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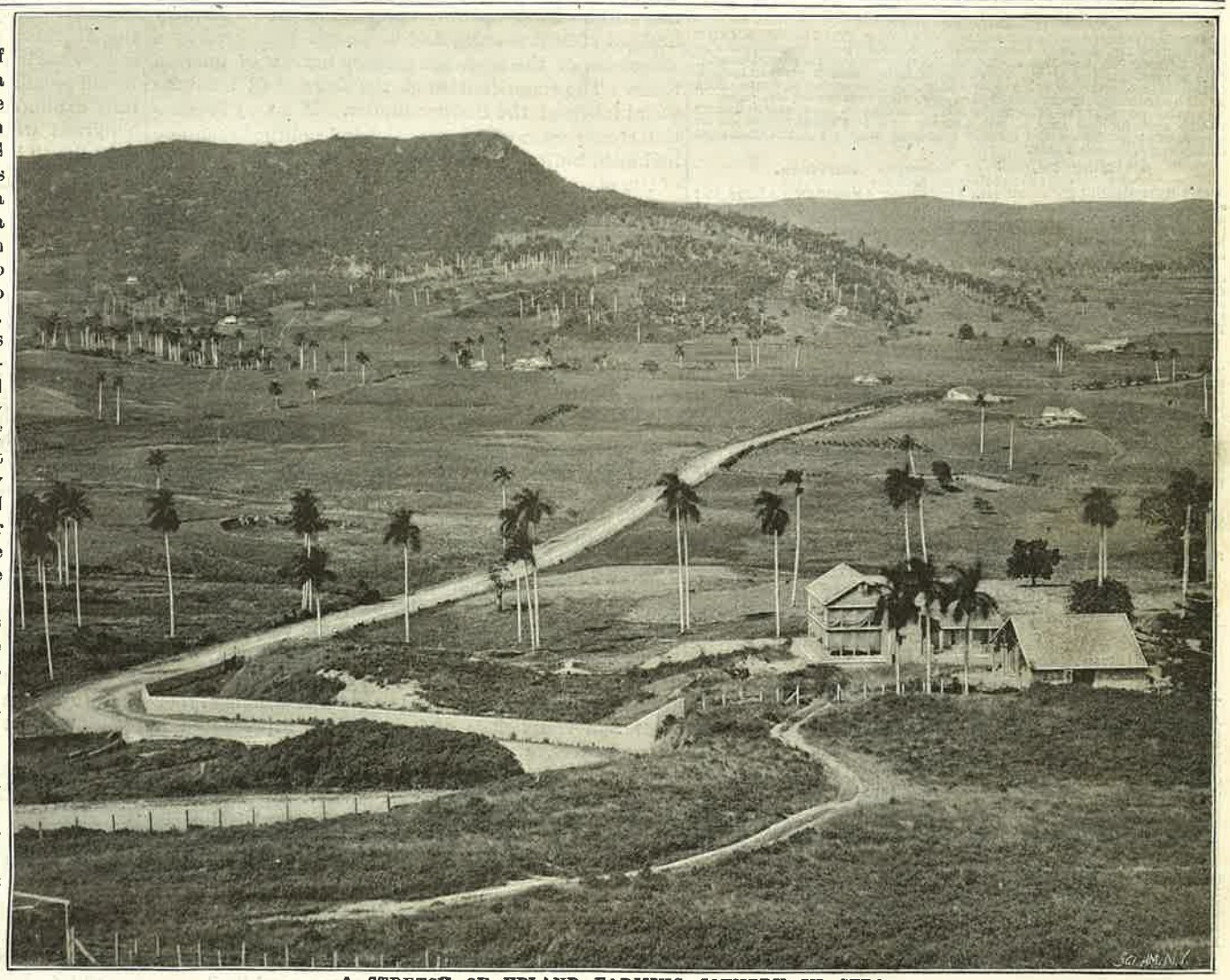
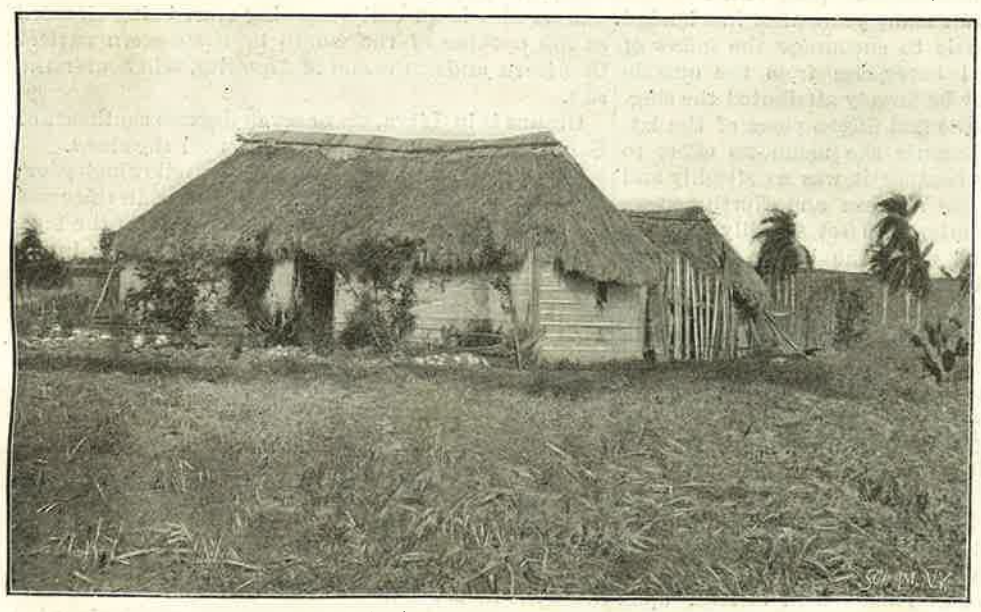
THE ISLAND OF CUBA.

We present in this issue a series of views illustrative of the city of Havana and the adjacent country, which were gathered during a recent tour through the island. Cuba is larger in area and population and richer in natural resources than is generally supposed. It has a total area of 43,319 square miles and a population of one and a half million souls. The distance from its eastern to its western extremity is nearly equal to the distance from New York to Chicago. To a soil of unusual fertility nature has added a climate which is peculiarly favorable to the growth of certain special crops of great value. The country may be broadly divided into the region of plains, the rolling uplands and the forest lands. The lowlands form a practically continuous belt around the island, and in them are to be found the great sugar plantations. Above these, and on the lower slopes of the hills, are found the grazing and farm lands, upon which, among other things, is raised the famous Havana tobacco. The balance of the island, especially the eastern portion, is covered with a dense forest growth.

The sugar plantations form the chief source of wealth in Cuba. The cane grows best in the level bottom lands, which are cleared of all shrub and timber growth for this purpose. Some of the plantations are of vast extent, including as many as 10,000 acres, and they stretch away in unbroken monotony on all sides of the batey, which is the name by which the collection of sugar mills, dwellings, stables, etc., in the center of the plantation is known. Roads or driveways



A STRETCH OF UPLAND FARMING COUNTRY IN CUBA.

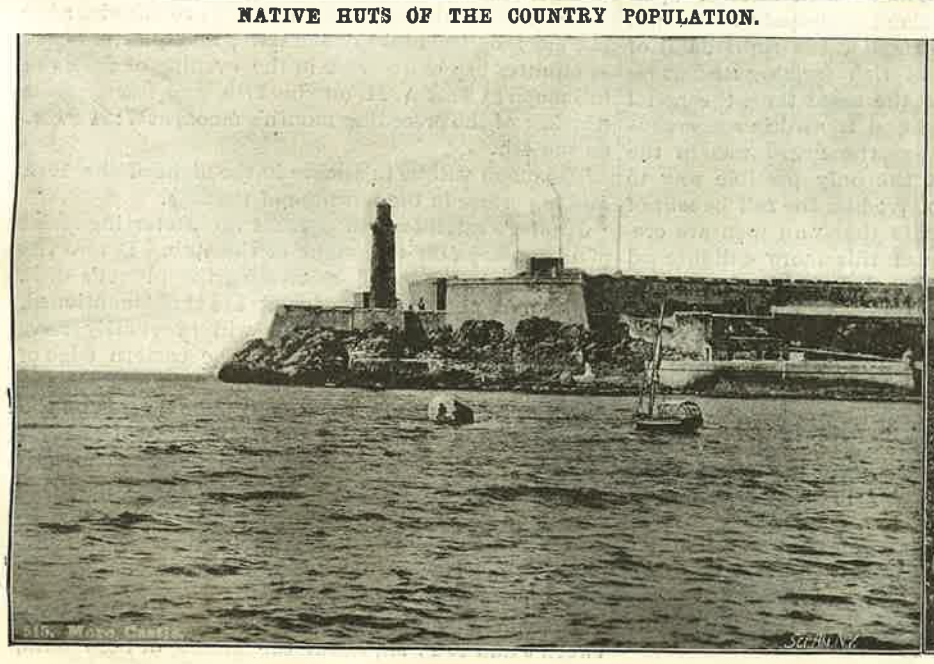


NATIVE HUTS OF THE COUNTRY POPULATION.

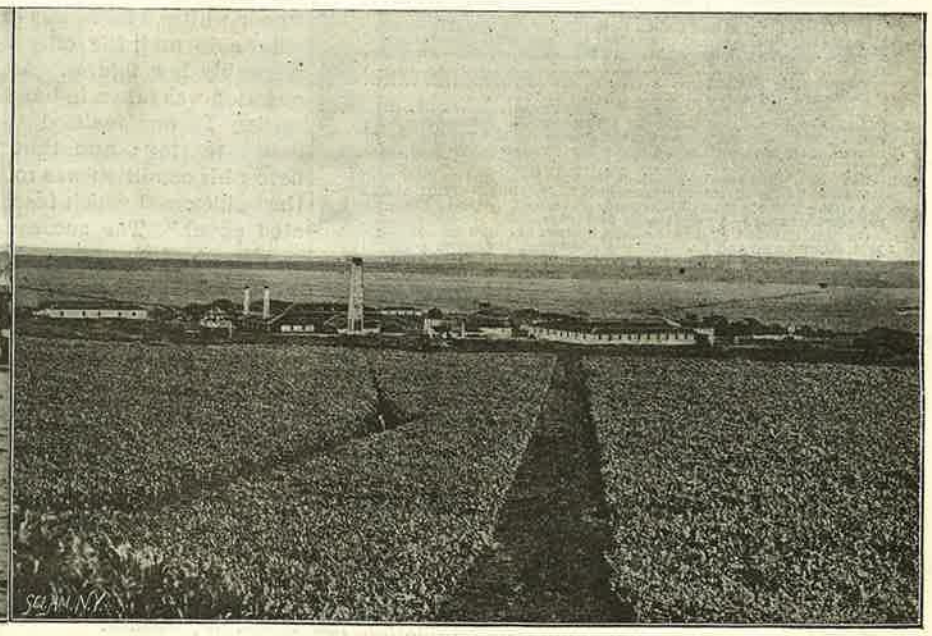
are cut through the cane and radiate in all directions, and along these the teams drag the heavily laden carretas to the mills. The Cuban does not place a heavy yoke upon the shoulders of the oxen, as we do, but uses a lighter yoke, which he lashes across the horns of each pair, so that a Cuban team pushes its load with the head. At the mill the cane is unloaded on to an endless belt, which carries it into the crushers.

The crushed cane, which is known as bagasse, is used for fuel, and the extracted juice is conveyed to large vats, where it is boiled. At a certain stage of the boiling it is transferred to pans, where it crystallizes to a brown sugar, which is then placed in long cylindrical moulds, where the molasses is allowed to run off. The sugar is now of a light yellow color, and, to further cleanse it, it is placed in centrifugal separators, where the molasses that still remains is removed, and the sugar, which is now fairly white in appearance, is ready for export. The average production is about 2,000 pounds to one acre. In former days, when the work was done by slaves, they were housed in quarters known as the barracon, which were located within the inclosure of the batey. Although in some parts of the island the laborers occupy the old slave quarters, it is now a common thing for the laborers to live in separate homes, scattered in the neighborhood of the plantations. They are very primitive dwellings, and consist of a square frame of posts, upon which is nailed a layer of boards, the interstices being plastered up with adobe clay. The roofs are thatched with palm leaf, the

(Continued on page 232.)



MORO CASTLE AT THE ENTRANCE TO HAVANA HARBOR.



A CUBAN SUGAR PLANTATION.

Sirius is flashing near the western horizon while the brilliant Vega is rising in the northeast.

Nearly overhead shines the Great Dipper, and south of it appears the softly twinkling Berenice's Hair. East of the latter is Arcturus, a royal star in brightness and color, while between Arcturus and Vega glitters the pure white Spica in the constellation of the Virgin.

Among the easily observed double stars now favorably placed are γ Virginis, ε Boötis, Mizar in the middle of the Dipper's handle, γ Leonis, and Castor, the great double in Gemini.

THE CONTEST BETWEEN SHOT AND ARMOR.

At the present writing it looks as though the superiority of shot over armor was proved, and that unless some new method of treating the plate be devised, the gun will have the armor at its mercy. That is to say, it will at the proving grounds; whether the hazard and confusion of a sea fight will very often afford the ideal conditions for penetration is open to question. The twelve inch side armor of the two Chinese battleships, which bore the brunt of the Japanese attack at the Yalu, was struck repeatedly; and yet no shot made a deeper penetration than four inches, although the three leading Japanese ships were armed with a gun—the 66 ton Canet rifle—which was credited with the highest power of penetration of any in the world. It is certain that, during the many hours that the fight lasted, some of the shots from these big guns must have struck the armored portions of the Ting Yuen and Chen Yuen. Judged by proving ground results, any one of these shots should have easily penetrated the belt, and wrecked the "vitals" of the enemy.

Now all this goes to show that the gun versus armor contest must not be judged from the results at the target alone. In target firing the gun has everything in its favor. The range is accurately known; the target is stationary; and the shot is delivered normal to the face of the plate. In a sea fight the range is uncertain; the target is moving; and the face of the armor will very seldom be struck squarely by the shot —this last being an element in favor of the armor of greater value than is generally supposed. To this, we think, more than to any other cause, must be attributed the surprising powers of resistance shown by the out-of-date armor plates of the Chen Yuen and her mate.

The history of the development of armor plate dates from the Crimean war and the war of the rebellion. In its earlier stages, the advantage lay with the armor. Penetration was comparatively rare; and in the attacks upon the Russian forts in the Black Sea, and upon the Southern batteries, the side armored vessels proved comparatively invulnerable to the round shot and shell of that date. The gun crews on the floating batteries suffered, as a rule, no greater inconvenience than the rattle of the round shot as it fell harmlessly from the iron plated sides of the vessel. Even the great 15-inch shot from the Rodman smooth bores could not get through. For a while, iron armor held the field. Then came the so-called conical shot, the long rifled gun, and the resulting increase in velocity; in the presence of which the thin plates of iron proved to be helpless.

Armor plate makers tried the next natural expedient, and made the plates thicker; and, as these plates were successively penetrated, they kept adding to the thickness until, in 1881, when the British Inflexible was floated, she carried no less than two feet of solid iron upon her sides. Difficulties of manufacture and the excessive weight of such armor led to the adoption of steel in place of iron. Here, however, the brittle nature of the steel presented a difficulty, and an attempt was made to combine the hardness of steel and the toughness of iron in what is known as the compound plate. This consists of a plate which is made up of an extremely hard steel face upon a softer iron backing. The idea of this device was that the steel face would provide the resistance to penetration; and that the iron backing, upon which the steel was welded, would prevent the steel from cracking; or, should it be cracked, it would keep it from falling to pieces.

The theory was plausible; but the results obtained in trial have been very disappointing; the steel face cracking and flaking off from the backing in most alarming fashion. The failure of the compound plate left the field open to the "all steel" advocates, and for the manufacture of a perfect plate there was only wanting some process by which the steel could be toughened without losing any of its hardness. This process was found in the nickel steel armor, in which the introduction of a proper percentage of nickel gave a remarkable toughness to the steel, without impairing its resisting powers. Shots were put through the test plates without producing those radiating cracks which at the second or third penetration had resulted in complete demolition.

Meanwhile the gunmaker had not been idle. Increased length and smokeless powders resulted in increased velocities; the penetration per ton of gun grew steadily larger; and the thickest steel plates succumbed to a caliber of gun which a few years before would never have been thought of as capable of piercing heavy armor.

The victory now lay with the gun.

It was reserved for an American inventor, whose name will forever be famous in the annals of the armor plate industry, to introduce a process which turned the tables entirely, and placed the advantage strongly on the side of the plate. The Harvey process, which is named after the inventor, seeks to present intense hardness of face, rather than thickness of metal, to the shot. The inventor realized that it was useless to attempt to resist the enormous momentum of modern ordnance; and that the only way to meet that momentum was to break up the material of the shot at the moment of impact. This he accomplished by making the face intensely hard, so hard, indeed, that it was capable of cutting glass. The Harveyized plates were a success from the very first. Shots which theoretically should have easily passed through a plate flew to fragments at the moment of impact.

For some few years the new plates remained practically impregnable against the hardest projectiles. Various systems of shot hardening have been tried, but with limited success; and it is only within the past few months that the gun makers have been able to regain their old ascendency. The first whispers of successful penetration came from Russia, where shot, which had been made on a "secret process," were reported to have passed through Harveyized plates without breaking up. What the process was can only be surmised; but the recent remarkable tests at the United States proving grounds at Indian Head make it probable that some form of what is known as the "soft steel cap" was used on the projectiles.

In these tests, and also the tests at the same grounds last October, the successful shot were "capped," that is to say, the point of the projectile was covered with a soft steel cap. The theory of this device is that when the point of the shot strikes the plate it will be prevented from flying apart by the surrounding metal of the cap. When the point has once entered the hard face of the armor, it is held together by the metal of the plate itself, and the shot can then expend the energy of its unbroken mass upon the body of the plate.

In the experiments of October last a Harveyized plate, which had broken up the ordinary 6 inch shot, was cleanly perforated by four 6 inch capped shot. The experiments now in progress with heavier 8 inch and 12 inch shot will be watched with keen interest, and thus the final advantage seems to lie with the gun.

Roentgen Photography.

