716,642
Rotary motor, D. P. Upson 716,791
Saddletree and elastic checkrein and backstrap holder, combined, J. I. Ayres.. 716,512
Salter, stock, McHenry & Wilson.......... 716,743
Sand carriage, self-strewing, Green & Larsson 716,409
Sand drying and heating apparatus, W. C. McElheny 716,462
Sash, revolving window, W. E. Ogden et al 716,575
Sash, window, C. D. Tabor 716,594
Saw clamp, M. D. Converse..... 716,385
Saw guide, band, C. Ryan 716,763
Saw handle, M. D. Converse..... 716,521
Saw shipping case, E. H. Taylor..... 716,785
Scale, weighing, G. Hoepner 716,544
Seal, jar cover, E. A. Marshall..... 716,730
Shade, window, P. G. Emery 716,832
Shaft bending machine, C. N. Allerding.. 716,612
Shaft shackle, vehicle, S. R. Bailey...... 716,513
Shafts, device for withdrawing keys from, Bement & Black 716,368
Shingle, E. Schneider 716,585
Ships' bottoms, etc., coating, A. P. Cuthriell 716,678
Shirt neckband expanding ring, H. H. Horr 716,545
Shoe, C. K. Flowers..... 716,528
Shoe tip clamp, R. E. Woolman 716,608
Show case, A. D. Guibert..... 716,410
Shutter holder, C. Holmcrans 716,636
Shuttle check, Bailey & Snow..... 716,514
Signaling apparatus, marine, W. B. Barker 716,617
Signaling system, day, B. A. Fiske........ 716,402
Sleigh knee, M. Creighton 716,674
Sleigh runner, double ender, J. E. Hobbs.. 716,543
Silver can, J. B. Crouch 716,675
Smoke consuming furnace, B. F. Binnix.... 716,369
Snap hook, A. R. Otterman 716,748
Snow removing device, J. Sullivan........ 716,784
Soda by electrolysis, apparatus for producing caustic, Allen & Moore........ 716,804
Spectacle fitting instrument, Boothroyd & Johnson 716,516
Speed changing device, Innes & Hazard.... 716,550
Speed indicator operating means, C. E. Kelly 716,721, 716,722
Speed recording apparatus, F. Bayerdoerfer 716,364
Speed regulator, M. G. Miller..... 716,456
Springs, machine for separating the coils of spiral, Daniels & Marshall......... 716,683
Springs, manufacture of, F. H. Daniels et al. 716,679, 716,680
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Stacker, hay, M. H. Mooney..... 716,738
Stacker, hay, C. W. Nickell 716,745
Stacker, straw, C. H. Brunger 716,374
Steam engine, W. S. Colwell..... 716,382
Steam engine, multiple expansion, J. Deneal 716,523
Steam shovel or excavating machine, C. M. Harrison 716,538
Steering lever, C. B. Hershey 716,709
Stone, finishing artificial, Black & Richards 716,371
Stone, etc., manufacturing red aggregates for use as artificial, H. W. C. K. Dyson 716,689
Stopper extractor, H. C. Wehrle 716,602
Stove, A. Landry 716,436
Stove, camp, H. M. Leininger 716,560
Stove or heater, I. Brooke 716,661
Stove, portable, J. Watson..... 716,501
Strainers, machine for making tubular, J. H. King 716,555
Stump puller, W. Anderson 716,360
Surgeon's operating table, T. B. Powers.. 716,756
Suspender cast off, J. F. Molloy 716,736
Switchboard, multiple, W. E. McCormick.. 716,460
Switches, device for automatically opening or closing, J. T. Rice..... 716,758
Syringe, A. B. Jamison 716,426
Syringe-bulb, R. H. Eddy 716,526
Tablet, writing or drawing, F. E. Dodge.... 716,629
Tanning apparatus, B. & W. C. Allen..... 716,358
Telegraphy, multiplex, H. Shoemaker 716,771
Telephone system, W. C. Wright 716,802
Telephone transmitter circuit, A. B. Stetson 716,779
Theatrical scenic arch, E. L. Snader...... 716,490
Thresher, flax, J. T. Smith..... 716,587
Tie, J. E. Glahn 716,704
Tire setting machines, joint closer for rubber, W. C. State 716,590
Tires, pneumatic inner tube for, C. E. A. Esse 716,693
Tobacco filler drying machine, H. Reber.... 716,646
Tobacco stripping or stemming machine, M. Deiller 716,627
Tobacco, yarn, etc., machine for treating, W. M. Schwartz 716,766
Torpedo steering apparatus, J. Borresen.... 716,517
Toy gun, E. J. Howard 716,547
Toy, mechanical, G. S. Gallagher 716,631
Track brake, Bains & Waaser 716,616
Traction wheel, J. E. Wood..... 716,606
Traction wheel, R. L. Dutcher 716,688
Train stopping apparatus, J. P. de Braam.. 716,621
Tram and railway, electric, R. Hacking.... 716,411
Transfer presses, detachable gear for, F. L. Eberhardt 716,525
Trolley, W. L. Baker 716,362
Trolley guard, P. M. Reed 716,477
Trolley pole, T. C. Buder 716,376
Turbine, steam, C. E. Sargent 716,765
Turnbuckle, J. P. & T. J. Hains..... 716,633
Typewriter, G. W. Disher 716,687
Typewriting machine, C. Gabrielson 716,701
Typewriting machine, C. H. Shepard 716,770
Typewriting machine attachment, C. R. Kelly 716,719, 716,720
Umbrella holder, M. Taussig 716,596
Valve handle wheel, G. M. Ritchie 716,761

