SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845) ..... $3.00 a year
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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, DECEMBER 17, 1904.

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.

PANAMA CANAL PROBLEMS.

One by one the various fictions that lingered around the Panama Canal have given way before the thorough investigation of the subject which is now being carried on by the United States government. Most of these errors related to the engineering problems, and they were due to the persistent efforts of the advocates of the rival scheme at Nicaragua to prove that to build a canal at Panama was an engineering impossibility. It took much time and patience to refute these errors and present the true facts to the American public. Now that the work of education is done, and the country is committed to this splendid enterprise, it is a matter of no small satisfaction to this journal to reflect that the SCIENTIFIC AMERICAN took an early stand in favor of the Panama route and contributed largely by its text and illustrations to the desired result. To-day, it is well understood that a canal at the Isthmus is not only perfectly feasible, but that its cost, and the period of time in which it can be completed, may be accurately stated. There was one popular misconception, however, containing just enough of truth to make it formidable, which seems to die very hard. We refer to the widespread belief that the climate of Panama is so fatal, that the construction of the canal can only be accomplished at an enormous sacrifice of human life. Popular ideas on this subject are based upon the percentage of deaths that occurred, or are supposed to have occurred, during the construction of the Panama Railroad, and during work on the canal when it was under French control. There can be no doubt that tropical diseases did make serious inroads upon the army of laborers employed at the Isthmus, in the period referred to; for there seems never to have been any serious attempt at sanitation, either in the construction camps or in the towns along the route of the canal and the railroad; but that the mortality was as frightful as stated has always been open to doubt.

One of the first active steps taken when the canal question passed over to American control was to make a thorough investigation of the climate, the diseases, and the local conditions affecting health in the zone of the canal, and to apply the latest ideas both for the prevention and cure of tropical diseases. The work already done has given most excellent results. Both malaria and yellow fever may be said to be to-day practically under control, and these are the two diseases which are most to be dreaded when the great construction camps are assembled and work is in full swing throughout the whole length of the canal. According to Gen. Abbott, whose various articles, published during the past few years, have been a powerful agency in breaking down the tissue of falsehoods that have grown up around Panama, the records of the hospital of the old Panama Canal Company show that the total death rate among the laborers was far less than is commonly supposed, being, in fact, from 44 to 67 per 1,000. This is much below the exaggerated estimates, which have obtained common credence, one of which told of the death of 600 imported Chinamen within a single year, out of one single force of 1,000 that was landed at the Isthmus. It seems, moreover, that the rainfall has been the subject of as gross exaggeration as the diseases. It varies from about 130 inches on the Atlantic to 65 inches on the Pacific, a record that can be duplicated in the United States, where the average rainfall on the Atlantic coast is about 50 inches and the fall on portions of the Pacific coast compares in total precipitation with that at the Atlantic terminus of the canal. Furthermore, it will be news to many residents of our more northerly latitude to learn that the temperature ranges at Panama from 70 deg. to 85 deg. F., and that it is very rarely that the thermometer reaches the high temperature which is experienced when a hot wave passes over the United States. Temperatures of from 90 to 100 degrees are not uncommon during an ordinary summer on our Atlantic seaboard, and consequently it is not surprising to learn that there are natives of the United States in Central America and Panama who have lived in those localities from ten to eighteen years in good health and with complete immunity from local diseases.

BLONDLOT AND PROF. WOOD ON THE N-RAYS.

Those who have followed the controversy which has been waged over the existence and non-existence of the N-rays, will read with interest two articles which, for lack of space, we have been compelled to publish in the current issue of the SUPPLEMENT. In one article, reprinted from Nature, Prof. Wood advances what are probably the most telling arguments thus far published on the non-existence of the N-rays. In the other article, written at the Editor's request, Prof. Blondlot replies to Prof. Wood, and demonstrates with convincing scientific evidence that the emanations of which he is the discoverer do exist.

Prof. Wood, after a searching investigation of the rays in an unnamed laboratory which is evidently that of Prof. Blondlot, says that he was "not only unable to report a single observation which appeared to indicate the existence of the rays;" but also that he left "with a very firm conviction that the experimenters who have obtained the positive results have been in some way deluded." Passing over Prof. Wood's criticisms of direct visual observation, in which the element of personal skill enters too largely, the most formidable objection which he has raised is the fact that the method of photographing the N-rays was not conducted with the scientific accuracy demanded in a discovery of so problematic a character. A number of photographs were displayed to him which showed the brightening of the image under certain conditions. A plate was exposed in his presence; but the exposures, as Prof. Wood rightly maintains, were made under conditions which admitted of too many sources of error. The brilliancy of the spark throughout the time fluctuated by an amount roughly estimated as 25 per cent, and this alone rendered accurate work impossible. Furthermore, the two images (with N-rays and without) were built of "installment exposures" of five seconds each, the plate-holder being shifted back and forth by hand every five seconds. It was possible that the difference in the brilliancy of the images was due to a cumulative favoring of the exposure of one of the images, quite unconscious, to be sure, but still sufficient to frustrate the purpose in hand.