In a recent Franklin Institute paper, Drs. Edwin J. Houston and A. E. Kennelly gave the following directions for using the ordinary alternating lighting current for X ray work. To the primary terminals of an induction coil are connected leads from a 50 volt alternating current circuit. The secondary of the induction coil connects with a battery of Leyden jars and with the primary of the Tesla coil. The Tesla coil is made by winding about 80 turns of No. 19 cotton covered wire on a glass tube about ¾ inch in diameter. Over this is passed a slightly larger glass tube wound with about 400 turns of No. 31 silk covered wire. The whole is immersed in a jar of resin oil. The Crookes tube is connected to the secondary of the Tesla coil. This arrangement gives the disruptive discharge, which is of increased effect and less likely to injure the tubes. The discharging electrodes of the induction coil are placed about 5 mm. (0·2 inch) apart. To secure sharp images the use of a metal plate perforated and used as a diaphragm is recommended.

Nikola Tesla has continued his experiments on reflection of X rays from different materials, using an angle of incidence of 45° as the most crucial test. Each sample was tried simultaneously as to its power of reflecting and transmitting the incident ray. Zinc, mica, tin and lead were the best reflectors. Aluminum reflected no appreciable portion of incident rays. There was no corresponding order in transparency to the rays. Zinc, tin and lead proved opaque; mica transparent. He upholds as his view that the X rays are both cathodic and anodic. He has obtained good results by using a zinc reflector for his tubes. He announces that he has not found the least evidence of refraction.

MM. Darien and De Rochas have tested an eye, which was placed upon a plate holder with two fingers beside it. The X rays were then produced and a photograph taken. The eye proved intermediate in opacity between bone and muscular tissue. The rays passed axially through it.

A very interesting line of work has been initiated by Mr. H. I. Dreschfield, L.D.S., of Manchester. He used X ray photography to show the development of the second set of teeth in a living subject, a boy about thirteen years old. He succeeded in obtaining a photograph showing the first set of teeth in place and the second set still in situ in the bone back of and above the others.

It is definitely stated that X rays were used in Vienna to determine whether a wrapped mummy contained the remains of an ibis or of a human being. The process showed it to be the mummy of an ibis.

A very ingenious attempt to measure the intensity of the X rays is due to Prof. R A. Fessenden and Prof. James Keeler, Western University, Pittsburg, Pa. They immerse the ends of two terminals of a circuit in paraffin, the ends being about one-half inch apart. The X rays are then caused to pass through the paraffin and their effect in causing an electric discharge to pass is used as a measure of their intensity.

Prof. Rowland, of Johns Hopkins University, and Elihu Thomson both appear as enunciators and upholders of the hypothesis that X rays are of the anodic order, and not of the cathodic order. Thomson found that no X ray effect could be obtained from an excited tube when the anode and a fluorescent screen had a patch of opaque metal interposed upon the glass of the tube between them, although the cathode was unscreened. Anode rays he found to be erratic in distribution from the anode, and to require very high exhaustion for their production. He says that it is fortunate for science that the Crookes tube used by Roentgen had a high enough vacuum to give anodic rays.

Cost of Bad Roads.

According to statistics collected by the office of Road Inquiry of the Department of Agriculture, the amount of loss each year by bad roads of the country is almost beyond belief. Some 10,000 letters of inquiry were sent to intelligent and reliable farmers throughout the country, and returns were obtained from about 1,200 counties, giving the average length of haul in miles from farms to markets and shipping points, the average weight of load hauled and the average length per ton for the whole length of haul. Summarized, it appears that the general average length of haul is twelve miles, the weight of load for two horses 2,002 pounds, and the average cost per ton per mile 25 cents, or $3 for the entire load.

Allowing conservative estimates for tonnage of all kinds carried over public roads, the aggregate expense of this transportation is figured at $946,414,600 per annum. Those in a position to judge calculate that two-thirds of this, or nearly $631,000,000, could be saved if the roads were in reasonably good condition. At $4,000 per mile a very good road can be constructed, and if an amount equaling the savings of one year were applied to improving highways, 157,000 miles of road in this country could be put in condition. The effect of this would be a permanent improvement, and not only would the farmer be astonished in the sudden reduction in his road tax, but he would also wonder at the remarkable falling off in the cost of transportation. He would also find that he required fewer horses and less feed for them. He could make two trips to market a day instead of one, when ability to get his goods there at a time when high prices are ruling is a matter of great consequence. Farmers are beginning to apply a little simple arithmetic to some of these matters, and it is not too much to expect that in the near future we shall see a decided revolution in the condition of our rural highways.—New York Recorder.

Value of Farm Animals.

According to statistics published by the Department of Agriculture at Washington, says the Iron Age, the aggregate value of farm animals in the United States has declined very materially in recent years. At the present time the value of these animals is $755,580,597 less than it was in 1893. The decline is more particularly observable in the case of horses. Taking the seven years from 1890 to 1896, it is shown that horses increased in number until 1893. In 1892, however, their value began to fall off, and in 1895 it was not quite half that of 1892, showing an aggregate decline in this respect of about $500,000,000. This depreciation is attributed in the main to the introduction of trolley cars and bicycles. The high cost of fodder, however, after recent seasons of drought, is also given as a contributing cause. The value of mules since 1890 has fallen nearly $80,000,000, or not far from half the total existing value of these animals in the United States. On the other hand, milch cows have increased in numbers, while the average value of these animals has advanced steadily within the past few years. The increase in the value of milch cows last year, as compared with 1894, is $1,300,000. Oxen and other cattle decreased in numbers more than 2,000,000 in 1895, while their value increased on an average $1.80 a head in the same period. A decline is noted in the numbers and value of sheep in the last three years, the decrease in value aggregating about $60,000,000 and the falling off in numbers of these animals last year being nearly 4,000,000. Swine, in 1895, declined 3 per cent in number and 15 per cent in aggregate value, the total decrease in the value of swine in 1895 being nearly $33,000,000. It is expected, however, that the enormous corn crop of last year will have a favorable effect upon the next statement of farm animals, the tendency to an increase in numbers and value being already observable.

The Annual Reception of the New York Academy of Sciences, March 26.

BY E. O. HOVEY.

The third annual reception of the New York Academy of Sciences, which consists mainly of an exhibition intended to illustrate recent progress in all branches of science, was held Thursday afternoon and evening, the 26th of March, in the American Museum of Natural History. The afternoon session was intended especially for the teachers and advanced pupils in the schools and was informal in its character. In spite of the unpleasant weather, the evening session was very largely attended, and the whole affair was pronounced a decided success. The exhibition was very comprehensive in its scope, fourteen departments of science being represented. So much material was displayed that it was impossible for a person to get even a general idea of what was to be seen and studied, and our report can deal with only a few of the most striking features of the exhibition. It seemed to many that it would be well if the academy could arrange to hold the reception two days instead of one, or could have the lecture on a different evening from the main exhibition.

Popular interest evidently centered around the exposition of the Roentgen X rays and their application. Prof. M. I. Pupin, of Columbia University, delivered an interesting and instructive lecture on the subject, illustrated by apparatus, experiments and photographs. One piece of apparatus that he had was Edison's latest invention, the "fluoroscope," which had been received from the celebrated electrician only three days before. This instrument consists of a hopper shaped box, the small end of which is fitted into a hood which is placed over the eyes like the eyepiece of an oldfashioned stereoscope. The large end of the hopper is closed by a flat screen coated with tungstate of calcium, which has been found to be especially susceptible to the fluorescent influence of the X rays. The screen is about ten inches distant from the eyes, and the whole apparatus is thus very compact and convenient. After the lecture many persons in the audience availed themselves of Prof. Pupin's invitation to examine the shadow of the bones of their own hands through the new fluoroscope, a novel experience for every one. This instrument will enable surgeons to examine broken bones, gunshot wounds, etc., by means of the X rays, without the tedious delay and inconvenience incident to developing photographic plates.

In the sections of physics and electricity in the exhibition hall were numerous Roentgen photographs of a great variety of objects, the most striking of which was a life size representation of the hand and forearm of an adult, with every peculiarity in the outline of the bones clearly brought out. The term used by Prof. Pupin for these pictures is "radiographs." Another interesting exhibit in the section of physics was the apparatus recently devised for photographing the human vocal chords while in action and photographs made by it. These photographs show that the cartilages rotate, and thus vary the length of the vibrating portion of the chords.

In the photographic section there was a very interesting series of photographs of lightning. These showed that lightning is wavy, not zigzag in its course. Forked and branched discharges, both natural and artificial, were represented, as well as "thunderbolts." One picture showed how trees are of service during a thunder storm in dissipating, neutralizing or conducting a discharge. Another was of ribbon lightning, which was caught by the camera from the rear platform of an express train at midnight while crossing the prairies of North Dakota. In this section also was a beautiful series of reproductions by the new three-color process of studies from nature and paintings from negatives and plates untouched by hand.

The astronomic exhibit consisted of several pieces of apparatus and of a large number of photographs illustrating the work done at the observatories of Harvard and Columbia Universities and at Allegheny, Pa. At the last place much work is being done toward the solution of the problems of planetary atmospheres and rotation by spectroscopic methods.

Experimental psychology is a science which has taken great strides of recent years, and some most ingenious machines have been devised for use in its investigations. One of these was on exhibition at the reception and excited much popular interest, to judge from the crowd around it watching its operation. The machine is adapted for use with several different mental stimuli, but the color wheel was the only one used on this occasion. The observer looks at the rotating wheel, and, as soon as he sees the given color, he pushes an electric button. The machine registers the instant when the color comes in sight and the instant when the observer responds to the stimulus. It has been found that, as a rule, educated people are more quick to respond than uneducated.

Ethnology and archæology had a large exhibit, mostly from the recently made collections of the American Museum of Natural History. Here were representations of animal forms in pottery, painting, weaving, gold, stone, and wood, in the art of ancient Peru, and portrait heads in pottery of the same time and place. A series of pathological specimens from a prehistoric burial ground in Kentucky showed that both sexes were equally subject to inflammation and suppuration of the bones, the skeletons of nineteen out of fifty-five adults being affected with it. Skeletons exhumed last summer at an Indian burial place at Tottenville, Staten Island, showed a very close relationship between the prehistoric people of that locality and the Indians now living in Nova Scotia. Dr. G. M. West exhibited diagrams which he had prepared which show that children develop differently in different parts of the country and at different times in the same locality. In Worcester, Mass., children grow very tall, especially the boys. In Boston and Toronto both boys and girls are shorter than the average, while in Milwaukee they are a little taller. The diagram of Oakland, Cal., presented a curious phenomenon. At one time the children were all very short, then they began to get taller, and the girls have kept the upward tendency, while the boys fell back again and then took a new start upward. Another interesting exhibit in this section was that of arrow games in Asia and America. By means of many specimens Mr. Stewart Culin showed how playing cards and chess had originated in the arrow. He also illustrated the hypothetical development of the seal cylinder, the Chinese coin and the folding fan.

Next to this section came that of palæontology, and the strange skulls and pictures in it attracted much attention. The pictures formed a series of attempts to put flesh and blood on to the wonderful skeletons which have been found in the extensive Tertiary lake deposits of western North America, and gave one a vivid idea of what the condition of affairs must have been when the uintatherium, titanotherium and hyrachyus (or rhinoceros) dominated the land.

Geology, mineralogy and physiography occupied the north end of the space given up to the academy for the evening. The first contained much matter of great interest to the specialists present, though most people would have passed the whole by as being so many "stones." A suite of specimens and photographs illustrated the mode of occurrence of the ores and rocks in the now famous Cripple Creek, Colorado, gold fields. The ores are fresh or decomposed telluride of gold and are oftenest associated with dikes of igneous rock (phonolite or nepheline basalt), which penetrate the red granite of the Pike's Peak region, or a decomposed breccia of andesite, though they also lie in veins which fill more or less irregular veins in the andesite breccia away from dikes. A series of variegated marbles from Swanton, Vt., showed a beautiful and remarkable variety of colors and markings. Madrid, New Mexico, furnished a suite of specimens of coal showing the change from pure bituminous to pure anthracite, caused by the proximity of volcanic rocks. The display of minerals was very large and contained many unique specimens, as well as samples of rare and new species. The monster tourmaline crystal from One Hundred and Seventy-first Street and Fort Washington Avenue was exhibited, as well as a much larger but coarser crystal of the same mineral from Bethel, Conn.

Specimens of the new minerals, lorandite, northupite and lawsonite, were shown, as well as large quantities of the very strange and heretofore rare mineral thaumasite, which has very recently been found in abundance at West Paterson, N. J. The display of minerals from this new locality was rendered especially noteworthy by the exhibit of A. H. Ehrman, who has the choicest of the material thus far obtained there. In one corner of the mineralogical section Geo. F. Kunz had a booth erected in which, by means of electric light passed through violet glass, he showed that some diamonds are strongly phosphorescent, while most diamonds do not have this property. One of the stones he exhibited emits phosphorescent light for several hours after the original source of light has been shut off. One of the anomalies shown in this section were pseudomorphs of pyrite and turquoise after orthoclase from Cerro de Potosi, Bolivia. The section of physiography was of especial interest to teachers, on account of the newly issued text books, relief maps and models and wall maps on exhibition.

In the botanical department one could see numbers of beautifully mounted preparations illustrating new species of plants and microscopical and other features illustrating recently elaborated life histories and relations of plants and groups of plants. The economic as well as the scientific side of the science was shown in three series of specimens, preparations and drawings used in making a comparative study under varying circumstances of as many plants which are used extensively as drugs, with the object of furnishing means of determining whether the plants had been collected at the proper time or not and whether they were retaining their valuable properties or not.

Persons interested in chemistry were much pleased at the opportunity given in the chemical section of seeing the spectra of the newly discovered elements—argon and helium—as well as the apparatus used in extracting helium from the mineral monazite.

Living things always arouse interest, and the aquaria shown in the department of zoology were always surrounded by crowds of people who seemed perfectly willing to expose their ignorance by the curious questions they asked. One aquarium contained living tube worms and a ship worm, corals, barnacles, a soft clam and some sea anemones. Others had in them paradise fish, the nest building sticklebacks and black dace, fish bred for great eyes, for particular colors and for fantails. The largest single item exhibited in any of the sections was in this of zoology; it was the great Asiatic elephant Tip, of unsavory fame at the Central Park menagerie and elsewhere.

We are apt to think of bacilli or microbes as being harmful things, but that they are not always such was shown in the department of bacteriology by the exhibit of Prof. H. W. Conn. In milk received some time ago from Uruguay he found a bacillus which proves to have a marked power of ripening cream for butter making, improving the flavor and keeping qualities of the butter made by its use.

The section of anatomy had an exhibit which consisted for the most part of series of casts showing variations in the pectoral muscles of man, and comparing them with similar muscles in nine other animals, and showing the development of the sternalis muscle, which is now usually very small and useless, but which in some former stage of life apparently extended all over the chest, and was very important.

The president of the academy this year is Prof. J. J. Stevenson, of the University of the City of New York, and just before Prof. Pupin's lecture on the Roentgen X rays he gave a general survey of recent scientific work, especially that accomplished in the past year. Prof. H. F. Osborn was the chairman of the reception and exhibition committee, while Dr. J. L. Wortman was chairman of the special committee of arrangements. The departments of the exhibition with the men in charge of each were:

Physics, William Hallock and Herbert T. Wade; electricity, M. I. Pupin; photography, Cornelius Van Brunt; chemistry, Morris Loeb and C. E. Pellew; astronomy, Harold Jacoby; geology, J. J. Stevenson; mineralogy, E. O. Hovey; physiography, R. E. Dodge; zoology, William Stratford: bacteriology, T. M. Cheesman; palæontology, J. L. Wortman; anatomy, George S. Huntington; ethnology and archæology, Franz Boas and M. H. Saville; experimental psychology, J. McK. Cattell.

The Hospitals of Florence.

Many institutions now engaged in active charitable work in Florence date their origin from the twelfth and thirteenth centuries, and successive generations of Florentines have carried it on, in many cases without intermission, down to the present day. Hence we find, says the British Medical Journal, bacteriological research and modern methods of treatment, antisepsis and hygiene, carried on side by side with traditional usages in buildings which carry the mind back to early mediæval times. There is not a single modern hospital in Florence; the new hospital for children is without the walls. Among the records of early charitable institutions of Florence are those founded by the Knights Templar and the Knights of the Order of St. John of Jerusalem in the twelfth century. The principal hospital of the present day, Santa Maria Nuova, was founded in 1288, and about the same time the captains of the Bigallo determined to preside over the hospitals in order that the sick should be tended with brotherly love; the captains of Or San Micheli took into their charge orphans, the destitute and widows, and the brotherhood of the Misericordia undertook to transport invalids to the various hospitals, and the dead to their last resting places. This brotherhood is still performing the same work of mercy, and may be daily seen robed in long white gowns which completely cover the head, and are only pierced with eyelet holes, traversing the streets of Florence with their living or dead burdens. In 1340 Villani's history records that there were more than 1,000 beds for the sick poor in Florence. At the end of the fifteenth century there were thirty-five hospitals, some special, some general, and some to give shelter to the destitute. All these institutions were established by the various guilds or privately endowed, and if all the wealth left to Florence had been preserved to its original destination, it is said that half Tuscany would belong to institutions for the relief of the poor. In early days the moneys left to the poor generally reached their destination—a contrast, says Pastarini, with present times, when much of that which was intended for the poor finds its way into the pockets of the employes of charitable institutions. Many of these charities were suppressed by the Council of Regency, in 1750, and many more by Peter Leopold, who wished to centralize public institutions in the state. At the present day most of the hospitals are directly or indirectly under government control.

AN early sign of incipient pulmonary tuberculosis is prolonged expiratory murmur. The respiration is apt to be short and "catchy."

Acetylene Standard for Photometry.

