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

AMERICAN ENGINEERING PROGRESS.

During the spring of last year there appeared in The London Times a series of fourteen articles on the subject of American engineering competition, written by a special correspondent of that journal, who had made a tour of the principal industrial centers of the United States for the express purpose of comparing American industrial methods with those in vogue in Great Britain. This remarkable series, which was republished in consecutive numbers of the SCIENTIFIC AMERICAN SUPPLEMENT, commencing July 21, 1900, was evidently the work of a thoroughly qualified observer. It created a profound impression upon British manufacturers, the most advanced of whom were already familiar with the broad aspects of a question, which was here more explicitly discussed. The influence of these articles upon the British press, however, was to arouse a considerable amount of heated and antagonistic discussion, the consensus of opinion being that the articles were altogether too pessimistic in regard to the future prospects of British trade.

The author of the articles has recently commenced a second series, under the title, "American Engineering Progress," in which he undertakes to prove that his prediction of last year is already being fulfilled. The writer had predicted that the natural resources of the United States, the energy with which these resources had been developed, the splendid equipment of American steel works and the large scale upon which they were operated, would prove a menace to the British steel industry, whenever the slackening of the home demand in this country should leave a surplus product available for exportation. In the first article of this series, which will be found in full in the current issue of the SUPPLEMENT, The Times' correspondent states that there seems now to be dawning the period foretold, inasmuch as American makers are not only sending their surplus product to markets that are common both to themselves and Great Britain, but also are carrying the invasion into Great Britain itself. He quotes a Glasgow correspondent who, writing in November of last year, stated that steel rails continued to be very much depressed, since most of the export orders were being absorbed by American mills, at prices which British manufacturers could not at that time touch. At the same period, another correspondent, writing from Middlesbrough, stated that German manufacturers were offering plates at a price with which it was impossible for the home manufacturer to compete.

While it is admitted that the British steel makers are aware of the threatened attack upon their natural market, and that they are doubtless taking steps to meet the invasion, there is a strong disposition, chiefly on the part of the press, to look upon the matter simply as a spurt due to a temporary disturbance of the balance of trade, while there is a prevalent opinion in England that no country heavily protectionist in its settled policy can compete with free-trade in Great Britain. The writer admits that there is much to be said both for and against the latter view, but at the same time urges that no effort should be spared by Great Britain to develop her resources to the utmost and bring her blast furnaces and steel-making trades to the highest pitch of excellence reached in the United States, Germany, or elsewhere.

The Times' correspondent goes to the root of the matter when he says that a favorite method of avoiding the unpleasant admission that a very real crisis is at hand, is to point to the fact that the cry of calamity has been heard in England for the past three hundred years, one commentator on the articles on American engineering competition going back to the reign of Queen Elizabeth for a quotation to prove his point. In reply to these statements, it is pointed out that during the nineteenth century the development of the factory system, which in turn has been the result of mechanical invention, has caused the scepter of power to pass from the military to the commercial elements of the nation. A hundred years ago historians measured a country's success by battles won or lost, but to-day commercial supremacy is the first material essential to national greatness. Although it is still the "man behind the gun" who will decide the battle, the gun (and a very good gun, at that) must be there, and, for England, the ship to carry it, with all the marvelous complications of machinery that are essential to a modern fleet. It is pointed out that the racial characteristics which have enabled Great Britain to win battles are not necessarily those which furnish the best defense against commercial rivalry.

From this statement the argument passes naturally to a second and more important aspect, in which the present conditions differ from those of the past centuries; this being the increased extent to which other nations are competing with Great Britain in the markets of the world. Nothing like it has ever been seen before, and yet it is more true to day than ever before that England must make and sell, or starve. In that distant period of Queen Elizabeth to which one of the critics of The Times articles referred, the English might shut themselves up in their island and wait for a Spanish Armada, perfectly secure, provided the Spaniard could not gain a footing on their shores. Foreign trade was a small matter then. The country could live without it. So it was, though in a less degree, almost up to a time within the memory of men still living. Rapid interchanges of knowledge, no less than of commodities, however, have leveled distinctions, making the conditions of the race for commercial supremacy alike for all. Great Britain was the first in the field, with a long start in the race. For the greater part of the nineteenth century America was busy peopling her undeveloped territory; Germany, as we now know her, did not exist, and the other manufacturing countries seemed willing to concede to Great Britain the role she had allotted to herself as the "workshop of the world." By the end of the nineteenth century national commerce had become a ruling factor in the extended prosperity that has fallen to all nations; and it is only during a comparatively recent period that other countries have made a determined bid for the share which Great Britain has held in the world's manufacturing industries. It is this which differentiates the present from the previous periods, and gives to the present crises a significance all its own.