Since Prof. Wood's visit to the Nancy laboratory, Prof. Blondlot assures the editor of the SCIENTIFIC AMERICAN that he has measured the times of exposure with the utmost accuracy by means of an automatic apparatus. To remove all uncertainty, Prof. Blondlot caused the spark, in the absence of N-rays, to act for a somewhat longer period on the plate, so that the exposure under these conditions was one half a second to one and one-half seconds longer than when the N-rays were allowed to exert their influence. The N-rays were produced by a Nernst lamp, between which and the spark 50 centimeters distant were inserted three sheets of aluminium, a sheet of zinc, a spruce plank 2 centimeters thick, a sheet of cardboard, a sheet of paper, and lastly a plano-convex aluminium lens 5 millimeters thick. Despite these obstructions, the N-rays caused a pronounced increase in the photographic effect of the spark. The photographs thus obtained seem to have been made with such scientific care that they may be considered strong evidence of the existence of the N-rays.

Readers are referred to the SUPPLEMENT for a more detailed account of the investigation conducted by Prof. Wood and the reply of Prof. Blondlot. We have confined this brief *résumé* to the photographic process because upon photography alone can any scientific confirmation of Blondlot's reputed N-rays be based.

THE ELECTRIC SMELTING OF IRON ORE.

In an age like the present, when the electric current is being applied to such a variety of uses in the industrial arts, there is, at the first mention of it, something decidedly attractive in the proposal to use the electric current in the smelting of iron ore. The wide range of industries covered by the electrical furnace, and the vast scale upon which their operations are conducted, lead very naturally to the presumption that the electric furnace may some day displace the huge blast furnace, costly to erect, and costly to operate because of the enormous tonnage of materials that must be handled to produce a given output of pig iron. The persistency with which the problem is attacked by men who are well qualified for the investigation, proves that the end sought after is no mere dream of the enthusiast. Indeed, electric smelting of iron ore is a perfectly feasible process, if we are willing to leave out of consideration the all-important element of cost. In the present state of the art, however, it must be admitted that for the majority of cases the cost is altogether prohibitive.

The subject has recently been made the subject of investigation by an expert commission appointed by the Canadian government, whose study of the subject was directed particularly to the question as it affected the iron-ore deposits of Canada. The commission made a tour of the best-known electric iron-smelting furnaces in Europe, and its findings have been embodied in a report which has recently been issued by the Canadian Department of Mines. Its conclusions are summed up in the statement that pig iron can be produced on a commercial scale, at a price to compete with the blast furnace, only when electric energy is very cheap and fuel very dear. It was found that on the basis assumed in the report, with electrical energy at $10 per electric horse-power year, and with coke at $7 per ton, the cost of production is the same as the cost of producing pig iron in a modern blast furnace. Under ordinary conditions, where blast furnaces are an established industry, electric smelting cannot compete; but in special cases, where ample water power is available and blast-furnace coke cannot be readily obtained, electric smelting may be commercially successful. On the other hand, although the cost of electric ore reduction prevents it from competing with either the Bessemer or the Siemens open-hearth process in the production of the common grades of commercial steel, the process was found to be in successful commercial use in the production of high-grade crucible steel.

Now the report of this commission, outside of having fulfilled the immediate purpose for which it was presented, should serve as a safeguard to the general public against being led into hasty and undigested schemes for the electric smelting of iron ore. The figure of $10 per electric horse-power year can only be realized under very exceptional circumstances, where water is abundant, readily available, and contiguous to large deposits of iron ore. We believe that the lowest figures obtainable at Niagara are from $15 to $20 per horse-power, and here, because of the size of the plant, and the unlimited volume and great head of water available, the conditions are ideal for cheap production. It may be that some of the large plants which, during the past few years, have been hurriedly erected on a scale far beyond the immediate local demand for power, are making contracts at prices that give very little, if any, return on the investment; and great care should be exercised in using such low figures as a basis of indiscriminate estimate of the cost of electric iron-ore reduction.

LAUNCH OF THE ARMORED CRUISER "TENNESSEE."