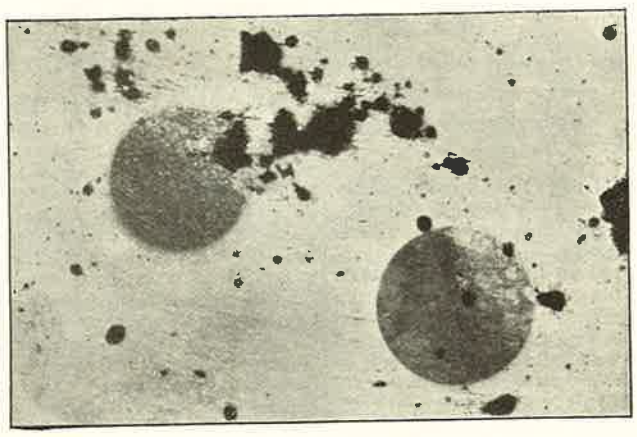
The practical advantages of flames as standards of light have led to their almost exclusive employment for this purpose at the present day. A gas of constant chemical composition, burning under defined conditions, must admittedly form a useful accessory standard. Acetylene, the importance of which has been shown in a masterly study of it by M. Berthelot, appears to be well adapted for the purpose. M. Moissan has found the means of readily preparing the gas in a pure state by the action of water on calcium carbide, which is easily manufactured in the electric furnace. If acetylene is consumed under slight pressure in a burner which gives a broad, shallow flame, the latter is quite steady, very bright, remarkably white, and, for a fairly large surface, of practically uniform luminosity. By placing in front of the flame a screen with an opening of fixed dimensions, which can be varied for particular cases, a source of light well fitted for ordinary photometrical observations is obtained.

These principles were enunciated last year at a meeting of the Société Francaise de Physique, and M. Charpentier (for whose valuable assistance my thanks are due) has constructed for me a standard lamp embodying them, and easily used. The acetylene, issuing from a small conical orifice, draws in the required air, and then passes through a narrow aperture into a tube in which mixing occurs. This tube ends in a steatite batswing burner, like those employed for illuminating gas. Either the whole or a clearly defined portion of the flame may be used. In the model employed, the flame is inclosed in a small chamber, one of the sides of which is provided with an iris diaphragm, enabling any desired number of candles to be secured. Another side is made to accommodate plates with previously calibrated apertures. The whole flame corresponds to more than 100 candles, under a pressure of 0·30 meter of water, and a consumption of 58 liters (2·049 cubic feet) per hour. The illuminating power of acetylene is therefore more than twenty times that of coal gas burnt in a Bengal burner, which gives 1 carcel (9 6 candles) per 105 liters (3·708 cubic feet), and at least six times that of coal gas consumed in a Welsbach burner, which gives one carcel per 30 liters (1·059 cubic feet). Moreover, spectrophotometry shows that for the whole length of the spectrum, from C to F, the light from acetylene differs little from that of platinum in a state of fusion. The latter is employed as the absolute unit, and it is so related to the candle that this is defined as one-twentieth of that unit. Photography, which offers the best means of studying rays of small wave length, shows that in the flame of acetylene there is an actinic intensity, which should prove of most valuable service.—M. Violle in Comptes Rendus.

RADIOGRAPHY.

In the March number of the Red and Blue, of the University of Pennsylvania, is given an account of Roentgen photography and some experiments made at the university in the same direction by Dr. Arthur W. Goodspeed, assistant professor of physics. These experiments were successful repetitions of the experiments of Roentgen and others, together with original work; but the item of greatest interest was contained in the last clause of the article referred to, which we produce, together with cut of the first shadow picture, for which we are indebted to the magazine above mentioned.

In the year 1890, Mr. Jennings, of Philadelphia, had associated himself with Dr. Goodspeed in experiments on spark photography. One evening, the 22d of February, 1890, at the close of work, with the table still littered by plate holders and apparatus, Dr. Goodspeed brought out the Crookes tubes for Mr. Jennings' amusement. Next day that gentleman wrote that he had had a curious failure among his plates—a negative spotted by two disks; but since no one could explain the phenomenon, comparatively uninteresting as it was, the plate was thrown aside and forgotten. Six years later after the discovery of the Roentgen rays, it was recalled to mind and recovered. A duplicate was prepared under exactly the same circumstances; both plates exhibited the same indications of genuineness—the sharp line at one edge of the disk, the dull line of shadow at the farther edge. These photographs the Red and Blue has the honor of presenting for the first time. It was in a lecture on the evening of University Day that Dr. Goodspeed told the story, and concluded thus: "We can claim no merit for the discovery—for no discovery was made. All we ask is that you remember, gentlemen, that six years ago, day for day, the first picture in the world by cathodic ray was taken in the Physical Laboratory of the University of Pennsylvania."



THE FIRST SHADOW PICTURE IN THE WORLD.
Taken by accident at the University of Pennsylvania, February 22, 1890.

DR. CHANTEMESSE, of Paris, has it is said discovered an anti-typhoid serum, with which he has experimented on three patients. After the first hypodermic injection they passed through the ordinary stages of the disease and became convalescent.

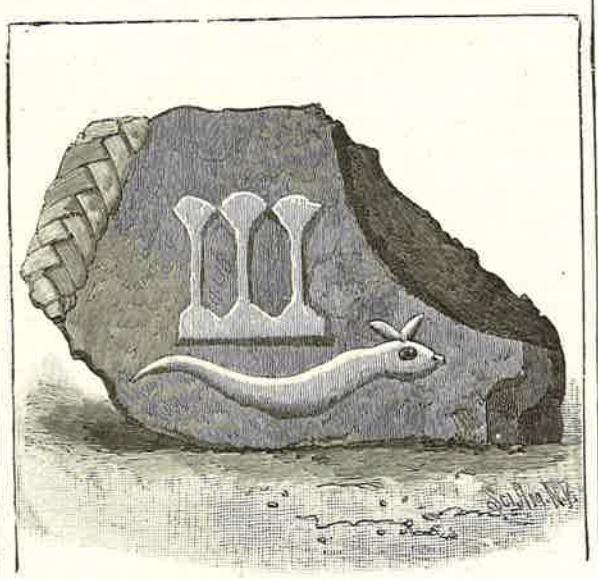
AN INTERESTING ARCHÆOLOGICAL DISCOVERY.

We have received the following letter from Mr. George E. Raum, late of San Francisco:

Cairo, Egypt, February. 29, 1896.

To the Editor of the SCIENTIFIC AMERICAN:

Dear Sir: I inclose a rough sketch of a portion of the rock crown of the Sphinx found by me. This portion of the stone crown or diadem of the Sphinx was found at the bottom of the temple, between its forepaws, on February 26, 1896. Originally this stone crown was in all probability ten feet broad and as high



CAP OR DIADEM OF THE SPHINX.

again, with a stone stem seven feet long, which fitted into the perpendicular hole in its head, to hold it on. We now know how the Sphinx originally looked.

Yours truly, GEORGE E. RAUM.

This discovery of Col. Raum is of great interest, though the statement of the find has been received with incredulity in some quarters. The arguments of the gentlemen who are inclined to disbelieve in the authenticity of the stone found are not convincing, being principally based on the fact that the temple has been excavated by several modern explorers—Caviglia, Mariette, and M. Maspero. Again, others state that "it is not usual to hear of holes 'drilled' by the ancients in their monuments," but the Egyptians worked hard stones with bronze saws set with corundum or diamonds, and for tubular drilling they had tools like our modern diamond rock drills (see Engineering, xxxvii, page 282). Another point which has been made is that there are three lotus columns on the cap. This is more reasonable criticism and may possibly be satisfactorily explained. The fallibility of Egyptologists is well known, but until some really convincing proof is brought forward, it is probably safe to believe that the marked stone found by Mr. Raum is the cap or diadem of the Sphinx.

The Egyptian Sphinx was usually an emblematic figure representative of a king, and may be considered, when with the head of a man and the body of a lion, as the union of intellect and physical force. The Great Sphinx lies about 1,800 feet southeast of the Great Pyramid of Gizeh. It is a recumbent androsphinx, or man-headed lion, hewn out of a natural eminence in the solid rock. Owing to certain defects in the rock, these faults were remedied by a partial stone casing, the legs being likewise added. The addition of these pieces militates against the argument that the cap so recently found could not have belonged to the Sphinx, as it did not form a part of the solid rock. An excellent idea of this hoary monument of antiquity may be obtained from the engraving in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 864. The Sphinx has been variously measured. The figures given by Mr. E. L. Wilson are length, 155 feet; height from the base, 63 feet. Between the paws is a temple (?) which speedily fills up with sand after being excavated. It is considered that the Sphinx is older than the Great Pyramid. Various interpretations have been given to this boldly sculptured figure which rises out of the waste of sands. Cambyses mutilated the face of the Sphinx, and it may have been at this time that it lost its cap.

The brow of the Sphinx is nearly 14 feet broad; so the cap, which is 4 feet 6 inches long at the bottom, probably only formed the tip of the cap, as stated by Mr. Raum. Col. Raum obtained permission to excavate in and around the Pyramids and Sphinx from the Egyptian government. He came upon the cap at a depth of fourteen or fifteen feet below the surface in the temple (?) between the forepaws. The stone is painted red in the decorations, as was in order, as the countenance of the Sphinx was originally of a reddish hue. The cap is irregular in shape, measuring 2 feet 2 inches at the top and 4 feet 6 inches at the bottom; on the left side, from top to bottom, it measures 2 feet 8 inches. The left side has a conventional decoration. In the center are three lotus columns and a fish, on the right side is a portion of the sun's disk. The wonderful discoveries conducted by Mr. L. De Morgan, at Dahshur, Egypt, are described in the current issue of the SUPPLEMENT. The tomb of Queen Khnemit was unearthed by the discoverer and a beautiful golden crown and other ornaments of elaborate workmanship were found.

Fire from Steam Pipes.

The burning of the Warren (R. I.) cotton mill having been attributed to the carbonizing of the wooden lagging on the cylinder of the large quadruple expansion engine, again brings up the possibility of wooden coverings to steam pipes taking fire without the presence of a spark to start the combustion, and some recent investigations by the Boston Manufacturers' Mutual Fire Insurance Company are of considerable interest. In a report of these investigations, appearing in the Providence Journal, several instances are given where wood coverings, although separated from steam pipes by several thicknesses of hair felt and other coverings, became badly charred and in several instances actually took fire.

Mr. Edward Atkinson, president of the company, says that it is sometimes held that this finely carbonized wood will not ignite from any cause except actual contact by spark or flame from an outside source. In proof that charcoal in a porous condition will ignite from the sudden influx of fresh air, he cited an example in his own experience.

Having had occasion to test heat-retarding substances on his own behalf, he once obtained some sections of prepared wood pulp in slabs of 1½ inches in thickness and of a very porous quality, which are made use of in the construction of refrigerators. His purpose was to determine whether or not such slabs could be used to prevent the escape of heat from a lamp oven. He therefore raised the heat of the inner oven, which is a tight inner iron box one inch distant on all sides from an outer case made of vulcanized and very solid wood pulp, to a little under 400 degrees. In the center of that inner oven, isolated from any metallic contact with the wall, was placed one of these slabs and there left subject to heat at less than 400 degrees for about one hour. He then removed the front of the outer oven and opened the door of the inner oven, letting a very quick and large supply of fresh air into the chamber, in which the oxygen had probably been in part exhausted by subjection to the hour's heat. The slab of wood pulp had turned from pure white to dense black, having been converted into very porous charcoal. In less than a minute after the fresh air was let in it took fire and burned to ashes. He repeated the experiment with the same result. Four hundred degrees Fahrenheit will be developed by a pressure of steam of 238 pounds per square inch, but the same carbonization ensues by lapse of time even at boiling heat, or 212 degrees, as has been proved.—The Engineering Record.

Life of a Cannon.

La Nature contains a short note in which the horse power of a cannon is calculated. An Italian cannon of 100 tons with a charge of 550 lb. of powder and a shot weighing about 2,000 lb., will give an initial velocity of 523 meters per second; the length of time during which the powder acts is less than one-hundredth of a second, from which it follows that the horse power developed is about 17,000,000. The writer adds that after about 100 shots the cannon is put out of service and its total active life is, therefore, only one second! In large modern cannon the horse power runs as high as 24,000,000. If the writer had carried out these calculations still farther, he would have found that, after all, this 24,000,000 horse power does not represent a large amount of energy, as it would be just sufficient to run 31 incandescent lamps for only one day.

PROFS. AYRTON and Medley find that incandescent lamps appear to increase in effectiveness during the first 80 or 100 hours of use, after which the light slowly fails.

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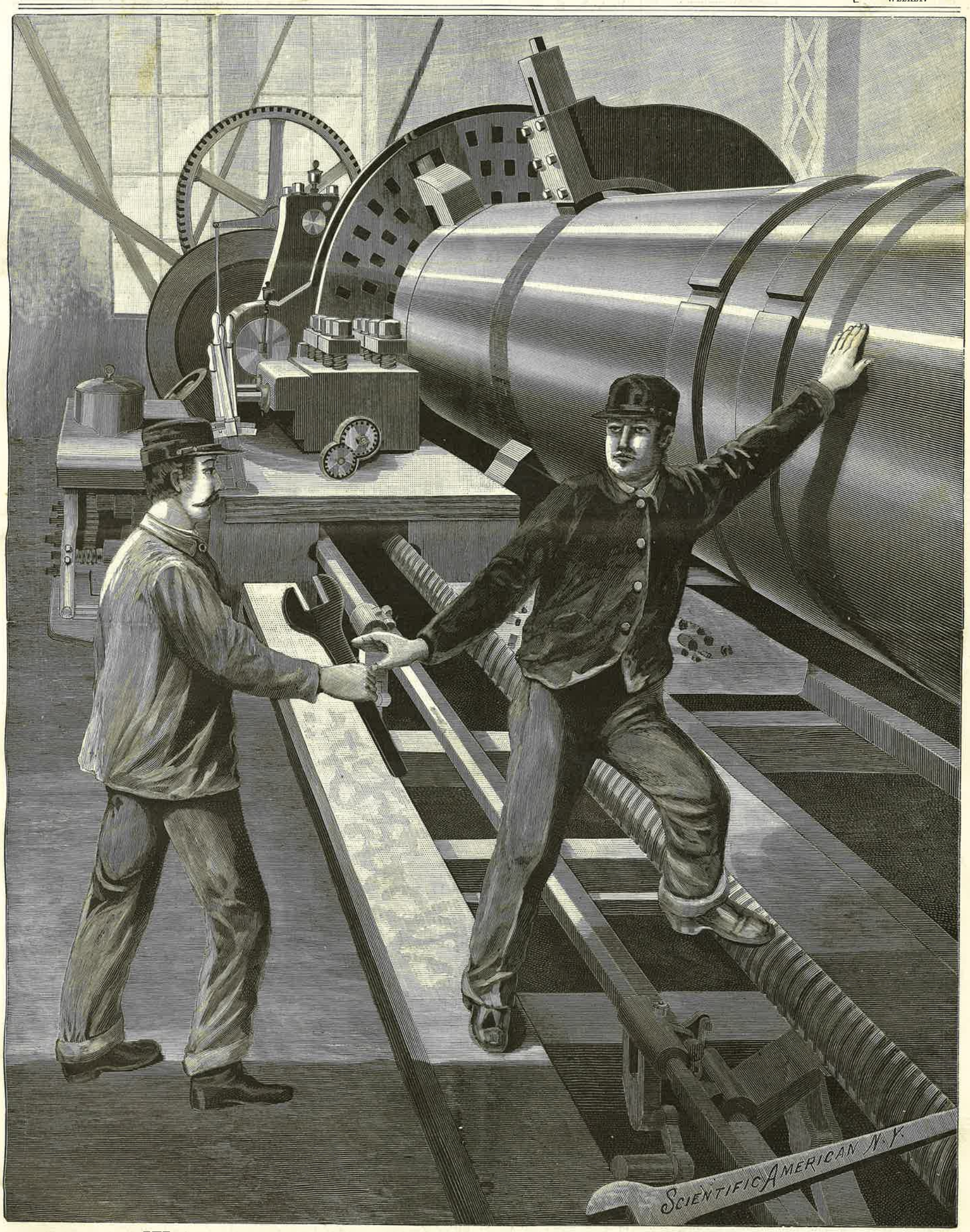


THE GREAT SIXTEEN INCH GUN LATHE AT THE WASHINGTON NAVY YARD.—[See page 343.]

jected to blows numbering from ten to fifty each of the same drop weight, falling one-half the former distance, these blows being insufficient to break the bars. The weight was then permitted to fall upon each of these bars in turn, from the height at which the six bars previously tested were broken on first blow. Not one bar broke. Two, three, six, ten, and in one case fifteen blows of the same drop, from the same extreme height, were required to break these bars. In another similar case the weight was dropped once from the former maximum height, then raised by inches until four more blows, each fall being one inch higher than the last, were delivered before breaking the piece. Subsequent tests gave still greater gains in strength."

In conclusion it was pointed out that "molecular annealing" differed from annealing in the oven in that it cannot change the chemical constitution in any way; and it is merely claimed that "every iron casting when first made is under a condition of strain, due to difference in the rate of cooling of the metal near the surface and that nearer the center, and also to difference of section; that it is possible and practicable to relieve these strains by tapping repeatedly the casting, thus permitting the individual metallic particles to rearrange themselves and assume a new condition of molecular equilibrium."

It is suggested in conclusion that all castings which are to be subjected to sudden and severe strains in actual service should never be tested at first up to anything like their full capacity. This applies to such castings as steam hammer frames, housings for rolls, and possibly to cast steel and all metal castings. The influence of shock upon the various forms of castings other than iron is now being made the subject of experiment.

Celestial Sights in June.

BY GARRETT P. SERVISS.

This is the month of the summer solstice. In June the sun attains its greatest northern declination, and the astronomical summer begins. The event occurs about 5 o'clock in the afternoon of the 20th, Eastern standard time. In the course of the month the sun will cross the Milky Way from Taurus to Gemini. During the first week the celestial "Bull," himself invisible in the blaze, will carry the god of day upon his "golden horns." At the end of the third week the sun will be received by Gemini, and at the time of the solstice will be close to the wonderful star cluster called M 35. Looking at the noonday sun in the middle of the month, it will be interesting to remember that Orion, with all his splendors of belt, sword, double stars, clusters and nebulæ, which made so brilliant a display during the winter evenings, is now hidden by the blue screen of the atmosphere just underneath the place occupied by the sun, and that if the latter should be suddenly extinguished, the surprising spectacle would be presented of the great luminaries of winter glittering through the warm summer air.