CURRENT OF 3,000 VOLTS AT THE MOTORS.

Electric traction on the Italian railroad systems is of special interest, as Italy is not a coal-producing country and fuel is consequently high in price; on the other hand, waterfalls are abundant, and it is quite natural the attention of the railroad companies has been turned toward the use of electricity for traction upon certain of their lines, now that the processes of transmission and utilization of energy have been well established. Among the most interesting projects is that of the Meridional Railroad Company, by which more than 60 miles of railroad are to be operated from a single generating station. For the first time a tension as high as 3,000 volts will be used directly for the motors. The projects of this company are about to be put in execution. The lines included in the system of electric traction undertaken by the Adriatic Company and Ganz & Company, of Budapest, extend to the north of Lecco toward Sondrio and Chiavenna, forming a system of roads which is almost independent of the rest of the system, and placed under conditions as regards traffic. These conditions are such that an important freight and passenger traffic will be developed. It has been necessary, in carrying out the project, to establish freight trains which are relatively heavy, and to separate entirely the freight and passenger systems. According to the project, the passenger trains are to weigh 65 tons, allowing 30 tons for the motor car; the speed will vary between 18 and 36 miles an hour, depending upon the grades, for which 300 horse power will be needed. The freight trains will run at 10 to 20 miles an hour, and the motor car will be able to draw 200 tons of load, the trains being made up of 15 to 20 cars. For the Valteline lines, forming a part of the system upon which will circulate five passenger and two freight trains at a time, the energy is estimated at 2,500 to 3,000 horse power. The road will be operated by a hydraulic plant near the station of Morhegno. A fall of about 100 feet will be utilized, and the water will be carried to the generating station by a tunnel nearly three miles long, cut through the rock. The station is to have three turbine-dynamo groups of 2,000 horse power each. The dynamos are of the three-phase type, of 1,500 kilowatts capacity, giving 15,000 volts. The road is fed by a trolley line, and the high tension wire is carried along the whole extent of the road upon the same posts (except in tunnels). By a series of sub stations located along the road at distances of 6 miles, the tension is reduced to 3,000 volts for the trolley wire. The system of trolley used is of a rather original type, and has been carefully designed to meet the requirements. Two trolley wires are used, and the current is taken into the car by two contact rollers, formed of aluminium cylinders of some length, rolling upon bearings carried by a boxwood shaft covered with insulating substance; the boxwood piece is supported from a heavy cast iron base on the roof of the car by means of a system of articulated bars and springs, so that the rollers are kept well in contact with the wires and can move readily in the vertical direction, while the system is otherwise quite rigid. The motor cars are of two patterns, for freight or passenger service. The former carry four motors of 125 to 250 horse power, being veritable locomotives; the latter have four motors of 75 to 150 horse power; only two of the motors work continuously, the two others being used when it is desired to obtain a greater tractive effort at the same speed. The trains are made up of a motor car and train of 65 tons, and the speed varies between 20 and 35 miles an hour. The trains are electrically lighted, heated and ventilated.

CONSTRUCTION OF THE SIMPLON TUNNEL.

The Simplon Tunnel, whose construction is being actively carried on, will considerably shorten the route from London and Paris to the Suez Canal; the distance from Calais to Milan, which is now 657 miles by the Mont Cenis, and 642 by the St. Gothard, will be only 565 miles by the Simplon. The Ostend-Milan will also be shortened by 57 miles over the distance via the St. Gothard. The agreement for the establishment of a tunnel across the Simplon, from Brigue to Isella, was signed on November 25, 1895, by the Swiss and Italian governments; this agreement gave to the Swiss company of the Jura-Simplon a concession for the construction and operation of the new line. The contract for piercing the tunnel was awarded to Brandt, Brandau & Company, of Hamburg. In reality, the construction includes two tunnels of single track, parallel, and having their axes 52.4 feet distant, uniting near the middle of the course into a single tunnel of 1,230 feet length, of double track, in which the crossings will be made. The first of these tunnels was to be completed in the space of six years, while the second will be taken up only when the traffic of the line exceeds a certain tonnage. The work was commenced August 15, 1898, and there seems to be little doubt that it will be finished within the specified time, or the middle of 1904.