The armored cruiser "Tennessee," which was successfully launched on December 3 at the Cramps' yard, Philadelphia, is an armored cruiser which, in the great power of its batteries and its very extensive protection by armor, brings the armored cruiser type one step nearer to the battleship. The "Tennessee" is an improved "Pennsylvania"; but the improvements are of such a nature as to render her a far more formidable ship than her prototype. She has the same speed and coal capacity, but her displacement is 1,100 tons greater, and her armament far more powerful. Her main battery consists of four 40-caliber 10-inch guns of the latest naval pattern, these pieces taking the place of the four 8-inch guns in the "Pennsylvania." The 8-inch gun, when firing capped armor-piercing shells, can penetrate 7¼ inches of steel at 5,000 yards; but the 10-inch piece of the "Tennessee" can penetrate 11¾ inches at the same range. The respective weights of the shells are 250 pounds and 500 pounds, and the muzzle velocity is the same; but, whereas the muzzle energy of the 8-inch piece is 13,602 tons, the 10-inch has a muzzle energy of 27,204 foot-tons. The "Tennessee" carries two more 6-inch guns, or sixteen as against fourteen, and five more 3-inch guns than the "Pennsylvania." Another improvement is in the distribution of the armor. The thickness of armor on the main gun turrets has been increased from 6 inches to 9 inches, with 7-inch bases to the turrets, and the side armor above the water-line belt has been extended until it overlaps the barbettes of the main turrets, thus materially strengthening the protection of this important element. The weak point, if it may be called so, in the design, is that the side armor at the water-line has been reduced from 6 to 5 inches. We could wish that the difference of one inch had been on the *plus* rather than on the *minus* side.

With the exception, perhaps, of the new armored cruisers of the "Warrior" class, designed for the British navy, this is the most powerful armored cruiser in existence. The "Warrior," on the same displacement, is to carry six 9.2-inch guns and ten 7.5-inch guns, the side armor being 6 inches in thickness as against 5 inches in the "Tennessee" and the speed 23 knots as against 22 knots. On the other hand, the protection of the main battery in the new English cruiser is inferior, consisting of only 6-inch, as against 9-inch armor.

NEWS ABOUT THE SUBMERGED COAL EXPERIMENTS.

Some time ago we drew attention to the experiments that were being carried out by the British Admiralty with submerged coal. In May, 1903, five crates of coal, each holding two tons, were sunk in a basin at Portsmouth, and a similar quantity was placed at the coal-

ing point on land, in small heaps, covered with tarpaulins. Six months ago some of the submerged coal was raised and burnt, in conjunction with a similar quantity of that which had been kept on land, and the results showed that the submerged coal had greater calorific qualities. Owing to the success of this test, further experiments are to be carried out on the same basis.

"AMERICAN ESTATES AND GARDENS."

Time was, and not so very long ago, when the attempt to produce a work of high quality devoted to American estates and gardens would have been foredoomed to failure for lack of material. A few planters' homes in the South, some fine old Colonial homes in Virginia, a few good Colonial houses in New England, and some scattered dwellings of the older families in the various seaboard States, the latter owing their interest more to historical than architectural considerations—this would have been the unfruitful field from which the materials for the work must have been gathered.

It was otherwise when the historian and the artist joined hands in the production of the lovely volumes on the stately homes of England which have appeared in profusion during the past few years, and are valued not less in America than in the country they portray. There the authors found ready to hand a wealth of material, the product of centuries of growth, and presenting a bewildering variety of architectural style, most of it infinitely grand and beautiful, and all of it enriched with that charm which only the hand of Time can impart.

At the same time the rapid growth in wealth and possessions of the American people during the past quarter of a century has given them the opportunity to express in larger degree that home instinct which is one of the strongest of our national traits; and the result is seen in the rapid growth among us of the house of importance, the stately home which by virtue of its size, dignity, and spacious surroundings is entitled to rank with the historic houses of the older countries. How rapid has been this development, how numerous and truly magnificent are the great houses and estates of America, is but little understood. It is in the belief that the time is ripe for giving this subject systematic and adequate treatment that we have published a work, "American Estates and Gardens," in which for the first time full justice has been done to a neglected feature of our national growth.

In the three hundred and forty pages and two hundred and seventy-five illustrations of this work, will be found portrayed and described practically every notable home and estate in the country; and it includes many lovely and unique places, whose beauties have never before been illustrated, the exterior and interior views being made by special permission for the present work.

In choosing the subjects for illustration, an effort has been made to include as great a variety as possible of styles, and show how admirably some of the foreign methods have been adapted to local climatic and domestic conditions, especially as affected by country life. The list of subjects includes the mansions of New York, Philadelphia, Boston and other leading cities; the "palaces" of Newport; the splendid seaside residences of the Sound, Long Island, and Palm Beach; the great interior landed estates and mansions to be found from Maine to Florida and as far west as California; while in size the houses illustrated range from the stately "Biltmore" to the snug hunting lodge in the Adirondacks or the tasteful studio where the artist makes his summer home.