The majority of the planets are too near the sun, or too inconveniently situated, to be well seen this month. Mercury is low in the west, in the constellation Taurus, just after sunset at the opening of the month, but on the 10th it passes between us and the sun, emerging as a morning star after that date.

Venus is also in Taurus as a morning star, and at the beginning is situated about half way between the Hyades and the Pleiades. She is moving eastward and gradually gaining upon the sun, which she will overtake, in the center of Gemini, on the 8th of July. After that date she becomes an evening star.

Mars makes a long excursion through the constellation Pisces, passing into Aries at the end of the month. But, although it rises not long after midnight, it cannot yet be studied to advantage, even with the aid of a powerful telescope, because its distance from the earth is fully a hundred million miles greater than when the planet is in opposition.

Those who wish to see Jupiter during the present season must make haste. The great planet is sinking rapidly toward the western horizon, and, by the end of the month, will set as early as 9 o'clock. It is in Cancer, moving slowly toward the southeast, but it will not pass out of that constellation before disappearing from the evening sky. I append a few phenomena of its satellites:

June 2, 8:36 P. M. Satellite III begins a transit of the planet's disk.—9:05 P. M. The shadow of III enters upon the disk.—9:06:08 P. M. Satellite IV disappears in eclipse.—9:25:58 P. M. Satellite II reappears from eclipse.—June 16, 8:26 P. M. Satellite I begins a transit of the disk.—9:18 P. M. The shadow of I enters upon the disk.

Saturn is still near the star α in Libra, and during the month will move slowly westward. It is finely placed for telescopic observation, crossing the meridian about 9 P. M. in the middle of the month. A singular splitting up of the central bright ring into four parts, separated by exceedingly narrow divisions resembling faint hair lines, has been lately noticed in Europe. Similar phenomena have been observed in this ring at various times as far back as the days of Herschel. The most natural explanation of them seems to be that they are due to recurring variations in the disturbing attractions of the planet's satellites. These new divisions of the rings are hopelessly beyond the power of ordinary telescopes, but Ball's division, which always exists, can easily be seen.

An excellent opportunity is now presented for seeing some of Saturn's satellites. A good 4 inch telescope, under favorable conditions, will show five of them. The only certain way to distinguish between the satellites and small stars which may be near the planet is to carefully observe their motion from night to night. The fainter satellites can only be seen when near their greatest elongations from the planet. In order to facilitate their recognition I give the approximate times of elongation for the five satellites most easily seen, beginning with the nearest to the planet.

Tethys, eastern elongation, June 15, 10:26 P. M.; June 17, 7:50 P. M.

Dione, eastern elongation, June 12, 10:38 P. M.; June 23, 9:20 P. M.

Rhea, eastern elongation, June 1, 9:32 P. M.; June 10, 10:09 P. M.; June 19, 10:56 P. M.

Titan will be on June 3 east of the planet; on June 7 south, i. e., above as seen with an inverting eye piece; on June 11 west, and on June 15 north.

Japetus from the beginning of the month until the 13th will be seen moving eastward from the planet; after the 13th it will approach the planet, coming into conjunction with it on the south the 1st of July.

Uranus is in Libra, eight or nine degrees east of Saturn, but although visible to the naked eye, only the trained observer is likely to see it without optical aid. A strong opera glass will suffice. Those who care to see Herschel's planet can pick it up in this way: Find in Klein's Star Atlas, Map X, the little star marked "22," and, by the aid of the more conspicuous surrounding stars, locate it in the sky. Uranus, on June 3, will be just east of "22," and in the course of the following three or four days will pass close to the north of that star, moving in a direction somewhat north of west. A correct eye will easily detect the effect of the motion from night to night.

Neptune, in Taurus, comes into conjunction with the sun on the 7th.

June opens with a waning moon, which reaches last quarter on the morning of the 3d. The June new moon comes on the morning of the 11th; first quarter on the morning of the 18th, and full on the morning of the 25th. The moon will be nearest the earth on the night of the 20th and farthest on the morning of the 5th.

Following are the dates of the moon's planetary conjunctions for June:

Mars on the 5th, Venus and Neptune on the 10th, Mercury on the 11th, Jupiter on the 14th. This conjunction will be interesting. It occurs about 4:12 P. M., and with a telescope the observer will be able to see Jupiter in full daylight less than a degree south of the crescent moon. On the 21st the moon meets Saturn, and on the 22d Uranus.

Taurus, besides carrying the sun this month, will gain additional distinction from the maneuvers of the three planets, Mercury, Venus and Neptune, which will meet and pass (and in the case of Mercury and Neptune, meet and pass a second time) between his horns. Unfortunately, owing to the presence of the sun, these planetary conjunctions will not be visible. Their dates are: Mercury and Neptune, 14th, 7 P. M.; Mercury and Venus, 15th, 2 A. M.; Venus and Neptune, 15th, 5 A. M.; Mercury and Neptune, second meeting, 30th, 2 A. M.

The possessor of a telescope will find June presenting great attractions among the double stars. About 10 P. M. in the middle of the month Antares, in the Scorpion, will be well placed east of the meridian, and, with a steady atmosphere and keen eye, a 3½ inch glass may show the minute bright green companion of the great red star. A 4 inch, under good conditions, is certain to show it. The star β in the Scorpion is an easy and beautiful object with the smallest telescope. Farther east the Milky Way clusters in Sagittarius, and Scutum Sobieskii will be seen rising, and with nothing more powerful than a field glass one may catch a glimpse of their gorgeous sun swarms. Overhead at the same hour will be found the Northern Crown, and further east Hercules and Lyra, both crowded with beautiful telescopic objects, while dipped in the Milky Way below them appears the Northern Cross, with the exquisitely colored double Albireo in its foot. I have separated the orange and blue components of this star with a simple pocket telescope.

Ruling Diffraction Gratings.

"Rowland's grating" is made by ruling parallel lines on a concave plate of what is known as speculum metal. This metal is an alloy of two parts copper and one part tin. The parallel grooves are made with a delicately adjusted diamond point. The machine on which the grating was made was manufactured after eighteen months' hard work by Theodore C. Schneider, the machinist at Johns Hopkins University, from the designs of and by processes invented by Prof. Rowland, who was constantly at hand to direct every movement. This machine is in a dark vault under the laboratory. When a "grating" is being made, it runs night and day. The vault is locked, and no one is allowed to enter it, for the machine is so sensitive that the temperature of a human body would disarrange it. When a new diamond point is being tested, as is now the case, Prof. Rowland will permit a few people to visit it. Sir William Thomson, the Earl of Rosse, Lord Rayleigh, Prof. Ball, Astronomer Royal of Ireland, the late Prof. Helmholtz, of Berlin, Prof. Mascart, of Paris, and Prof. Lemstrom, of Sweden, are among those to whom this courtesy has been extended. The motive power of the machine is a hydraulic engine. The water is kept at a constant height in a tank near the roof, to insure unvarying speed. It is driven by a belt attached to a solid brass driving wheel on the machine. A crank is turned by the same on the other end of the shaft. This crank moves the carriage that conveys the diamond point back and forth over the surface of the "grating" or plate. This carriage rests on two steel ways, which are flat on top and slanting slightly outward, so that there are three points on one way or rail on which the carriage rests. These "ways" are ground so as to make them as nearly accurate as possible. But they cannot be made perfect, for Mr. Rowland tested them with a microscope and found that they were "out"—that is, not exactly perfect—by one fifty-thousandth of an inch. He did not attempt to improve them.—Appleton's Popular Science Monthly for May.

The National Electrical Exposition.

EDISON'S X RAY EXHIBIT, MOORE'S ELECTRIC DAY LIGHT, PHOSPHORESCENT DIAMOND.

One of the greatest attractions of this varied and interesting exhibition has been Mr. Edison's arrangement for the examination by every one of the skeleton of their own hands by means of the X or Roentgen rays. An improvised curtained room about twenty feet square is provided, illuminated by two red incandescent electric lights. On a platform in one corner is arranged a vertical fluorescent screen eighteen inches square of a composition best adapted to be affected by the rays, and fixed at a height above the floor of about five feet. Behind the screen about eight inches is a frame or screen of wood having a square aperture of about six inches. Just back of this is the vacuum Crookes lamp, or rather Edison's improved lamp. Lower down and to one side on a box is a Bunsen gas burner casting a bluish light upon the operator standing close by in his shirt sleeves.

The effect on entering the darkened chamber is somewhat weird, inasmuch as the blue light of the Bunsen burner reflecting from the white sleeve of the operator produces the impression that one is observing an X ray view of a human arm.

Back of the operator is the induction coil, and in another adjoining room is the interrupter. Directly in front of the fluorescent screen on the floor were two iron rails, between which the procession of two hundred or more persons passed two at a time, stopped, and were told by the attendant to place their hands behind the screen and then to watch as the operator turned on the current. As he did so, the current being on perhaps three seconds, the skeletons of the fingers were clearly observed. Exit was made at the other end of the room. Each time the current is turned on, a miniature fog horn sound is heard all around the place. It is reported that a man who had carried a shot in his hand, which could not be located by his physician, was among the procession of persons, and instantly saw, when the X rays illuminated his hand, that the shot was between his second and third fingers. The opaqueness of gold rings on the finger is very marked as compared with that of the bones.

Half hourly lectures were given illustrating on the screen many curious X ray shadowgraphs. Another attraction of interest was Mr. D. McF. Moore's daylight electric vacuum tubes, fitted up in a curtained room. The light is so much more diffused than the ordinary arc or incandescent light that it does not appear to be as bright to the eye, but photometric tests, we believe, prove it to be so. Many visitors crowded to see this. Tiffany & Company, through Mr. George F. Kunz, exhibited a peculiar phosphorescent diamond. In a darkened chamber, the light of an arc electric lamp passed through a blue glass lens and was allowed to strike the diamond for one or two seconds. It was then shut off, and the diamond glowed quite plainly in the dark chamber for about four seconds. The special fluorescent quality in the diamond causing that effect is termed by Mr. Kunz tiffanite.

One of the singular things missing in the exhibition was the absence of any trolley cars, their adjuncts and improvements.

A QUALITATIVE examination of the mineral species northupite from Borax Lake, California, shows that it is a double chloride and carbonate of sodium and magnesium.

Science Notes.

In the ocean, at a depth of 500 feet below the surface, the sun has an illuminating power about equal to the light of the full moon.

Dr. Behring has donated the 25,000 francs he received from the "Albert Levi" prize to establish a fund for sero-therapeutic research.

The deaths from alcoholism in Sweden amount to 90 per thousand. This is the highest rate in the world, says the Medical Record.

The German Emperor has had his left arm "skiagraphed" preparatory to an operation which is expected to give him partial if not complete use of the now useless member.

It is reported in the British Medical Journal that those working with the X rays are likely to suffer from a variety of skin affections said to be similar to the results of sunburn.

The Medical Society of Berne has inaugurated a plan for the suppression of press notices of suicides, as it has been observed that epidemics of suicides, so called, come from "suggestion," acquired through printed accounts of them.

A peculiar case of rabies has occurred in Cheshire, England. A black retriever last September bit eight cows, and after being killed proved to be mad. The cows showed no sign of madness, but two of them gave birth to calves which undoubtedly died of rabies.

Observations taken during the second half of 1895 at the observatory of the Roman College by Tacchini show that during this period sunspots have continued to decrease with a secondary minimum in November, when days without sunspots were observed. The protuberances have shown very little change during 1895.

A curious property of potassium uranyl sulphide has been reported to the French Academy by M. Becquerel. When excited to phosphorescence, this substance emits rays which last a long time—more than 160 hours—after phosphorescence ceases, which pass through paper, aluminum and copper, and which discharge electrified bodies like the Roentgen rays.

The discomfort produced by crowded, ill-ventilated rooms, in persons not accustomed to this condition of things, is not due to the excess of carbonic acid, nor to bacteria, nor, in most cases, to dusts of any kind. The two great causes of such discomfort, though not the only ones, are excessive temperatures and unpleasant odors.—Drs. J. S. Billings, S. Weir Mitchell, and D. H. Bergen in Smithsonian Contributions.

The researches of M. Moissan show that yttrium forms a carbide of the formula C_2Y. It occurs in transparent crystals decomposable by cold water, with formation of a gaseous mixture rich in acetylene, and containing methane, ethylene, and a small quantity of hydrogen. Thorium also forms a crystalline and transparent carbide, C_2Th, which is also decomposed by water, producing gaseous carbides, poorer in acetylene, but richer in free hydrogen.

Mount Mauna Loa, in the Sandwith Islands, was in violent eruption at 7 o'clock on the morning of April 20. The fountain of lava, flame, and ashes on the summit of the mountain was estimated by observers at Hilo as 4,000 feet high. The light was so brilliant that it was seen from Lahama, 110 miles away, the next night, and the glow was seen at Diamond Head, 180 miles distant. This indicates an eruption of the greatest magnitude.

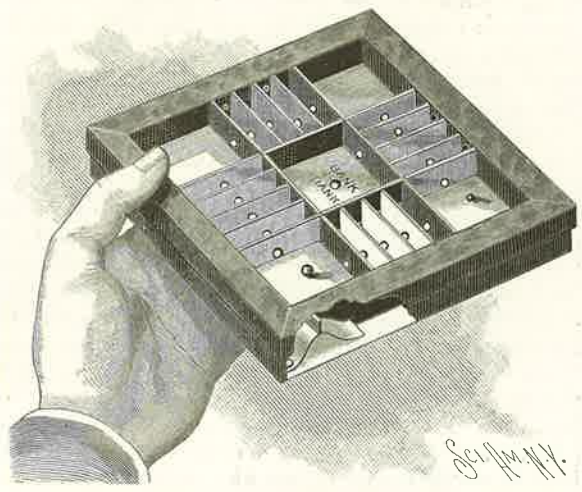
The first edition of Prof. C. A. Young's work on "The Sun," published in 1881, mentions twenty-one elements as having been detected by the spectroscope in the sun. In all of these 860 lines had been identified. The new edition of Prof. Young's book states that Prof. Rowland has now compared sixty elements with the solar spectrum, and established the existence of thirty-eight of them in the sun, being doubtful in regard to eight of the others. Of iron lines alone he has identified more than two thousand.

M. Moissan, in France, has analyzed specimens of opium as used by the Chinese, says Knowledge, and finds that the smoke is formed of volatile perfumes and a small quantity of morphine. It is the latter which produces the phenomena sought by opium smokers, and it is said that they do not appear to find more ill effects from the practice than most tobacco smokers, provided that they use the preparation known as chandu of the best quality. The commercial quality of opium is, however, very different, and the inferior sorts when decomposed by heat produce various poisonous compounds.

An egg of the now extinct great auk was recently sold in London for 160 guineas, although the shell was slightly cracked. So rare and consequently so valuable are these eggs that each one has a history. The one in question was purchased in 1841 from Frederick Schultz, of Dresden. In the Newcastle Natural History Museum, which possesses one of the finest collection of sea birds in Great Britain, the curator keeps in a locked drawer what appears at first sight to be a large number of great auks' eggs. But only one is a real specimen, the rest are chalk or plaster models of other existing treasures, and so good are the imitations that only a practiced eye can detect the real from the sham, handling being, of course, prohibited.

THE THIEF AND DETECTIVE PUZZLE.

The puzzle shown in the accompanying cut has been patented by Mr. Oscar Beisheim, of New York City. It consists of a shallow box, which is divided by thin partitions into a series of streets and squares, whose arrangement will be seen in the illustration. All the partitions are perforated to allow passage from one street or square to another, the perforations being of two sizes to match the sizes of two balls which are supposed to respectively represent a detective and a thief, the thief being able to traverse all the streets and openings, the detective being restricted to movement in a predetermined path. Within the side street, on



THE THIEF AND DETECTIVE PUZZLE.

one side of the box, two coverts are arranged, having perforations in the roofs, through which the thief only will pass, and within the side street on the opposite side is provided a spring keeper, adapted to cover and retain the detective. A money vault or safe is supposed to be located in the central square. The box is provided with a glazed top, which allows all of the interior to be seen, except the four side streets. The puzzle is handed to the player with the thief inside the covert and the detective held by the keeper. To solve it he has to start the thief on his way to the bank, and set the detective after him in pursuit. This is done by inverting the box, when the thief will roll out of the hole in the covert, and by slightly raising the corner of the lid, which will release the keeper and permit the detective to roll into the street. To solve the puzzle, the player must now bring the thief and the detective together in the central square or bank.

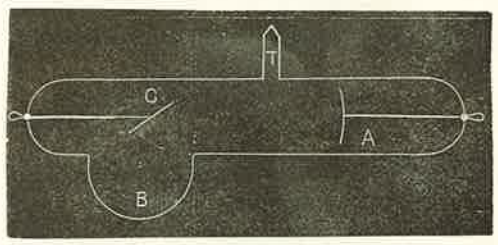
IMPROVEMENTS IN CROOKES TUBES.

BY C. C. HUTCHINS AND F. C. ROBINSON, BOWDOIN COLLEGE.

During the last two months every college, high school and private individual that could procure an induction coil and a Crookes tube has been making pictures of hands, coins, keys and such things in endless variety.

At Bowdoin College a long series of experiments has been in progress with a view to improving the tubes.

We have made and tested every shape and variety



IMPROVED CROOKES TUBE.

MADE WITH ONE-HALF SECOND EXPOSURE THROUGH PLATE HOLDER.

that seemed to give any promise of success, and are convinced that the ordinary spherical or bulb form is about the worst possible, while a comparatively small tube has so far given the best results.

The window intended for the passage of the rays must be as thin as possible, because glass, as is well known, is more or less opaque to them. At the same time it must be thick enough to bear the pressure of the atmosphere when the tube is exhausted.

Of all the forms of tube that we have tried, the one shown in the annexed diagram is the most effective. Here the anode, C, is an inclined plate of thin platinum. This is placed at or beyond the focal point of the cathode, A. This piece of platinum becomes red hot, and is, as far as can be judged, the source of the ray. It is a curious fact that the anode, C, if made in the form of a thin plate, may nearly fill the tube without in any way obstructing the passage of the rays out at the bulb. The bulb is filled with an intense green fluorescence, and sparks can be drawn from it by approaching the finger.

Not only do these tubes give remarkable results in the way of intensity of rays, but also extremely fine definition.