The method of construction employed consists in piercing a gallery for each tunnel; these being united every 600 feet by transverse galleries. The gallery of the first tunnel is then enlarged to the normal section; while the enlargement of the second is reserved for a later period; it is, however, utilized at present for the arrival of the cars, which after being loaded leave by the first gallery, as well as for the evacuation of the water and for ventilation; the latter is carried out on a large scale by two 500 horse power ventilators, operated by turbines, which force the air into the second gallery and it comes out by the first. The ventilators will furnish 1850 cubic feet of air per second, at the pressure of 20 inches of water, which is necessary to drive the air to the extremity of the work. Except the last two, all the transverse galleries are stopped up so that the fresh air arrives to the first gallery at a point near the end. The front of the work proper is, however, outside of the sphere of air-circulation, and a special conduit has been installed which brings 20 to 30 cubic feet per second, kept at a temperature of 8 to 10 degrees C. below that of the walls by a system of water sprinklers. At the maximum working, these may absorb 15 gallons per second. The motive power used in the construction is furnished by the Rhone; a dam has been established at 2½ miles above the entrance of the tunnel, and the water is brought to a hydraulic plant which utilizes a fall of 1,250 feet and a maximum supply of 200 cubic feet of water per second. The turbines are thus furnished with an effective force of 2,230 horse power, which is well above the figure determined for the needs of the boring, ventilation, etc. This plant suffices for the northern entry of the tunnel, and for the southern entry a second plant has been established, utilizing the water of the Diveria, which gives a fall of about 500 feet with a minimum supply of 40 cubic feet per second, representing 1,600 horse power. The following table gives some of the principal data of the tunnel, together with that of the three other main tunnels of the Alps.

	Mont Cenis.	Saint Gothard.	Arlberg.	Simplon.
	Feet.	Feet.	Feet.	Feet
Length of tunnel.....	42.140	49,130	32,590	64,715
Maximum altitude of tunnel.....	4,273	3,795	4,323	2,326
Maximum altitude of the mountain along axis of tunnel.....	9,735	9.438	6.699	9,372
	Degrees C.	Degrees C	Degrees C.	Degrees C.
Interior temperature.	29.5°	30 8°	18.5°	40°

At the end of August, 1900, the length of the working galleries was 11,050 feet for the north end of the tunnel, and 8,130 feet for the south end, or a total of 19,180 feet. The maximum force of workmen employed simultaneously on the two sections has been 1,073. The mean progress of the drilling has been 12.2 feet per day; up to the present only three drills have been used in each section. At 6,000 feet distance from the entry, the temperature of the walls has been found to be 20.4 degrees C. for the north section and 28.4 degrees for the south. The ventilation has absorbed daily, since the month of May, 52,984,000 cubic feet of air, of which 27,400,000 were for the north and 25,584,000 for the south end. The ventilators are as yet established only on the southern section; on the north section the air supply is obtained for the present by a ventilating shaft which is heated to increase the draught. The water-sprinkling devices are installed in each of the sections; the temperature of the water coming out of these is 20 degrees and 15 degrees C. for the north and south ends respectively, when it is but 10 degrees at the exterior. The volume of water under pressure which is sent to the extremities of each section amounts to 703 cubic feet for the north end and 592 for the south. For the north section, the mean daily consumption of dynamite is 1,110 pounds, being 596 pounds for the mechanical drilling and 594 pounds for the hand drilling; for the other section this consumption is 893 pounds. with 620 pounds for the mechanical drills.

THREE IMPORTANT PATENT DECISIONS BY THE UNITED STATES COURT OF APPEALS AT NEW YORK.

The United States Court of Appeals for the Second Circuit last week handed down its decision in the suit of the Thomson-Houston Company against The Lorain Steel Company for alleged infringement of Letters Patent to Walter H. Knight, No. 428,160, for electric motor regulators, commonly known as the "Interlock" patent. The complainant in this suit contended that this patent covered broadly the use of a stop or lock, controlled by the regulating switch of a motor controller, for preventing the operation of the reverse switch except when the regulating switch was at its off, or open circuit position; or in other words, that the patent covered all forms of the devices now in use in motor controllers which make it necessary for the motorman to operate his controller handle to shut off the trolley current before he can operate his reversing switch.

In an opinion by Judge Wallace, the Court of Appeals reverses the decision of the lower court, which held the defendants liable under the patent, and declares the patent to be invalid as to all the claims involved in the suit. Judge Wallace decided:

"The patent cannot be broader than the real invention, and that is measured by the novelty of the particular contrivances which constitute the locking mechanism. . . . We are of the opinion that the broad claims of the patent (claims 1, 2, 3 and 4) are not warranted by the scope of the real invention by Knight. As it is not asserted by the complainant that infringement of the fifth claim has been established, it is unnecessary to advert to the differences between the devices employed by the defendant and the patented devices. We conclude that the first four claims of the patent are invalid, and in the absence of any proof of infringement by the defendant of the fifth claim, the Court below should have dismissed complainant's bill with costs."