The work is rich in interior views—a feature which will render it particularly valuable to those who are contemplating the erection of similar homes; for it is freely illustrative of the latest ideas in furnishing and decoration. Moreover, the American of wealth and leisure is an industrious traveler, and many of the owners of these homes are enthusiastic and discriminating collectors of objects of art. This feature has been borne in mind by the illustrator, and interior views have been selected, as far as possible, which included many of the choicest of these art collections.

A great house, like a rare gem, calls for appropriate setting; and much of the beauty of our American homes is due to the great care with which they have been placed with regard to their landscape surroundings, and to the lovely gardens which flank or front them. The work of the landscape gardener in many of the great homes rivals that of the architects, and throughout this superb volume, the garden views will be found to be one of the most attractive features.

Both the letter-press and the engravings (many of the latter in duotone) are samples of the very best work that can be done in the present state of the art, and the whole is printed on heavy plate paper. As this is the standard work on notable estates and gardens in America, and must remain so for many years to come, it should be in the library of every lover of domestic art and architecture.

THE NEW BRITISH PATENT ACT.

Several months ago the British Patent Act was amended and, among other changes in the practice, provision was made for the examination of patent applications to ascertain the novelty of inventions which are made the subjects of applications for patents. Hitherto there has been no examination in the British Patent Office as to the novelty of inventions, the result being that many invalid patents were granted in Great Britain. The knowledge of this law led many irresponsible attorneys, for the fees received, to encourage inventors to file applications for British patents, the grant of which there was no hope of sustaining in the courts. In fact, so many invalid patents were granted by the British Patent Office that every patent in Great Britain was looked at with suspicion, and the uncertainty concerning the validity of the best patents was seldom, in even a measure, cleared away except after laborious and expensive examinations made by solicitors, the public at large not being convinced that the patent, in fact as well as in name, created a monopoly until the patentee successfully contested the question in the courts. This very unsatisfactory condition led to the change in the law, the operation of which, however, was delayed until a trained corps of examiners could be secured to make the examinations and room could be provided in which they might work. Arrangements having now been completed, January 1, 1905, has been set as the time when the new provisions of the law will go into operation.

The examination will not in Great Britain, as in the patent offices of many other countries, attempt to include within its scope all that has been done throughout the industrial world, for it is provided in the new law that the examination will only include British patents, the applications for which were filed within fifty years immediately preceding the filing of the application which is being examined. As the knowledge of an invention outside of Great Britain will not in itself prevent the grant of a valid British patent, the examination in effect is much more complete than would at first appear, and the result will be to add materially to the commercial value of patents and patented inventions.

United States, German, and other inventors in whose home countries thorough examinations are made by the patent offices, will especially benefit by the new law, for they seldom file their applications in Great Britain until, by the actions of the examiners in the home patent office, they know the invention is novel, and they will therefore be able to obtain under the new law the same grant which they might have obtained under the old law, but with the additional value given by the examination. The patent granted under the new law, while substantially the same as that granted under the old provisions, will therefore receive public respect, which under the old provisions was often delayed until after much litigation.

The Patent Office is not authorized to refuse a patent because of lack of novelty, the decision of that question still remaining with the courts, but when an applicant refuses to amend an application to overcome what the examiners believe to be a pertinent reference, the Patent Office is authorized to print the number and date of the reference on the printed copy of the specification, to inform the public where the reference can be found and that certain features of the invention are believed to be anticipated by the examiners in the Patent Office.

The fees under the new law have been increased, but applicants will receive a most satisfactory return for the slight increase in the cost of the British patent.

TO OUR SUBSCRIBERS.

We are nearing the last issue of the year—the fifty-ninth of the SCIENTIFIC AMERICAN'S life. Since the subscription of many a subscriber will soon expire, it will not be amiss to call attention to the fact that the sending of the paper will be discontinued if the subscription be not renewed. In order to avoid any interruption in the receipt of the paper, subscriptions should be renewed before the publication of the first issue of the new year. To those who are not familiar with the SUPPLEMENT a word may not be out of place. The SUPPLEMENT contains articles too long for insertion in the SCIENTIFIC AMERICAN, as well as translations from foreign periodicals, the information contained in which would otherwise be inaccessible. By taking the SCIENTIFIC AMERICAN and SUPPLEMENT the subscriber receives the benefit of a reduction in the subscription price.