The cellular structure of the bones is clearly brought out and the course of the tendons can be traced along the arm. Good pictures of the bones of the fingers can be obtained in from five to thirty seconds, and of the hand and wrist in from one to ten minutes.

Mr. Edison, in the current number of the Century, states that a good tube should give a distinct impression upon the photographic plate through eight inches of pine in fifteen minutes.

We have photographed metallic letters through ten inches of pine in five minutes; while such objects as keys and coins can be satisfactorily done in one-tenth to one second through the slide of the plate holder, using only the ordinary induction giving a five or six inch spark.

With the fluoroscope the bones of the arm, leg, etc., can be minutely examined, and clear light obtained through the trunk and chest.

[The pictures to which reference is made show the texture and cellular structure of the bones, and are remarkable for sharpness and clearness. They are far in advance of the usual X ray silhouettes, and we regret that the distinctive features could not be reproduced in half tone. In response to our query as to the ability of the tubes to retain their efficiency, Prof. Hutchins informs us that "if the vacuum becomes too high by use, it is only necessary to heat the tube a little."—EDS.]

Signs Among Savages.

If no serious writer tells of a people actually dumb, plenty even at this time assert that there are races which cannot converse among themselves without the assistance of gestures. We hear of them east of Cape Palmas, in Tasmania, Ceylon, Brazil, South Africa, North and South America, and upon excellent authority. But confirmation of the report does not arrive in such volume as we should expect at the present day, when thoughtful and observant travelers swarm in every quarter of the world. The most striking case is that of the Arapahoes, because it has the guarantee of Sir Richard Burton, not because it is most impressive in itself. He says that these red Indians must rise and sit by the camp fire when they wish to talk at night, or must kindle a fire for the purpose. But Burton could not possibly have been speaking of his own knowledge, for he spent a very short time—six weeks, if we remember right—in galloping through "the plains." His account of all such matters as this must have been hearsay. But there is no doubt that many savages would be embarrassed if they could not assist the transmission of their ideas by gesture. One could hardly fancy a Bushman talking without grimaces and motions at every syllable. But the serious interest of gesticulation lies in the identity or the difference of its forms in various parts of the world. Such strange and unaccountable resemblances have been noted among races as far remote from one another as could be, and so many of them appear in deaf mutes of civilized Europe that one may almost be tempted to think mankind had a natural language after all, but one—or perhaps two—of gesture, not speech. It may be confidently assumed that some earnest and laborious student will go into this subject thoroughly one day; perhaps he is now at work. It would be his task to gather lists of signs used by divers people, and compare them. Burton collected some; a vast number of travelers record a few. Dr. Tyler has noted many which coincide with those used by deaf and dumb persons—either their own individual discovery or adopted into their system of education. Thus he found that the signs for hiding, seeing, mother and sister, yes and no, truth and lie, food, think, trade, day, etc., recorded by Burton among the red Indians, were quite intelligible to deaf mute children in Berlin, where his studies were made. This is most extraordinary, if one think of it. And he gives some practical illustrations upon the authority of American experts. A native of Hawaii was taken to an asylum, and forthwith began to "chatter" volubly, telling the inmates all about his country and his voyage. A Chinaman who could speak no language but his own had fallen into a state of melancholy. Introduced to a number of deaf and dumb children, he became quite vivacious, talking and answering. And we have a letter from a deaf and dumb boy taken to see some Laplanders. He spoke to the woman by signs, "and she understood me. . . . She did not know we were deaf and dumb, but afterward she knew, and then she spoke to us about reindeer and elk, and smiled at us much."—London Standard.

SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXIV.—No. 24. ESTABLISHED 1845. NEW YORK, JUNE 13, 1896 [$3.00 A YEAR. WEEKLY.

CONSTRUCTION OF THE YARROW WATER TUBE BOILER.

We have been favored by Mr. Yarrow, of torpedo boat fame, with photographs and a description, showing his new system of expanding boiler tubes by steam, and other improvements in the boilers themselves. The tube expander which is here shown in operation in the shops at Poplar, London, was designed to replace the old apparatus, which was worked by hand. The introduction of the steam-driven tool has resulted in a great saving of time and cost over the old system. The expander, which is small and compact, is suspended at the desired height, and is driven either by a motor or, as shown in our engraving, by a cord from the overhead shafting, operating through a length of flexible shafting. The taper mandrel within the body of the expander is revolved by the action of the rollers, the body being driven by the miter gear, which can be seen in the cut. By giving the rollers a slight inclination they are made self-feeding, and over-expanding is guarded against by providing a stop. In the accompanying illustration three of the Yarrow boilers are shown turned up on end for the purpose of expanding the tubes where they enter the water pocket.

Mr. Yarrow states that the impression that it is a difficult matter to retube his style of boiler, on account of the tubes being straight, is erroneous, as may be seen from the accompanying cut, which shows a section through one of the boilers. If it is desired to insert a tube, say in the center of the tube plate, it is only necessary to pass it far enough through the upper or lower plate to clear the opposite plate, passing the tube from the hole in one plate to the next hole in other plate and repeating the movement until the desired position is reached. Thus the upper end of the tube is first passed through hole, A, in the drum; it is then slid down until the lower end enters hole, B, in the water pocket and the upper end is clear of A. This end is then passed up into C, and the lower end drawn out of B and placed in D. By continuing this movement the tube can be carried through a line of holes to its place. The same method is adopted in removing a faulty tube, though, of course, all the tubes in its way have to be also removed. The lower tube end is expanded, in the case of repairs, by sending a boy into the water pocket for the purpose. When this cannot be done, a long mandrel is passed through the tube and operated from above.

The accompanying section of the upper drum of a Yarrow boiler shows the new system of automatic feed. All makers and users of water tube boilers are aware of the value of any system that will automatically regulate the feed. These boilers contain very little water at any one time and the fierce ebullition causes great and rapid fluctuations of water level.

Yarrow & Company are endeavoring to overcome the difficulties of constant feed by providing an automatic device within the drum of the boiler, and by providing each boiler with its own independent donkey pump. It is claimed that only in this way can the obstruction of a breakdown in any one boiler be localized. In any group of boilers which have a common source of feed supply the bursting of a tube in one of the boilers will call for an extra supply of water that will be greater in all probability than the capacity of the pump. As a consequence the water level will be lowered, not merely in that particular boiler, but in the whole set. This would be a dangerous predicament and might easily result in serious injury to the complete plant.

These considerations are especially strong when applied to the water tube boiler, where the internal pressure in the tube would cause a specially large escape of

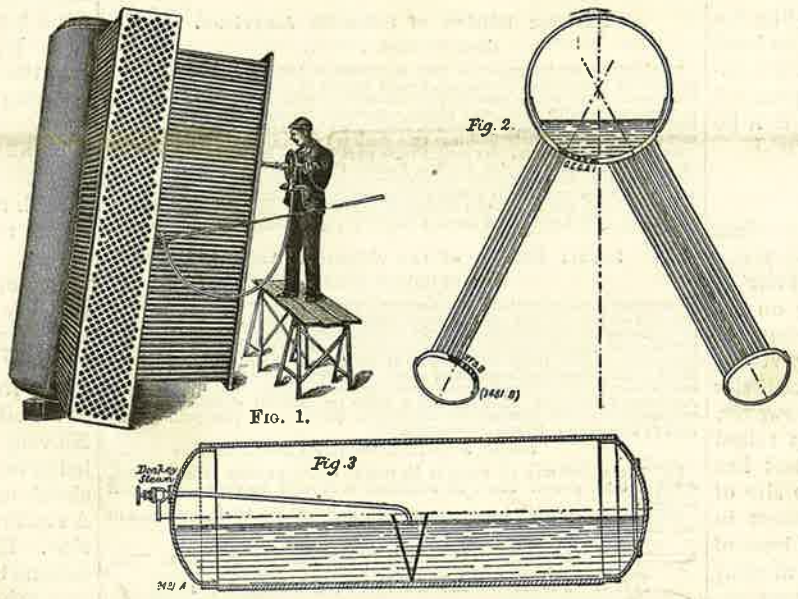
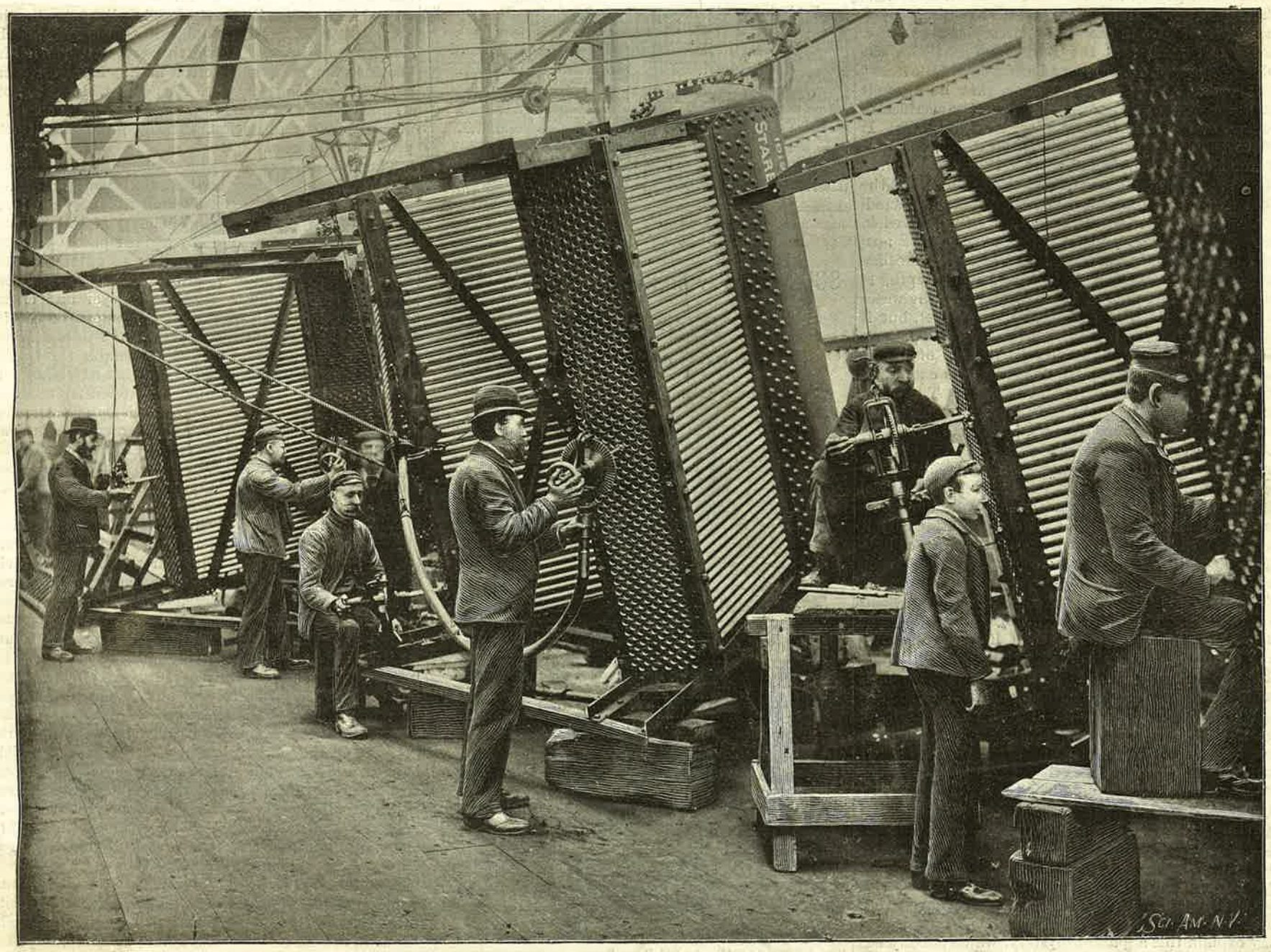


FIG. 1.

DIAGRAMS SHOWING METHOD OF RETUBING AND AUTOMATIC FEED OF THE YARROW BOILER.



EXPANDING BOILER TUBES IN THE YARROW & COMPANY'S MACHINE SHOPS.

Science Notes.

It is stated that Huxley's library is now offered for sale.

Dr. Adalbert Kruger, Director of Kiel Observatory, died recently. He was an astronomer of world-wide reputation and was editor of the Astronomische Nachtrichten.

Rev. W. C. Ley, a meteorologist of considerable reputation, died on April 22. His researches were principally on the clouds and the movements of the upper air currents.

The University of Pesth has conferred honorary degrees upon Lord Kelvin, professor in the Glasgow University; Herbert Spencer, the English philosopher; Max Muller, the orientalist; Prof. James Bryce, M. P., the eminent English geologist and scientific author, and Dr. John Shaw Billings, of Philadelphia.

It is said that dew is a great respecter of colors. To prove this take pieces of glass or board and paint them red, yellow, green, and black. Expose them at night, and you will find that the yellow will be covered with moisture, and the green will be damp, but that the red and the black will be left perfectly dry.

Negroes are black owing "to the stimulating action of solar heat, combined with moisture and an excess of vegetable food, yielding more carbon than can be assimilated, the character being then fixed by heredity." This extraordinary theory appears in a recent geographical school book bearing the name of Cambridge University.

The Paruchowitz bore hole, near Rybnick, in Silesia, which attained a depth of 2004·34 m. (nearly 1,096 fathoms) when the rod broke, has passed through eighty-three carboniferous strata, the total expense having amounted to $18,700, says the Practical Engineer. The 384 thermometrical observations that were made showed a very irregular increase of temperature with depth, the average being 1° C. (1·8° F.) for every 35·14 m. (18½ fathoms).

The question as to the fusibility of platinum in a carbon heated furnace seems at last to have been definitely settled by Victor Meyer, says Science. A sheet of platinum completely inclosed in a mass of fire clay was fused to a globule in a blast furnace heated with gas carbon. In this case action of carbon or of furnace gases on the platinum was absolutely excluded. Under similar conditions an alloy of platinum with 25 per cent iridium was unchanged.

Filehne has studied the action of copper when combined with albuminous substances, and finds that a cupratin compound, analogous to Schmeideberg's ferratin, can be administered to dogs and cats in doses of 2·6 grammes within twenty days without injurious effects. He infers that compounds of copper with albumen would not be injurious in human food, and that from 0·01 to 0·02 gramme of copper daily in this form would not cause any sensible disturbance. The case is very different with copper stearate, which causes serious degeneration of the liver and kidneys when administered for some long time, though it was not possible in this way to produce acute poisoning.—Deutsch. Med. Wochensch., 1896.

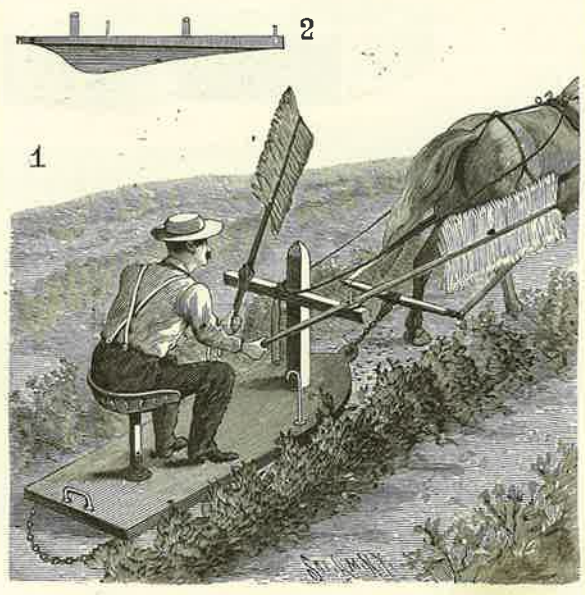
In the Contemporary Review for May, Dr. Alfred R. Wallace describes M. Elisee Reclus' proposed gigantic model of the earth, and argues that the construction of such a globe would be feasible and desirable. But he thinks that the scale proposed by M. Reclus, $\frac{1}{100000}$, should be reduced by one-half. This would give an internal diameter of 167 feet and a scale of almost exactly a quarter of an inch to a mile. The chief point made by Dr. Wallace is, however, that the model should be placed on the inner surface of the sphere.

There has been a volcanic eruption on the island of Socorro, off the Mexican coast. Two months ago, which is the latest date of news received, lava was running down the mountain sides, overflowing the lowlands, and moving toward the sea. The news came in a letter to the Hydrographic Office from the schooner Zampa, bound for Tacoma, whose captain spoke the Danish bark Schwalde, of Guaymas, which passed Socorro on March 20. The sky and sea were filled with ashes miles away from the island, and the blazing mountain was first made out at night. It was a magnificent sight, the Danish captain said, but he did not dare venture too near, on account of the troubled condition of the ocean.

An extremely interesting series of experiments on the action of a powerful magnetic field on the cathodic rays in Crookes' or Hittorf's tubes is described by Herr Kr. Birkeland in the Elektroteknisk Tidsskrift (Christiania). These experiments prove, says Nature, that in such a field the cathode rays are strongly deflected in the direction of the lines of force, and can even be concentrated on to the surface of the tube until the glass melts. Moreover, the evidence suggests that the rays which emanate from one and the same cathode fall into groups, of which the physical constants are connected by some definite law, just as are the frequencies of the different tones emitted by a vibrating rod. The investigation has an important bearing on the theory of the aurora borealis. The Danish meteorologist, Herr A. Paulsen, is of opinion that the aurora owes its origin to phosphorescence of the air produced by cathodic rays in the upper strata of the atmosphere, and Herr Birkeland suggests that the earth's magnetism may be the cause of this phosphorescence becoming intensified in the neighborhood of the terrestrial poles.

INSECT REMOVER AND DESTROYER.