The same Court has also handed down its decisions in the suit of the Thomson-Houston Electric Company vs. The Nassau R. R. Company and The Lorain Steel Company, and in the suit of the Thomson-Houston Electric Company vs. The Bullock Company, et al. These two suits, which were heard together on appeal from the Circuit Court, and in which The Lorain Steel Company was the real party defendant, involved two Letters Patent to Elihu Thomson, Nos. 283,167, of August 14, 1883, and No. 401,085, of April 9, 1889, commonly known as the "magnetic blow-out" patent, the suits being for alleged infringement by the defendant in the manufacture, use and sale of its motor controllers.

The earlier Thomson patent was framed to cover broadly the application of a magnet to an electric switch for the purpose of extinguishing arcs formed at the switch contacts. In the opinion by Judge Shipman, the Court affirms the decision of Judge Thomas in the Circuit Court, and declares the patent to be devoid of patentable novelty in view of the prior art.

The later Thomson patent involved the use of insulating material in an arc-rupturing device for the purpose of protecting the metal surfaces of the switch contacts or electrodes and of the blow-out magnet from the action of the electric arcs.

The Court of Appeals reverses the decision below which sustained the patent, and declares it invalid. The Court says:

"We cannot perceive that the effect of the insulation in an arc-rupturing d as anything more than the old effect which had always accompanied insulation."

These decisions of the Court of Appeals dispose of three patents claiming principles which lie at the foundation of the manufacture of the modern electric car controller, and terminate the protracted litigation which has been carried on under the patents against the controllers manufactured by The Lorain Steel Company.

THE GLASGOW EXHIBITION OF 1901.

The buildings to accommodate the exhibits at the great exhibition at Glasgow this year are rapidly approaching completion. Difficulty was experienced a short time ago regarding the delivery of the structural steel, but the trouble was avoided by eliminating a good deal of the steel work from the buildings. The designs for the buildings have been prepared by Mr. James Miller, I.A., of Glasgow. There will be four principal groups of buildings—the fine arts gallery, the machinery hall, the industrial section and the grand hall for entertainments—which will cover in all about 20 acres.

The buildings for the industrial section are in the Spanish Renaissance style. The building is 700 feet in length by 360 feet in width, and is crowned by a huge dome 80 feet in diameter, which is a conspicuous feature. The main avenue, 92 feet in width and 150 feet in height, extends longitudinally through this building, and has a massive circular arched roof. Four white towers spring from the building to a height of 180 feet above ground level. Round the exterior of the dome at a height of 100 feet above the ground is a large balcony which affords an excellent view of the whole of the grounds. Each corner of the building and the north and south fronts toward the center have a pavilion about 35 feet square, and surmounted with minarets, so that from the exterior the erection will present an attractive appearance.

The machinery hall is 500 feet in length by 320 feet broad, and consists of one central bay 100 feet wide, and four other bays each 53 feet in width. The height of the central span is 41 feet and that of the side spans 29 feet. The central bay is flanked on each side by an overhead gallery, 15 feet wide, from which the whole of the exhibits in the building may be witnessed. A railway is to be run into the hall for the conveyance of the goods, while a special footway is to be provided for passengers. The building together with the boiler house and goods yard covers 5½ acres.

The exhibition buildings will cost in all, with the exception of the magnificent new art galleries, $650,000. The art galleries, in which are to be placed the art treasures of the city, it is estimated will cost $1,250,000.

The exhibits are to be divided into eight classes, and all the leading countries of the world in addition to the British Colonies will be fully represented. The executive is desirous of making the section devoted to industrial design and manufacture specially exhaustive and adequate, and to attain this object deputations have been dispatched to the leading industrial centers to obtain the support of the most prominent manufacturers. Another important class is that devoted to machinery, electricity, motive power, and labor-saving appliances, which it is intended to make the most salient feature of the exhibition. The exhibits are to be driven by electric motors, and every assistance is to be extended to exhibitors in order that they shall be able to display the characteristics of their specialties to the best advantage. In the marine engineering and shipbuilding section will be exhibited a collection of models, representing the evolution of the modern ship from wood to iron, sail to steam, paddle to screw, and single engines to triple-expansion engines. In the locomotion and transportation section, the latest development of automobilism will be extensively represented, together with the most modern railway engines. Other sections include agricultural and mining machinery, scientific instruments, archæology, etc., while a special class is to be reserved for women.