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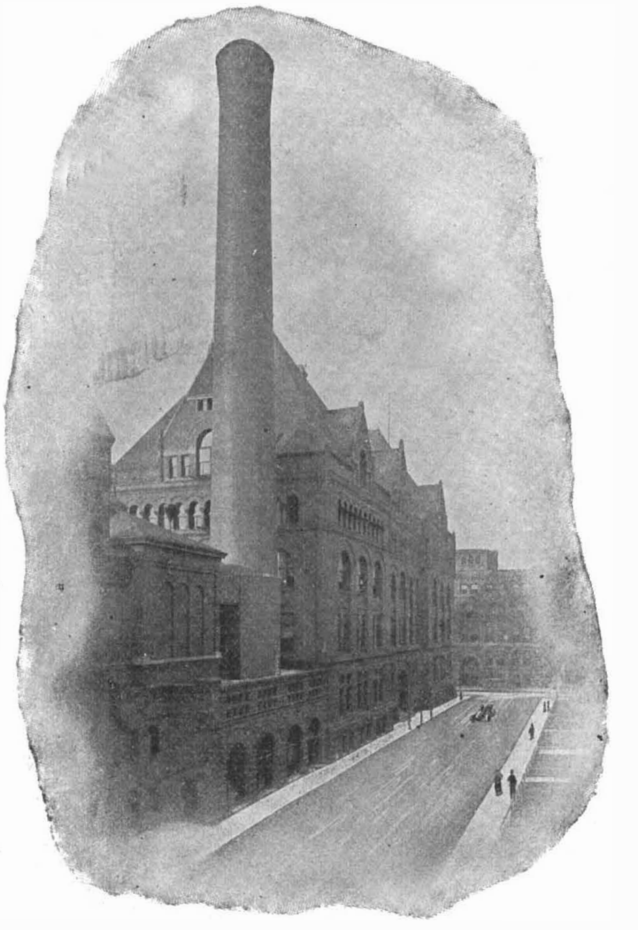

Main Building Armour Institute of Technology.

Valve, hydraulic, P. H. Cowper 716,626
Valve locking apparatus, R. P. Wilson.... 716,508
Vapor or gas to burners, apparatus for regulating the supply of combustible, W. Hooker 716,420
Vehicle body support, W. D. Butler 716,666
Vehicle, motor, W. O. Worth 716,610
Vehicle seat lock, W. D. Holley 716,712
Vehicle steering mechanism, motor, C. Crompton 716,388
Velocipede, J. S. Copeland 716,625
Vending machine, J. A. Williams..716,506, 716,507
Ventilator, S. H. Jacobson 716,714
Vise, double acting, J. Benedict 716,805
Wagon brake, J. Imel 716,425
Washing machine, H. M. Richardson 716,580
Washing machine, B. H. Klein 716,843
Washing machine, cloth, J. M. Woelfel.. 716,599
Washline fastener, J. M. Wood.......... 716,607
Watch protector, B. F. Giddens 716,530
Water from rivers, adjustable conduit for taking, A. C. Ryan 716,483
Water gage, J. McCormick 716,742
Water heater, J. Hartman 716,414
Water motor, Wheeler & Besse 716,650
Water purifying apparatus, L. Gathmann. 716,703
Water regulator, automatic, A. H. Hutchinson 716,549
Water system, circulating, I. J. French.... 716,529
Weaner, colf or calf, G. M. Miller 716,733
Weeding and cultivating implement, C. N. Choate 716,808
Well casing swage, E North 716,466
Whiffletree attachment, J. Hafer, Sr. 716,532
Windmill, J. G. Benster 716,658
Windmills, automatic balance attachment for, B. Terry 716,786
Window cleaning apparatus, S. C. Lawlor... 716,442
Window screen, C. A. Phillips 716,751
Wire clamp, M. D. Kilmer 716,723
Wood impregnating apparatus, J. L. Ferrell 716,400, 716,401
Wrench, W. S. Bonner 716,515
Wrench, C. C. Longard 716,564
Wurtzilite product, R. M. Thompson 716,787
Yohimbine, salts of, L. Spiegel 716,776

DESIGNS.