A new electric furnace method has been invented by M. A. Nodon. The electro-negative metal is fused and used as the cathode in an electric furnace with a non-attackable substance as anode and an electrolyte of a fusible, only slightly volatile, halogen compound of the more electro-positive metal. When a current is passed through, the ionization effected produces a combination of the metals, with liberation of the halogen.

SCIENCE NOTES.

Is it possible to express the pleasantness or unpleasantness of a climate on a scientific scale? asks Knowledge. Capt. W. F. Tyler, F.R.Met.Soc., has attempted to form such a scale. Concluding that the two dominant factors influencing our sensation of comfort are temperature and humidity, he has coined the word "hyther"—apparently from the first syllables of "hygrometer" and "thermometer"—to indicate this joint effect. A perfectly pleasant day is registered 0 on this hyther scale, and an intolerably oppressive one as 10. Capt. Tyler's own observations of "hyther" extend over several years, but in the end of the summer of 1902, he was able to get the co-operation of eleven other observers for the systematic observation of "hyther" throughout the month of August. The results of the comparison showed that most persons would require a considerable amount of practice before their observations could be considered trustworthy, but some approach was made toward the establishment of a definite law connecting the temperature and humidity with the hyther sensation. At the same time there were indications that some other factors, possibly barometric pressure or electric conditions, had an appreciable influence upon the sensation. The subject seems well worth working out on a more extended scale.

When an alkaline solution of gold is treated with different reducing agents, a strongly colored blue or red liquid is obtained which is supposed to contain the gold in a colloidal state. M. Hanriot, of Paris, took up a series of researches upon this question. He had previously shown that the different varieties of colloidal silver formed as many chemically distinct species having different properties, and wished to see whether gold did not act in the same way. Under the name of colloidal gold, Heinrich describes solutions which he obtained by treating chloride of gold with different reducing phenols such as pyrocatechine and hydrochinon. M. Hanriot formed a solution of colloidal gold by dissolving one gramme of chloride of gold in one liter of distilled water. This he boiled with enough carbonate of soda to give a slightly alkaline reaction. He then poured in a 1.1 per cent cold solution of pyrocatechine to the amount of 300 cubic centimeters. This formed a red color which soon changed to violet. Dilute sulphuric acid was added drop by drop until the solution became slightly acid. The liquid turns blue in this case and deposits a blue precipitate at the end of a certain time. After washing, the powder is dissolved in dilute ammonia and again precipitated by sulphuric acid, avoiding excess of the latter. This compound is a violet-blue powder which is very slightly soluble in pure water, but is insoluble in a slight excess of sulphuric or nitric acid or their alkaline salts. On the contrary it dissolves easily in alkalis, especially ammonia or carbonate of soda. The excess of ammonia can be expelled from such solution by boiling, but this does not throw down the gold. Strong acids, however, will cause a precipitate in this case. The latter precipitate is found to be hydrated, and water forms part of its constitution. Thus, when dried at 100 deg. C., it loses its solubility in alkalis. The analysis of the body, dried at 40 deg. C., is as follows: Water (which is expelled at 100 deg.) 2.04 parts; loss at red heat, 6.31; gold, 91.53; SO_3, 0.39. This compound is but little altered by acids. In alkaline solution it soon deposits metallic gold, while the liquid takes a brown color. It seems to contain an organic matter which is not easy to determine. Colloidal gold is not soluble in mercury. When calcined it gives off carbon monoxide and dioxide gases, and hydrogen. A point to be observed is that this body is precipitated from a solution by acids and in this state is insoluble, but is re-dissolved by adding an alkali. It is therefore not to be admitted that the solutions are formed of fine particles of gold which are not agglomerated, seeing that this body keeps its solubility even when in the solid state, as above shown. Besides, it shows acid properties and forms a series of salts with the heavy metals which are either soluble or insoluble, each having individual properties.

The retirement of William K. Jenne, of Wyckoff, Seamans & Benedict, was marked by a complimentary dinner given to him at the Waldorf-Astoria, Monday, November 28, and the tendering of a loving cup.

To Mr. Jenne, more than any one else, is the development of the modern typewriter due. It was in 1873 that the first crude model of the typewriter was taken to the gun works of E. Remington & Sons at Ilion. The development of the invention was placed in charge of Mr. Jenne. In Mr. Jenne's charge, it ever since remained. Through his labors the machine has steadily advanced through all the successive stages of improvement, from the first crude ideas of the inventors to the Remington models of the present day. During this time Mr. Jenne has not only seen the development of the typewriter, to which he devoted the labors of his life, but has also witnessed its progress from an absolutely untried experiment to the necessity it has now become in the world's work.