During the time the exhibition is open scientific meetings will be held. The British Association will celebrate their annual gathering here, under the presidency of Prof. Rucker, the savant of terrestial magnetism. The Society of Engineers and Shipbuilders, the Society of Chemical Industries, and several other similar scientific and mechanical institutions will also contribute lectures dealing with their respective ramifications of industry and commerce.

RESIGNATION OF COMMISSIONER DUELL.

We regret to note that the Hon. C. H. Duell, Commissioner of Patents, has resigned the Commissionership to resume patent practice. Mr. Duell has been a most efficient executive officer of the Patent Office, and he will retire to private life with the best wishes of those who have been associated professionally with him.

SCIENCE NOTES.

A bust of Gauss is to be placed in the lecture room for geodesy and mathematics at the University of Berlin.

Dr. Talamon, one of the physicians of the Bichat Hospital, Paris, announces the successful treatment of pneumonia by injecting anti-diphtheritic serum.

A party from the Massachusetts Institute of Technology has perfected plans for going to the island of Sumatra to observe the total solar eclipse of the sun on May 17, 1901. The party will be in the charge of Prof. Alfred E. Burton.

A relief expedition sent by the Duke of Abruzzi left Sandefjord March 5 on board the "Capella." It is commanded by Capt. Stockken, father of the missing machinist of that name. The "Capella" will go to Franz Josef Land. They hope to find alive the Norwegian machinist and the two Italians who were lost in the recent Abruzzi expedition.

Prof. Loeb's experiments in artificial parthenogenesis are most interesting. He has been able to develop eggs of Chaetopterus, an annelid, into free-swimming larvæ by placing them in solutions which cause them to lose water. Potassium chloride solutions and hydrochloric acid when added to the sea water have been found effective in causing the eggs to develop. The artificially developed larvæ did not differ from those produced by natural fertilization, and it was concluded that the processes of segmentation are a function of the constitution of sea-water.

A London journal calls attention to what might be termed the "elevator disease." It says it looks as though people with weak hearts had, after all, better climb ten flights of stairs than effect the ascent by means of the elevator. Lift attendants have died sudden deaths; people with weak hearts have noticed ominous sensations when in the elevator. We are told the sudden transition from the heavier air at the foot to the lighter air at the top is extremely trying to the constitution. Most people have experienced singular sensations of internal collapse when the lift floor sinks beneath the feet, but none suspected that the results might be so serious.

A great congress is to be held in London on July 22 of this year on the subject of tuberculosis, and the discussion of the experiences obtained in various countries for the cure of consumption and the best methods to adopt to bring about its eradication. The congress will last five days, and it will be supported by delegates from all parts of the world, who will advance any information relative to the subject at their command. The King of England, who has always taken a keen interest in the cure of this malady, will open the congress. One of the leading features will be a museum containing a number of pathological and bacteriological instruments, charts, models, etc.

Prof. Pickering makes the following statement relative to the light flash from Mars: "Early in December we received from the Lowell Observatory in Arizona a telegram that a shaft of light had been seen to project from Mars (the Lowell Observatory makes a specialty of Mars) lasting seventy minutes. I wired these facts to Europe and sent out neostyle copies through this country. The observer there is a careful, reliable man and there is no reason to doubt that the light existed. It was given as from a well-known geographical point of Mars. That was all. Now the story has gone the world over. In Europe it is stated that I have been in communication with Mars, and all sorts of exaggerations have sprung up. Whatever the light was, we have no means of knowing. Whether it had intelligence or not, no one can say. It is absolutely inexplicable."

Vacant lots have been successfully cultivated in Philadelphia under the direction of the Philadelphia Vacant Lots Cultivation Association. During the past years gardens were provided for 480 families, consisting of 2,486 persons. The aggregate receipts from the various farms showed a total of $24,560. This is six times the amount expended by the association on the lands. Five families became so adept at gardening that their savings have enabled them to hire ample farms of their own. Thirteen families were given Belgian hares for experiment last year, and the successful results attained will cause the association to take up this line of industry on the farms this year.

Dr. George G. Hopkins, of Brooklyn, has been using decomposed light in the treatment of consumption with considerable success. Dr. Hopkins' system is to use decomposed light as a substitute for sun rays. The patient is fed with arsenic, cod liver oil, etc., in order to build up the system and strengthen the tissues. Then the light, which restores vitality, is used and the patient is enabled to throw off the germs of consumption. The system originated with Dr. Finsen, of Copenhagen. It has also been used for the treatment of cancer. A 15,000-candle power arc light is used and the light is decomposed by blue glass, thus allowing only certain of the rays to strike the patient.