Carpet, L. H. Brown 36,179
Comb, J. Koenig 36,175
Molding, decorative, J. E. Chapman.......... 36,176
Pillow or cushion top, E. Coyle 36,178
Pin, M. Wickham von Koppen 36,174
Stove leg, G. H. Droege 36,177

TRADE MARKS.

Bells and push buttons, electric vibrating, Electric Gas Lighting Co. 39,541
Belts or bands, driving, Loewitz & Rohlfs.. 39,546
Bitters, J. Graffini & Co. 39,526
Boots and shoes, leather, G. P. Synder & Co. 39,516
Boots, shoes, and slippers, leather, J. W. Gibbs 39,515
Borax, H. Mack 39,533
Candy, C. J. Fletcher Candy Co. 39,530
Canned fruit and vegetables, Arbuckle & Co. 39,533
Coin-operated machines, Mills Novelty Co.. 39,549
Composition of matter for certain named purposes, Electrose Mfg. Co. 39,540
Cotoin compound, Vereinigte Chininfabriken, Zimmer & Co., Ges. mit Beschrankter Haftung 39,523
Diamonds, D. C. Townsend 39,508
Fire extinguishers, chemical, J. B. Miller... 39,554
Food for infants and invalids, Mellin's food Company of North America 39,529
Fuel preparations, certain named, G. E. R. Rothenbucher 39,539
Hair preparations, F. Parker 39,517
Horseshoes and horseshoe pads and blanks, Safety Horse Shoe Co. 39,551
Incandescent mantles, Peerless Gas Light Co. 39,542
Liqueurs, Nuyens & Co 39,527
Magazines, A. Walkley 39,511
Medicinal and chemical preparations for prevention and cure of diseases, H. K. Wampole & Co. 39,521
Medicine for diseases of the nervous system, Smith, Kline & French Co. 39,522
Metal, babbitt, Ajax Metal Co. 39,544, 39,545
Metal compounds for certain named purposes, Allgemeine Thermit-Gesellschaft M. B. H. 39,543
Metalware, enameled, New England Enameling Co. 39,547
Mouth, nose, and throat wash, C. E. Leigh. 39,518
Neckties, H. C. Cohn & Co. 39,513
Oil, lubricating, Galena Oil Company.......... 39,536
Oil, lubricating, Galena-Signal Oil Co. 39,537
Pickles, Kuner Pickle Company 39,532
Pipes, corncob, Hirschl & Bendheim.......... 39,538
Printed matter and publications, certain named, Ralston Publishing Co. 39,510
Pump curbs and conveyers, Cincinnati Pump Co. 39,553
Remedies for certain named diseases, J. A. Monger 39,519
Remedies for diseases of the stomach, E. R. Barbrick 39,520
Sheet metal, planished, American Sheet Steel Co. 39,552
Shoe polishing preparations, P. P. Lagomarsino & Co. 39,534
Silk, Home Circle Silk Co. 39,514
Sugar, syrup, and molasses, C. W. Goyer & Co. 39,531
Swings and baby jumpers, O. C. A. Manufacturing Co. 39,548
Tablets, fruit laxative, E. C. Houlette 39,524
Tennis, parlor, Ranson & Meade 39,512
Tires, rubber, W. T. Beasley 39,550
Tonic, blood, Maltine Company 39,525
Tooth filling, J. A. Sprague & Co. 39,509
Washing machines, B. L. Schmidt.......... 39,555
Water, electrically purified, electra-Pura Water Co. 39,528

LABELS.

"Aunt Kate's Pancake Syrup," for syrup, Truesdell Syrup Co. 9,630
"Cecil," for whiskey, Wineke-Bauernschmidt Co. 9,632
"Crozier's Arabian Liniment for Man and Beast," for a liniment, W. Crozier 9,626
"Electric Typewriter Carbon Paper," for carbon paper, Blickensderfer Manf'g Co.. 9,622
"Klenzine," for a carpet cleanser, Sanitary Chemical Co. 9,624
"Olive Branch," for flour, Akin-Erskine Milling Co. 9,629
"Sani-Tari Skin Soap," for toilet soap, Citizens Wholesale Supply Co. 9,625
"Southern Belle," for flour, Akin-Erskine Milling Co. 9,628
"The-Crystal-Rock-Mineral-Spring-Water," for mineral spring water, A. Meyer 9,631
"Universal Waterproof Cement," for cement, Ohio Rubber Co. 9,623
"Vegetable Catarrh Cure," for a medicine, E. B. Platt 9,627

PRINTS.

"Cecil," for whiskey, Wineke-Bauernschmidt Co. 596
"Ladies Apparel," for ladies' apparel, Meyer, Both & Co. 595
"Queen of All," for beer, A. von Cotzhausen... 597

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