A new and improved machine for the removal of potato bugs and like insects from vines has been patented by Mr. Washington Reeder, of Lake City, Michigan. The invention consists of a machine with

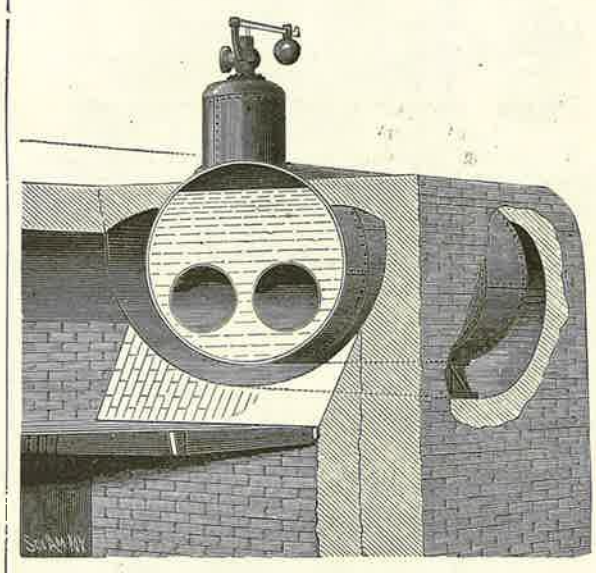


REEDER'S INSECT REMOVER AND DESTROYER.

a body shaped substantially like the hull of a boat, having a pointed front and a rounded keel as shown in the illustration. An upright mast is provided in front of the driver, upon which is fitted a cross bar, at the ends of which are pivoted two oar-like arms, which project on each side of the machine and terminate in brooms or brushes. The inner ends of these oars have suitable handles which can be grasped by the driver, and he is thereby enabled to beat and brush the bug-infested rows of potatoes on each side as he drives the machine through between them. At the front central portion of the body of the machine a clevis is provided, to which the machine may be attached. As the device is driven through a potato field the bugs are brushed into the space between the rows and crushed by the passage of the body of the machine over them.

IMPROVED BOILER FURNACE.

The improved furnace shown in the accompanying illustration has been patented by Mr. Henry Theodore Dieck, corner of Alvar and Dauphine Streets, New Orleans, La. The furnace may be constructed with only one shell, as shown in the illustration, or with two or more shells if desired. At the front end of the shell is a firebox with grate and ash pit of the usual construction. The bridge wall slants upwardly and



DIECK'S IMPROVED BOILER FURNACE.

rearwardly, and terminates in a flame bed, which is segmental in cross section, and has its upper surface eccentric to the exterior surface of the shell, the greater distance between the flame bed and shell being at the upper portion of the former. The flame bed falls slightly toward the rear, where it curves up and over, finishing against the end of the shell just above the shell flues, into which it guides the furnace gases. The flame bed extends upwardly on both sides to or above the shell flues and provides a large heating surface; and as the area of the cross section of the flame bed increases in a rearward direction, ample provision is made for the proper combustion and flow of the smoke and gases, and a superior draught is secured.

The Proposed Extensions of the Manhattan Elevated Railroads.

A committee of the Manhattan Elevated Railroad directors has submitted to the Rapid Transit Commission a comprehensive plan for the extension of their system. Briefly stated the proposed extensions and additions are as follows:

1. A new two track structure to commence at the Battery Place station on the west side and run along West Street to Little West Twelfth Street; then by Tenth Avenue to Twenty-third Street, where a spur would be run from the Pennsylvania and Erie ferry houses to Ninth Avenue. Another spur would run from Christopher Street ferry to the Eighth Street station of the Sixth Avenue line.

2. A cross town line from the City Hall station at the entrance to the Brooklyn Bridge, running up Centre Street to Canal Street, and westward along the same to a junction with the proposed West Street line.

3. To provide increased accommodation and speed on the up and down lines, it is proposed to provide four tracks on the Third Avenue line from Chatham Square to Sixth Street, and three tracks from Sixth Street to the Harlem.

On Second Avenue it is proposed to lay a third track from Grand Street to the Harlem River.

The Ninth Avenue line is to have a third track from the Battery to the curve at One Hundred and Eighth Street, whence a new line is proposed which shall run via Tenth Avenue or the Western Boulevard to Fort George.

Mr. Gould stated that the company stood ready to build these proposed lines at once; and he submitted two other routes which the company were prepared to cover as soon as the growth of the neighborhood called for it. The first of these was a line from the Fort George extension at One Hundred and Sixty-second Street and Tenth Avenue, to run out along the Kingsbridge Road to the city line. The other future extension was to take place from the One Hundred and Seventy-seventh Street terminus of the present line toward the city line to the north. To provide for a pressing need Mr. Gould said that his company was prepared to build at once a branch line from the One Hundred and Forty-ninth Street station on the east side line, running along the Westchester Road to the Bronx River. It is reported that the representatives of the Manhattan roads stated that they were prepared to build the extensions with their own capital and that they made no stipulations as to the payment of damages.

It must be admitted that this proposal is framed on comprehensive lines, and that it appears to meet the pressing necessities of the hour most admirably. The directors of the elevated roads have a rare opportunity just now to establish themselves in the confidence of the public, by pursuing the liberal and far-sighted policy which is outlined in their present proposals.

Explorer Peary's Plans.

Civil Engineer R. E. Peary's plans for his Arctic expedition this summer are now substantially complete. Instead of St. John's, N. F., as in former years, Sydney (Cape Breton) will be the point of departure, from which port the expedition will leave about July 15 in a steam whaler from the Newfoundland fleet. From Cape Breton the course northward will be laid along the Labrador coast, as the conditions of ice will permit; then, crossing Davis Straits to the Greenland coast, stops will be made, if practicable, at Godthaab and Godhavn, and possibly at Upernavik. Lieut. Peary will push forward with all practicable speed to accomplish the main object, the obtaining of the great meteorite, the largest in the world, which he discovered and located not far from Cape York last year. With the meteorite secured, the southern course will be laid across Melville Bay to Godhavn, where a call will be made on the return for the purpose of embarking any of the party who may have awaited the ship at that point. Coming south, an attempt will be made to penetrate Hudson Straits and, if possible, examine some valuable mining prospects which have been reported in an uninhabited and inaccessible place on the north coast of its waters. Calls may also be made at the Labrador ports, if circumstances favor, and it is possible that while the ship is absent Peary may go, if conditions are favorable, north of Cape York, to his former headquarters at Inglefield Gulf. The scientific party from Cornell University, headed by Prof. Ralph S. Tarr, of the department of geology, will embark on the steamer, leaving her at some point agreed upon in Greenland, for scientific field work, during the time of her absence to the north. Prof. Burton, of the Boston Institute of Technology, is also contemplating a similar scientific field excursion, and one or two other passengers may be added to the party. North of Godhavn, however, Mr. Peary will be without associates, excepting the captain and crew of the steamer, whose aid will be ample for the work which he will have in hand. If the expedition accomplishes its designed work and obtains the meteorite, it will return directly to New York.

Notice.

A premium of $250 is offered by the SCIENTIFIC AMERICAN for the best essay on

THE PROGRESS OF INVENTION DURING THE PAST FIFTY YEARS.

This paper should not exceed in length 2,500 words.

The above-mentioned prize of $250 will be awarded for the best essay, and the prize paper will be published in the Special 50th Anniversary Number of the SCIENTIFIC AMERICAN of July 25. A selection of the five next best papers will be published in subsequent issues of the SCIENTIFIC AMERICAN SUPPLEMENT at our regular rates of compensation.

The papers will be submitted for adjudication to a select jury of three, consisting of—

Prof. R. H. Thurston, Cornell University.

Judge A. P. Greeley, Washington, D. C.

Prof. R. S. Woodward, Columbia University.

Rejected MSS. will be returned when accompanied by a stamped and addressed envelope.

Each paper should be signed by a fictitious name, and a card bearing the true name and the fictitious name of the author should accompany each paper, but in a separate sealed envelope.

All papers should be received at this office on or before June 20, 1896, addressed to

Editor of the SCIENTIFIC AMERICAN,
361 Broadway, New York.

Correspondence.

X Ray Experiments.

To the Editor of the SCIENTIFIC AMERICAN:

I have in my possession a Crookes tube, exactly identical in construction with the one described on page 342, SCIENTIFIC AMERICAN of May 30, excepting the glass bulb, which is pear-shaped.

Considering the fact that I am using this tube with an ordinary Wimshurst induction machine of my own construction, with 20 inch hard rubber plates, its work is simply marvelous.

For the benefit of your readers who desire to use this kind of apparatus, I would say that the condensers should be small, not over 16 or 18 square inches of foil surface on each side, and the outside coatings should be connected with each other; the anode of the Crookes tube should be connected to the positive pole of the machine and cathode to the negative pole, with a spark gap of not less than one-half inch. Gap should be made between ball terminals, as a good, clean spark is absolutely necessary; if air is so damp as to break it into a brush discharge, no effect will be obtained in the tube.

The light is, of course, intermittent, but if the machine is in good order and runs fast enough, the sparks follow each other in such rapid succession as to be practically continuous in lighting effect on a fluoroscope, which this tube illuminates brilliantly, bringing out the bones in the hand very distinctly. The tungstate calcium used in fluoroscope is sold by dealers as high as $5 per ounce: but an ounce of it—enough for two or three fluoroscopes—can be made for 30 or 40 cents, as follows: Mix about 1 ounce each of common salt, tungstate soda, and choride calcium; last two articles should be bought at retail for about 2 cents per ounce. Put the mixture in a common crucible, also obtainable for about 10 cents, fit a tin cover to it and bury to the lid in a good coal fire—the kitchen stove will do—so as to bring it to a full red heat; leave it for two or three hours, or until contents are fused to a clear liquid, then set it out to cool and crystallize. The resulting hard, glass-like mass should be broken out with an old chisel or by breaking the crucible—broken up and thrown into a jar of water, which will gradually dissolve the chloride of sodium formed, and the fine crystals of tungstate calcium will settle to bottom. Wash by decantation till all taste of salt is gone, and pour out on filter or blotting paper and dry.

Make your screen of thin wood or cardboard, coat with common prepared glue, and sift on the tungstate, shaking off all that does not stick when dry. Fasten to bottom of ordinary box of the fluoroscope form, and you will have as good a fluoroscope for a few cents as can be bought for a few dollars.

I think I have demonstrated, and with rather poor apparatus, that the X ray will produce a visible image on the sensitive plate in less than 1-1000 of a second.

When I run my static machine very slow, the sparks can be made to jump the gap arranged as described at about the rate of one or less per second. The fluoroscope then shows a distinct instantaneous flash of light as each spark passes, seeming to indicate that the X ray is produced only at or during the instant of the passage of the spark, which, according to Wheatstone, occupies about 1-24000 of a second of time.

Desiring to test the effect of one spark and upward on a plate, I placed a common pocket comb in a metal edged case on a 4 × 5 plate holder, containing plate covering about three quarters of an inch of holder, with a block of steel one inch thick, and machine slowly run till one spark passed the gap, then plate of steel was moved up three-eighths of an inch, and one more spark passed, thus giving two sparks exposure to remainder of plate; the steel block was then pushed up another three-eighths of an inch, and two more sparks passed, giving four to remainder of plate, and so on up through 8, 16, 32, 64, etc., to 512 on last three-eighths inch of plate. Plate was developed immediately, the print from same plainly showing the metal rim of comb case down to the seventh space from top, corresponding to eight sparks, equal to about 1-3000 of a second's exposure.

My machine works in the open air, which is very damp most of the time at this time of year, but with a properly cased powerful machine and a spark gap of one inch or more, I think it could be shown that one spark would produce a visible image on the plate.

H. C. OGDEN.

Middletown, N. Y.

[We have received from Mr. Ogden some specimens of his X ray photographs, which are very fine; also the photograph mentioned, which shows the images produced by exposures of different lengths.—Eds.]

The Utility of Colored Skin.

Man, no matter what country he inhabits and what are the exterior conditions that he undergoes, has an internal temperature that varies within very narrow limits. If the exterior temperature is very cold, the circulation becomes more active and the chemical changes that generate heat are more intense, while physical conditions, such as friction and perspiration, contribute also a large part toward maintaining this balance of temperature by modifying at the proper time the formation or emission of heat. Races and climate produce in these vital actions certain curious modifications which have hitherto received little attention. It would be, for instance, interesting to know whether the human temperature is the same in all latitudes and for every race. Davy was one of the first to take up this question in two voyages to Barbados and Ceylon. He concluded that the temperature varies with the race by several tenths of a degree as we approach the tropics. The observations of Jousset accord with those of Davy. While other authors have held a different opinion, M. C. Richet, who has summed up the work on this problem, concludes that "the temperature of men of different races, under the same conditions of environment, is sensibly the same." This racial influence is then no greater than that which some have attributed to sex; that is, it is practically null.

Dr. Eijkmann, director of the Pathological Institute of Weltevreden, Batavia, Java, has attacked this question anew. He has especially tried to find how a Malay and a European react under the influence of exterior temperature, and what, in particular, is the role played by the color of the skin in the physical regulation of temperature. He has performed, for the solution of this problem, the following experiments. . . . One means of regulating temperature is by the loss of heat by conduction and radiation. If we place a thermometer near the skin of the arm or the chest and surround it with a sort of guard, the thermometer will rise the faster as the heat given out by the body is greater. M. Eijkmann has made this experiment in both Europeans and Malays. The results differ slightly according to season. During the warm and dry season the advantage is with the natives; the temperature of the thermometer placed near the arm is 33·55° C. [92·39° F.] with Europeans and 34·05° [93·29° F.] with natives. On the contrary, during the cool, wet season, Europeans give 32·75° [90·95° F.], while natives give 32·55° [90·50° F.] The latter have thus radiated off less heat. Observations made at different hours of the day prove that, in general, the loss of heat by radiation is a little less with natives than with Europeans, and this difference is about 0·4° [0·7° F.]

What causes this difference? We must in the first place eliminate the color of the skin. To test this, the author used two exactly similar metal cylinders, covered with skin carefully removed from the shoulders of persons who had recently died. The one was from a European, the other from a Malay. On one cylinder the European's skin was placed outside the Malay's; on the other, the Malay's was outside the European's. This arrangement was to prevent all possible error due to a difference in the conductivity of the two skins. The two receptacles were then filled with water in such manner that the thermometers plunged in each marked at the outset the same temperature. The results of the experiments made under these conditions show that there is no appreciable difference in radiating power between the brown and the white skin. The bulbs of two similar thermometers were covered with a double layer of skin [as before]. . . . Thus disposed they were exposed in a damp chamber to the sun's rays. At the end of a certain time the temperatures were as follows: White skin on outside, 47·5° [117·5° F.]; brown skin on outside, 50·1° [122·18° F.] But we return to the radiation. The color of the skin has no influence, and cannot explain the fact that the loss of heat is a little less in Europeans than in Malays. Other experiments give us the true reasons, which relate to the evaporation that takes place at the surface of the skin, which is greater in Europeans because they drink more.—Paris Cosmos.

Study of a Swiss Avalanche.

Natural Science gives a summary of the report made by Profs. Heim, Forell and Chodat on the great Gemmi Pass avalanche of September 11, 1895. The detailed description of the results of the catastrophe made by men of good standing in the scientific world is of great value. The avalanche was caused primarily by the splitting away of the lower parts of the Altels glacier.

The Abstract says: "On reaching the foot of the Altels, the avalanche, which up to this point must have consisted of one vast moving block of ice, measuring one and a quarter millions of cubic meters [4,000,000 cubic feet], was reduced to fragments, at the same time that the heat generated by the shock converted these into a semi-fluid condition. Among the debris were to be seen some blocks of considerable size, but only a few exceeded two meters [6½ feet] in diameter. With the velocity acquired in its descent, this river of ice rushed across the pasturage and up the western slope of the valley to a height of 1,300 feet along the rocky wall of the Weissfluhgrat. Not being completely able to surmount this barrier, the main mass came surging back—like a vast sea wave recoiling from the cliffs—with such force that some of it returned to a height of one hundred feet up the eastern side. Isolated blocks, however, were hurled clear over the ridge into the adjoining valley, the Uschinenthal.

"The avalanche was preceded by a terrific blast of wind which swept away chalets, trees, men, and cattle as though they had been feathers. This is proved by the fact that, far above the limit reached by the avalanche, hundreds of trees have been uprooted, and lie in regular rows, indicating with mathematical exactitude the direction of the aerial current. These trees are for the most part of great size, several indeed having trunks one meter in diameter. Such as were protected by a large rock or a reverse dip on the hillside have been spared. Others, standing with only half their height above such hollows, have had the exposed part blown off, while the subsequent oncoming of the avalanche has not succeeded in tearing up what was left of them, even when it has enveloped their base. This wind produced a veritable bombardment of ice dust mixed with stones, which has stripped the roots and branches of the trees laid low by the wind itself, and which must have killed man and beast before ever the real avalanche overwhelmed them. Further away the trees have only been denuded of their upper portion, the branches composing which were transported to a great distance, and now form a compact line of debris among the far-off scattered trees, like the bank of sea wreck left on open coasts after a fierce storm. Ice bombs, too, round like cannon balls, but with an average diameter of one foot, which lay all about in the neighborhood of the fallen mass, bore eloquent testimony to the extreme violence of the wind. On the way from the Hotel Schwarenbach, before coming to the Bernese frontier, the green pasture was strewn with these balls like a battle field in old muzzle-loading times.

"The true avalanche, in its recoil from the rock wall, has formed an immense rampart, separated from the rock by a deep trench. On the sides, under the stress of the enormous power of the wind, which, like the avalanche itself, was deflected by the Weissfluhgrat, blocks of considerable size were driven around as in a whirlpool, so as, at least on the northern edge, to have been forced back up the slopes of the Altels toward the entrance of the gorge leading to Kandersteg. These different atmospheric motions were well marked, owing to the disposition of the materials which came under their influence. Near the Winteregg, the trees, shrubs, and grasses were all bent toward the north, forming an exterior zone, which was more and more thickly covered with the dust, etc., raised by the catastrophe as the central mass was approached. A second zone, within the first, was found to consist of the loose rocks, etc., thrust aside by the head of the ice mass as it dashed up the west slope; the inner edge of this zone was itself covered by a layer of ice and snow, representing the matter that kept pouring off from the sides of the central body in its upward progress, and also the results of the reflux which took place when its further advance was barred. Some of the ice and stones hurled against the Weissfluhgrat had adhered to it, being plastered, as it were, into the fissures and gullies. These masses were being constantly detached from their precarious position, and kept descending in roaring avalanches."

DR. ROENTGEN has published some new facts about his rays. He finds that all solid bodies can generate them; the only difference being in the intensity, the greatest intensity being produced by platinum. He finds that the insertion of a Tesla coil between the Ruhmkorff coil and the ray-producing apparatus is very advantageous, and that the X rays and the air traversed by them can discharge electric bodies.

Yonkers, Hastings and Dobbs Ferry to the Ardsley Country Club, the return being made over the same road. The ride through the city was very exciting. The carriages dodged back and forth in front of and around cable cars and wagons, and demonstrated beyond argument that the horseless carriage is much more capable of control than the ordinary horse and carriage. They passed through the most crowded portions of the city, which was in holiday attire in honor of the day. The crowd at Madison Square was particularly dense, but the carriages had no difficulty in making their way through the crowd without accident. When the Boulevard was reached, speed was increased and the wheelmen had difficulty in keeping up with some of the carriages. The only serious accident of the day occurred on the Boulevard, where a wheelman was run into and seriously hurt by one of the horseless carriages. The operator was arrested.

From the Boulevard to Kingsbridge there are a number of hills, and in places the road is very bad. The carriages had no difficulty whatever in climbing these hills at a good pace, and demonstrated that they were all excellent in coasting down a hill. The noise made by the carriages was not particularly noticeable, and they did not appear to scare horses along the route. Occasionally they stopped to make minor repairs. Kingsbridge was reached at 1:10 P. M. Here the water tanks were filled, and the carriages awaited the arrival of the judges, who came on a special train. The judges were Gen. Nelson A. Miles, U. S. A.; Gen. William G. Craighill, Mr. John Jacob Astor, and Mr. Chauncey M. Depew.

The judges examined the carriages, and then took the train to Irvington. The speed race really began at this point. Four of the carriages made the turn at the Cosmopolitan building, at Irvington, and passed the judges' stand at the new Ardsley Casino, where a stop was made to get water. Carriage No. 1, in charge of Frank Duryea, arrived at the Casino at 3:15 P. M., the time from Kingsbridge, a distance of 13 miles, being made in one hour, five minutes, forty-two and two-fifths seconds. Carriage No. 2, a Duryea vehicle, arrived at 3:30 P. M., and No. 5, the Roger carriage, in charge of T. W. Brander, arrived at the Casino porch at 3:44 P. M. The judges stood on the Casino veranda and gave the official time as each carriage arrived. The award was based upon the following points, the maximum being 100: speed, 35; simplicity of construction and durability, 30; ease in operating and safety, 25; cost, 10. Several exhibition tests were given on the Ardsley Park ground. The first of the horseless carriages returned to the Post Office, New York City, at 7:13 P. M. It was one of the Duryea wagons, managed by Mr. F. Duryea. There was a large crowd in waiting as the vehicle came down Broadway and turned into Mail Street, north of the Post Office. The greatest speed was attempted between Kingsbridge and the Ardsley Country Club. In Yonkers arose an obstacle which filled the racers with gloom. Peabody Hill reared its lofty head above them and resisted every effort of the motor. So the driver and umpire descended and pushed it over the crest of the hill. Several of the carriages met with misfortune.

The trial proved beyond question that the American horseless carriage of the day is a success and is well adapted for use in our city, as it appears that it can be turned and stopped more easily than ordinary vehicles. We present illustrations of two of the carriages taken by the special photographer of the SCIENTIFIC AMERICAN just at the start. We have already illustrated the victorious Duryea carriage in the SCIENTIFIC AMERICAN for November 9, 1895.

The Roger vehicle was made in Paris and weighs 1,730 pounds; the guiding is done with the wheels, which turn inside of a narrow space, the inside wheels turning more than the outer. It is guided with extreme ease, and was stopped and started on the day of the race in good time. The five horse power Benz motor is actuated by gasoline. The ignition is produced by an electric spark; the cylinder is cooled by a water jacket; the power is transmitted to the rear wheels by means of belts, sprockets and chains. Two belt shifters permit different speeds, and differential gear allows the back wheels to turn with ease. The wheels are provided with solid rubber tires. The race demonstrated that the pneumatic tires were better adapted for the motor carriages than the solid tires. The other carriage, which we illustrate, is the Booth-Crouch carriage, made at Youngstown, Ohio. The motor was made by W. Lee Crouch, of New Brighton, Pa. The fuel used is gasoline. The carriage was driven by Dr. Booth, of Youngstown, Ohio, and it would undoubtedly have made a very successful showing if it had not met with the misfortune of the breaking down of the spark apparatus.

THE first woman who has received the permission of the minister of public instruction to attend lectures in the University of Munich, Bavaria, is Miss Ethel Gertrude Skeat, daughter of the well known editor of Chaucer's works.

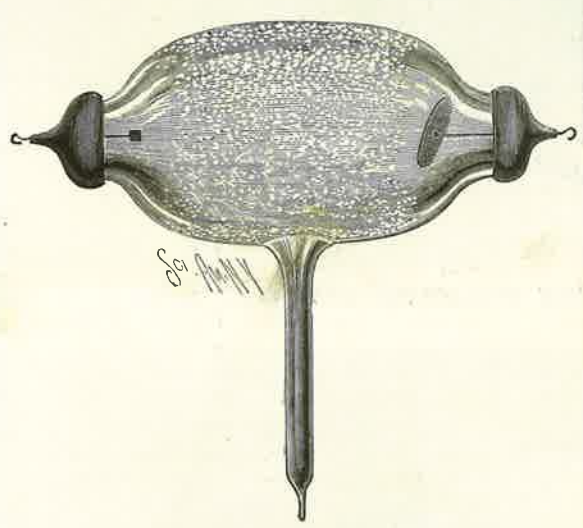
EDISON'S NEW ELECTRIC LIGHT.

A notable example of the stimulation of invention by new discoveries is found in the latest work of Edison, which follows the discovery of Roentgen and the flouroscope of his own invention. This latest invention is a fluorescing lamp in which is found the promise of the artificial light of the future. The lamp appears to have all the qualities requisite for perfect illumination; the light is mild but effective; it is diffusive like daylight. It gives off no perceptible heat, which latter quality goes to show that its economy has no parallel in other kinds of artificial illumination.

One form of the lamp consists of a highly exhausted oblong glass bulb having wires sealed in the ends, each wire being provided with a small plate inside the bulb, one of these plates being inclined to cause a distribution of the rays over the side of the lamp. The inner surface of the lamp is covered with a granular mineral substance which is fused on the glass and is highly fluorescent. When the lamp is excited by connection with an induction coil, the fluorescent material becomes luminous.

Originally Edison used calcium tungstate for his fluorescing material; but by trial he found that the vacuum soon deteriorated, and after a long series of experiments has discovered a fluorescing material which does not affect the vacuum, while it has a higher efficiency than the calcium tungstate.

Mr. Edison thinks that the fluorescing material converts all of the X rays into light. He has a theory as to the manner in which the light is produced. The crystals are composed of light and heavy particles and the impact of the waves produces a stress in the crystals which causes the emission of light. Mr. Edison describes these waves as sound waves, because they differ in their mode of vibration from ether waves. Their motion is infinitely more rapid than that of



EDISON'S FLUORESCING VACUUM LAMP.

sound waves with which we are familiar; they are comparable as regards velocity with electric or light waves. As to efficiency, the fluorescing lamp produces light at the rate of 0·3 of a watt per candle power. When this is compared with 3 watts per candle power for incandescent lamps, and ½ watt per candle power for arc lamps, it will be seen that there must be great economy in the fluorescing lamp.

The Record-breaking Trip of the St. Paul.

Friday, June 5, 1896, will be a red letter day in the annals of the American transatlantic marine. The passengers which the St. Paul landed at the North River dock, New York, at twenty minutes past four in the afternoon of Friday, had only left Southampton at noon on the previous Saturday, so that the time of the whole trip of 3113·7 knots was only 6 days 5 hours and 32 minutes. The excellence of the performance will be better understood when it is remembered that she traveled over the long route, thereby adding fully three hours to the time she would have taken had she followed the record course of the New York, which was 3,047 knots long, and was covered in 6 days 7 hours and 14 minutes. The average speed for the whole trip was 20·82 knots. The highest hourly average speed for a whole day was made on Monday and Tuesday, when she covered 521·9 and 521·7 knots, and slightly exceeded 21 knots per hour.

The story of the St. Paul's trip, her tenth to the westward, is thus told by her log:

	Distance.	Lat.	Long.
May 30, left Southampton, 12 noon.			
May 31	487·8	49·48	14·01
June 1	521·9	48·33	27·11
June 2	521·7	45·51	39·17
June 3	513·0	42·38	50·13
June 4	508·6	41·46	61·36
June 5	518·9	40·36	72·56
	41·8	To Sandy Hook.	
	3,113·7		

This performance places the St. Paul well up in the front rank for speed, being exceeded only by the Campania and Lucania, one of which has averaged slightly over 22 knots for the whole trip and about 23 knots for a single day's run. It must be remembered however that the horse power of these ships is 30,000 against the 10,000 horse power of the American ships.

The engines and boilers were being driven at full pressure for the whole distance, and the chief engineer states that there was not a single case of heated journals or leaking tubes. This is an admirable performance when it is remembered that the boilers carry 200 pounds of steam, and the revolutions are about 90 per minute. The coal consumption is given out as 310 tons per day against a reputed consumption of over 500 tons for the Lucania and Campania.

Notice to Our Readers.

In order to obtain the opinion of the readers of the SCIENTIFIC AMERICAN as to what invention *introduced within the last fifty years* has conferred the greatest benefit upon mankind, we publish the accompanying card, which please cut out and return to the editor. Those who preserve the paper for binding and do not desire to deface their files, or who read this notice at a library, will please answer by postal card. It is desired to get as full a vote as possible. The result of the vote will be published in the *Special 50th Anniversary Number of the* SCIENTIFIC AMERICAN *on July 25.*

Editor of the SCIENTIFIC AMERICAN.

Dear Sir:

I consider that.....

.....

invented by.....

has conferred the greatest benefit upon mankind.

Name.....

Address .....

The Significance of Gesture in Disease.

When you ask a patient to locate his pain, he does so by a movement of one or both his hands. The gesture, however, not only indicates its seat, but describes its character and distribution. This is an all important point. If the pain is widely distributed over the whole chest, the patient locates it with a circular rubbing motion of the palm of the hand, indicating the diffused soreness.

The pain of a serous inflammation, on the other hand, is described by first drawing the hand away from the body and then, with the fingers close together or with the index finger extended and the others flexed, cautiously approaching the seat of the inflammation.

In appendicitis the patient does not touch the skin at all when asked to locate the pain. He simply holds the palm of his hand over the diseased area.

With very violent abdominal pains which are not inflammatory, the patient slaps himself vigorously across the abdomen on being asked to indicate the location of his trouble.

If a child refers a persistent pain to the stomach, and there is no tenderness or pressure, disease of the spine is indicated.

In hip joint disease, the pain will be referred to a point inside the knee.

With terrific diffused pain in the leg, not due to an inflammation, the patient grasps the leg firmly. If it is a darting or lancinating pain, he will indicate it with one finger.

In the pain caused by the descent of renal calculi and gall stones, he follows their course with the top of the thumb or index finger.

The pain of hepatic neuralgia or "shingles" is indicated with the thumb or finger.

In joint pains the patient approaches the seat of trouble very cautiously with the hand spread flat.

The degenerative pain of locomotor ataxia is described by grasping the affected area firmly, indicating a band-like pain. Or, if the pain is sharp and lightning-like in the leg, the pain gesture is perfectly descriptive, an energetic downward motion, at the same time twisting the hand as though manipulating a corkscrew.

A patient will indicate the seat of a severe syphilitic headache by hammering with the tips of his fingers.

A patient complained of a severe headache. "In what part of the head is it?" he was asked. "The vertex," he replied. On being asked to indicate the exact spot, he placed his finger on the parietal eminence. This he did three times in succession, though claiming to feel the pain exactly on the top. Upon examining the mouth a defective tooth was found. As soon as it was removed the pain disappeared.—Nat. Board of Health Mag.

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MOSCOW AND THE CORONATION OF THE CZAR.

Palatial Petersburg and Holy Moscow are distant four hundred and three miles by rail, but the distance in time and civilization between the old capital and the new can only be reckoned by centuries. Moscow is a city of more than 750,000 inhabitants, yet it hardly deserves the name of city. It is in reality a colossal village, for it does not resemble even a European city of the third magnitude. Moscow consists largely of one or two story houses with court yards and outbuildings, each property being walled in, or at least provided with a hedge. There seems to be a lack of concentration to Moscow which interferes with the city having a monumental appearance. In the center stands the far-famed Kremlin, the shrine of Russian art and religion. With the Kremlin as a point of departure the city forms a succession of concentric zones. Moscow has a few streets that resemble those in St. Petersburg, which are adorned with fine buildings, statues, etc., as that of Nicholas I. This statue is situated between the Cathedral of St. Isaac and the Maria-Nicolaierna Palace. Nicholas I was the third son of the Emperor Paul. He succeeded his brother Alexander in 1825 and occupied the throne until 1855. The boulevards around Moscow are most imposing, and the parks and squares which are so abundant are in excess of the real demands. The reason of the isolation of the houses is the frequency and extent of the fires. From what has been said it will be seen that Moscow is not a monumental city, but at any rate it is a picturesque one with its three hundred and fifty churches with their bright blue and gilt spires and domes. This barbaric splendor of the decorations would soon become mean looking if, like the Hollanders, the Russians did not have a passion for paint and whitewash; and it is even stated on credible authority that the oldest churches in the Kremlin are entirely renovated every year or two. Moscow is not built on a level, and the elevation is changed so frequently that a large number of picturesque views can be obtained. The conveyances are numerous and are sometimes picturesque, sometimes prosaic, but they move at a brisk pace and help to give life and color to the scene.

The quaint and gorgeous Kremlin, standing on a hill in the center of this city of magnificent distances, is of uncertain foundation. In 1339 it was surrounded by oaken walls. It forms an inclosure nearly two miles around. Its walls are pierced with five gates; the principal being the Shaski Vorota, or Redeemer's Gate, having a highly venerated picture of the Saviour over it; all who enter by it are required to bare the head. Entering the square, the visitor sees three cathedrals and two other churches—one, St. Basil, having eleven polychromatic spires and cupolas; the great bell, the palace, etc. The great bell, which we illustrate, is one of the sights of Russia. The tower of Ivan Veliki is the campanile for the three cathedrals of the Kremlin. It contains thirty-four bells, the largest weighing 64 tons. The great bell at the foot of the tower is the Tzar Kolokol, which according to the inscription was cast in 1733. It never seems to have been actually hung or rung, having cracked in the furnace. It weighs about 440,000 pounds; its height is 19¼ feet; the circumference is 60 feet 9 inches. The thickness is about 2 feet. The weight of the broken piece is 11 tons. It is now used as a chapel. In the Cathedral of the Assumption, a small church founded in 1326 and rebuilt in 1475, the present Czar of Russia was crowned on May 26, with imposing ceremonies and fetes, the cost of which will exceed $20,000,000.

The Czar made his triumphal entry into Moscow on May 21, accompanied by the Empress and the Court. The route from the Petroffsky Palace to the Kremlin, a distance about three miles, was lined by an enormous crowd of spectators. The way was elaborately decorated by fluttering flags, banners, pennants and escutcheons. Streamers stretched across the roadway and garlands of heather hung from Venetian masts. Little sleep could be obtained in Moscow the previous night, on account of the large crowds of the lower orders, who were obliged to shift for themselves in regard to lodgings and places to view the pageant.

When the cannon announced that the cortège was getting ready, the church bells of the myriad-belled city began their chiming. Hats were removed and the sign of the cross was made by the devout Russians. His Majesty was followed by an immense retinue of officers of all nations in every variety of uniform. The Czar looked calm and serious and continually raised his hand to salute the acclaiming crowds. The progress was marked with a continual boom of cannon and a clanging of bells to the tune of the national hymn, joined to the cheering of the vast assembly. The Empress was seated in a magnificently gilded coach, drawn by eight beautiful cream colored horses, and in the following gilded coach, without a crown, sat the Empress Consort, graciously bowing acknowledgments. Both their Majesties were dressed in Russian costume, pure white with silver brocade. Their Imperial Majesties alighted at the Gate of the

(Continued on page 393.)

THE CORONATION OF THE CZAR—THE PROCESSION ENTERING THE HOLY GATE.

contribution. In many theaters the air is now renewed by electric fans. All such methods are good, and it is solely a question of selecting the one that is best adapted to the place in which it is proposed to establish the ventilation. Despite the already large number of processes known, however, it is often found difficult to effect a constant renewal of air at slight expense, either because automatic methods do not give an adequate movement or because motive power is lacking. It is in order to obviate such difficulty that Mr. Bessiere has devised the system which we figure herewith and which operates through a simple water cock arranged in the form of an atomizer which consumes very little liquid.

As seen in the figure, the apparatus consists of a tube, B, open at both ends and inclosed in a second tube, C, closed at each extremity, from which start one or more exhaust conduits.

An atomizer, A, situated near the top of the internal tube projects a thin sheet of water having the form of an inverted funnel whose edges come into contact with the walls of the tube. The result is that there occurs a forcing of the air contained in the lower part and a section of that contained in the upper. The current of air thus established, finding no other outlet, escapes through the conduits starting from the outer tube, and is naturally proportional to the pressure and to the velocity with which the water flows. The ordinary pressure of city mains, which always reaches from two to three atmospheres, is sufficient. The water that has been used flows out through a siphon, D, and may, if desired, be employed for other purposes.

It will be seen that it is possible by this means, at will and according to circumstances, to suck the air from a room and force it out of doors, or, conversely, to suck in air from the exterior in order to introduce it into a room. Fig. 1 represents the first arrangement, and Fig. 2 the second.

It will be remarked that, by its very principle, when the apparatus operates as indicated in Fig. 2, it supplies air that is slightly moist, which, moreover, is desired in the majority of cases. But if it were necessary to have dry air, nothing would be easier than to obtain it by causing the current to pass over desiccating substances, such, for example, as chloride of calcium. If it is a question of purifying the air of a room, some such disinfectant as formol may be so arranged that the current shall pass over it.

The apparatus may be installed in each room to be ventilated by connecting each of them with the water conduit of the house, and, when the room is of very large dimensions, it is possible to install a battery of several ventilators placed side by side. The essential and even indispensable condition for obtaining a good rendering is to have an adequate pressure of water at hand. In case this did not exist in the city mains, it would be necessary to create it artificially, either by means of a pump or by placing a reservoir on the roof of the house.

The starting and stopping of the ventilators of this system are very simple matters, since it suffices to open or close a cock in order to effect one or the other. It is, therefore, possible to intrust the manipulation of them to anybody.—La Nature.

Concerning Crookes Tubes.*

We would offer the following contribution to the rapidly increasing literature on the X rays of Roentgen. It has to do with a part of the subject upon which very little has been written, and for that reason may be helpful to other experimenters.

One of the chief difficulties in the way of experimenting has been the cost of the bulbs or tubes. We have proved to our own satisfaction that the making of them need not be beyond the resources of the ordinary laboratory, for within a few weeks time we have made and tested more than one hundred tubes, and have frequently made one and exhausted it and used it, all within an hour's time. All that is required is some little skill in gas blowing and in the manipulation of the pump.

The Glass.—A hard German glass or its equivalent, free from lead, has proved the best. It gives a strong green fluorescence under the action of the current, and, what is of great importance, resists without softening the heat generated by the cathode ray at its point of impact. Unfortunately it is not to be had free from bubbles, and these are the cause of the destruction of many tubes, the glass being chipped away into the bubble by the action of the current and the tube ruined. It is also rather difficult to put in the electrodes so that they will stay, and it may be necessary to use three kinds of glass—first the tube itself, then a bit of softer glass, and upon that very soft lead glass for the seal.

Shape of the Tube.—A good tube should throw shadows as sharp as possible and develop the rays as powerfully as possible. It should easily appear that the ordinary spherical form meets neither of these conditions.

To produce a sharp shadow the radiant must be small. It was found that a picture could be taken upon any side of a spherical bulb, making it probable at least that the entire surface is a source of radiation.

In the matter of strong action also the spherical form is inferior. This is for two reasons. First, glass more or less extinguishes the rays, according to its thickness, therefore the larger the bulb the more opaque it must be, for it must be thick enough to stand the atmospheric pressure.

Secondly, there is a comparatively large amount of radiant or conducting matter within the spherical bulb which diffuses the energy of the discharge.

Proof of the second point was obtained as follows: A moderately thick bulb about three inches in diameter was blown, and upon this a spot one inch across was blown out very thin, forming a smaller hemispherical bulb upon the first. Opposite this thin window was the concave cathode. This bulb proved better than the ordinary sort, but far inferior to tubes about to be described. A second experiment was made with a tube blown thin along one side for a space of three inches, and opposite to this was the cathode in the form of a quarter cylinder. The performance of this was also inferior.

Without going into the details of many similar experiments, it will be sufficient to say that we have found that a simple straight tube from one-half to one inch in diameter, having a small and very thin bulb for a cathode window, has given the most satisfactory results. In length it may be from four to eight inches. The bulb may be blown at the bottom of the tube, the cathode placed at the top and the anode across the tube just above the bulb. Better results are, however, produced by using a bit of platinum foil for an anode, inclining it about forty-five degrees to the cathode ray. In this case the small bulb may simply be blown out upon the side of the tube and the electrodes put in at the two ends, so that the cathode ray will be reflected into the bulb.

Shape and Disposition of the Electrodes.—We have made the cathode in the form of a wire, a flat plate, a convex plate and a concave plate. The concave form proves the best in every case. We have made it of varying size up to an inch or more in diameter and have not come to any conclusion as to which is best. It is very difficult to have other conditions sufficiently uniform to enable one to judge where differences are small.

We have made the anode in the form of a wire of aluminum, a flattened strip of it, and, as stated above, in the form of a platinum reflector. As yet we have got our best results from the platinum. One rather interesting result obtained was that when the anode was in the form of an aluminum disk parallel to the cathode and nearly large enough to close the tube, it gave little or no interference with the X ray. We made one on a hinge so that it could be swung out of the path of the ray or in at pleasure, and the effect on the photographic plate was the same in either position.

Source of the Rays.—Being able to construct tubes of any form, we have made many experiments as to the source of the rays, whether from the cathode or anode. One was in this way: Two tubes were joined together parallel so that they were exhausted together. The cathode rays could be made to pass down one tube and the anode rays (if such existed) down the other, and either screened off at will. We found that the anode rays affected the plate but slightly, and that practically all the effect came from the cathode.

Intensity of Effect.—We do not intend to convey the impression that these home-made tubes we have described are simply good enough for experiment and valuable from their cheapness. We believe also that they are more effective than others. We have made good negatives of bones of the hand, arm, including the elbow, foot, ankle, etc., all with remarkably short exposures; have taken impressions perfectly distinct through nine inches of wood in less than five minutes; have taken perfectly the bones of the hand through thin sheet zinc in two minutes and through the slide of the plate holder in five seconds. The ordinary coin and key impression requires not over one or two seconds with our best tubes.

Remarks upon Pumping.—The interest in the subject at present may make some remarks upon pumping here in place, most of all, since many have found great difficulty in this respect.

It is here supposed that the pump has a three-way cock above its bulb, opening in its two positions between the bulb and fork and the bulb and outer air; and that above this three-way cock are one or two cocks of the ordinary kind. Let the three-way cock be called A, the others B and C in order. Let the position in which A puts the bulb in communication with the fork be position 1; and that in which it puts the bulb in connection with B, C, and the outer air, position 2. The ordinary process of pumping with the use of A alone is supposed to be understood. After a greater or less number of strokes it is observed that no more air is obtained. The pump contains air, however, condensed upon the glass walls. To remove this A is put in position 2, and the mercury raised until a drop passes B. B is then shut and the mercury dropped until only a drop remains above A. A is then shut and the movable mercury tank dropped to its lowest point, when A is put in position 1. Pumping now goes on as before only with B shut, and the tank is raised only a third as high as before. After four or five strokes it is well to pass the mercury again above B.

If the highest possible degree of exhaustion is desired, this process can be repeated between B and C, but this is not necessary in exhausting a Crookes tube.

As soon as the stage of pumping with B shut is reached, the tube which is being exhausted must be strongly heated, moving the lamp flame over every part of it, and after two or three strokes more the current from the coil is turned into the tube. By the combined action of the heat and current the occluded air is driven from the glass and exhaustion proceeds rapidly. It should not occupy over twenty or thirty minutes for a moderate sized tube.

Allowing the tube to cool, if short sparks can be drawn from the bulb and there is little or nothing to be seen in it except green light, the exhaustion is complete. There is danger of carrying it too far, for the vacuum very much increases during the first hour that the tube is used; but of these matters a little experience is the best teacher.

*By C. C. Hutchins and F. C. Robinson, in American Journal of Science.

Notice to Our Readers.

In order to obtain the opinion of the readers of the SCIENTIFIC AMERICAN as to what invention *introduced within the last fifty years* has conferred the greatest benefit upon mankind, we publish the accompanying card, which please cut out and return to the editor. Those who preserve the paper for binding and do not desire to deface their files, or who read this notice at a library, will please answer by postal card. It is desired to get as full a vote as possible. The result of the vote will be published in the *Special 50th Anniversary Number of the* SCIENTIFIC AMERICAN *on July 25.*

Editor of the SCIENTIFIC AMERICAN.

Dear Sir:

I consider that.....

.....

invented by.....

has conferred the greatest benefit upon mankind.

Name.....

Address .....

A Dog Iron Worker.

Keys, the canine employe of the Union Iron Works, met with an accident recently by which his front right leg was broken, says the San Francisco Examiner. Keys has been looked upon by the officers of the iron works as one of the regular workmen for about four years. He is a dog of no particular beauty, and his pedigree would not be considered by dog fanciers, but he possesses wonderful intelligence. He makes the Potrero Police Station his home, and he is the pet of Lieut. Bennet, but nearly every workman in the ship building concern claims the friendship of the dog.

At the first tap of the gong every morning Keys has reported for duty at the gates of the Union Iron Works, and he has never left until a full day's work had been accomplished. He was particularly useful in the ship yard and in the boiler shop, and the foremen of these departments say he was more valuable to them than a man for doing certain kinds of work. He could crawl through small holes in boilers and about ships, and his particular work was to carry tools, bolts, nuts, rivets and other small articles needed by workmen who had crawled into such places, and to have them creep back and forth for which would have caused considerable loss of time. Keys thoroughly understood his work, and he was always on hand when needed. Recently a steamer was placed on the dry dock for repairs, and the dog, realizing that his services might be needed by the workmen, was climbing a ladder to the deck when he slipped and fell about twenty feet. The men picked him up, and making a stretcher of some pieces of canvas carried him to the police station and sent for a physician to set the broken limb.

ACCORDING to Mr. Dewar, a liter of liquid air placed in a globular silver vacuum vessel and subjected to exhaustion, will produce as much as half a liter of solid air, which can be maintained in this condition for half an hour. In its solid state air is comparable to a jelly. When examined in a magnetic field, the liquid oxygen is drawn out of it to the poles. If pure, the jelly is clear and transparent. If it contains carbonic acid, it is milky.

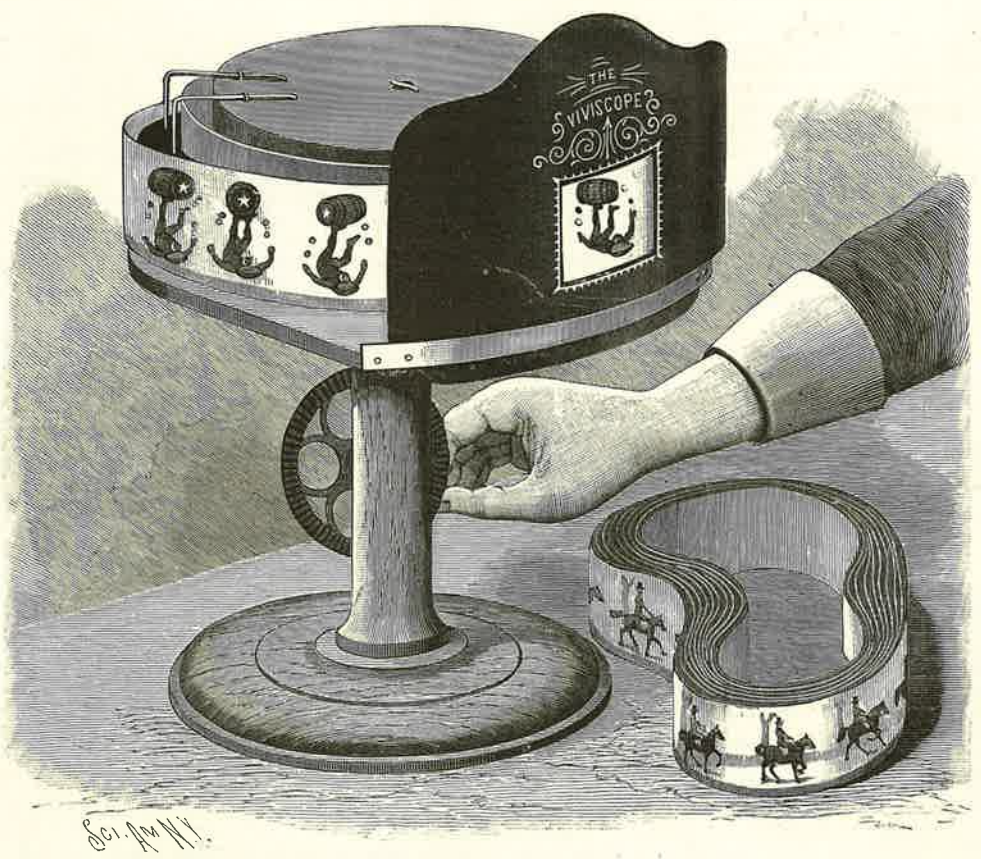
THE VIVISCOPE.

A great deal of ingenuity is devoted to the production of entertainment devices, and many most ingenious ones have been illustrated in our columns, but it is seldom that one more interesting, from the scientific as well as amusement standpoint, can be offered to our readers than the one we here illustrate. It is termed the viviscope. Supported on a standard is a circular stage. Concentric with the stage a circular block about eight inches in diameter is rotated by a hand wheel. This block is surrounded by a cylinder secured immovably to the circular stage. Attached to the disk are two wires projecting nearly radially from it and carrying at their outer ends a block of crescent shape and which depends directly over the perimeter of the stationary cylinder. As the hand wheel is rotated this block whirls around and around the cylinder.

With the viviscope are supplied a number of endless bands of paper with colored pictures of figures in progressive stages of movement, drawn on the zoetrope principle, the same as is followed in securing the photographs for the kinetoscope and vitascope. These bands have their ends pasted together and are of such length as to fit rather loosely over the stationary cylinder and the depending block. A screen with a hole is provided which is mounted on the perimeter of the circular stage, and through this aperture the spectator is supposed to see the figures. One of the beauties of the instrument is that the screen is not really necessary and that without it the movements can be seen by an entire room full of people. When the hand wheel is turned, the block whirls around between the stationary cylinder and the endless band with the figures on it. As the block passes under each figure, by a very peculiar principle of wave motion, the figure is shifted one space forward. Thus, for each rotation of the block, every figure on the band, which of course means the whole band, is shifted one space ahead, so that a perfect zoetrope effect is produced and the figures seem endowed with life.

The easiest way to figure to one's self the mechanical principle evolved is to imagine a rope secured to the floor at one end of a room and reaching clear across it exactly to the door sill opposite the wall, near whose base it is attached. Now let a footstool be placed beneath the rope near the fastened end. It is obvious that the free end will be drawn back, say a foot, from the door sill, and, of course, all the rope in front of the footstool will share the same displacement. Now let the footstool be moved forward toward the door. The rope will pass over it, and, as it is left behind by the footstool, it will regain its original place upon the foot. Each particle of the rope is left one foot in advance of the position it occupied when in front of the footstool. As the footstool is pushed out of the door the end rope will leave it and regain its original position with its end at the door sill a foot in advance of its position when the footstool was beneath the rope back of it. The difference between the rope illustration and the mechanism of the viviscope is that in the viviscope an endless band takes the place of the rope.

It will be obvious, we think, why this ingenious toy seemed worthy of a far more than passing consideration. It represents a most ingenious mechanical movement, one which may be termed paradoxical and which really is a good subject for the exercise of ingenuity in reaching a full and satisfactory explanation of its principle. Independent of this feature, it forms an excellent entertainment device, one whose principal charm consists in the fact that the figures are directly seen without the intermediation of any slot. The band, it will be noticed, is perfectly fixed in position, except such parts of it as the block passes under; the block being but one-seventh of the circumference of the cylinder, the band is stationary six-sevenths of the time. This gives the requirements for a kinetoscope, and the viviscope must, we think, be recognized as such. It is peculiarly timely now when the public has been so much interested by the exhibitions of the kinetoscope and vitascope, which have been witnessed by so many. Considered as a toy, it marks the only radical advance ever made on the construction of the old slotted zoetrope. It is manufactured by E. B. Koopman, 33 Union Square, New York.

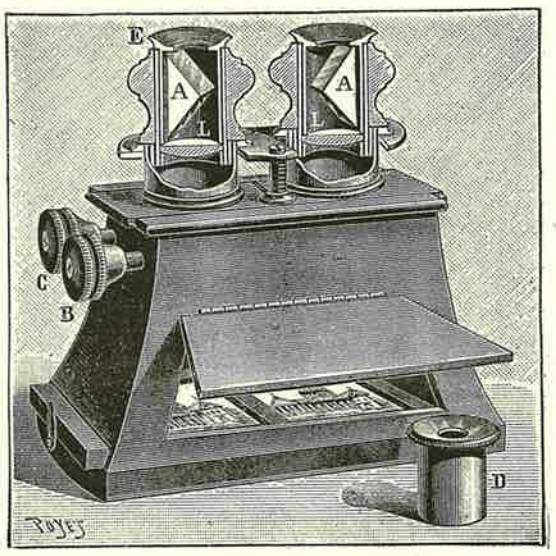


THE VIVISCOPE.

NEXT October a scientific jubilee will be held in honor of the fiftieth anniversary of first application of ether in surgical operations.

AN INVERTING STEREOSCOPE.

A photographer who, provided with a stereoscopic apparatus, should take it into his head to make a positive upon glass directly by contact with his negative would be much surprised upon afterward looking into his stereoscope to see the foreground transferred to the rear, while the background would come to the front. He would obtain what has been called pseudoscopy. This fact is well known to stereoscope amateurs, who also know that when they print a positive of their negative it is indispensable to put to the right the image that has been obtained to the left, and vice versa. The necessity of such inversion is demonstrated geometrically in taking as a basis an examination of



AN INVERTING STEREOSCOPE.

two truncated cones; but such demonstration would be too lengthy to reproduce here, and we refer those who desire to make themselves acquainted with it to special treatises.

However it be with theory, the fact is, nevertheless, quite annoying in certain cases. When a print is made upon paper, nothing is simpler, in order to conform to the rule, than to remember that it is necessary to separate the two images and to invert them upon the support upon which they are pasted; but if we print a positive upon glass, there is a slight complication, for it is then necessary either to cut the negative and afterward unite it in the proper direction or else make use of a special frame (of which there are several models) that permits of doing the printing in two operations, but without cutting anything. Now, stereoscopic views upon glass are from every point of view preferable to those upon paper, and tend to become more and more popular among amateurs.

Messrs. Carpentier & Gaumont have very recently constructed a style of stereoscope that permits of seeing the normal relief without making the inversion. To this effect, they utilize two small total reflection prisms, A, which they place in front of the lenses of the apparatus, as shown in the accompanying figure.

We know, in fact, that when we look through a prism of this kind in holding the hypotenuse face in a plane at right angles with that of the image, the latter is inverted, the right is transferred to the left, and vice versa. Now, to thus invert every image in place gives the same result as if one were shifted with respect to the other, provided, however, that we operate upon the wrong side of the image, without which the objects would not be found in their true direction, and, in case there were inscriptions, the latter, being likewise inverted, would become illegible. As it is a question here of transparent views only, there is no inconvenience in placing them wrong side up in the stereoscope.

It may be objected that with such a system it would be no longer possible to examine the views made up to the present and in which account has been taken of the necessity of transposing the images. But the manufacturers have anticipated this and have taken care to mount the prisms in a small tube which slides by slight friction in the piece, E, so that it is very easy to remove them (as seen at D) and then have an ordinary stereoscope. The focusing and the spacing of the objectives is effected by means of the buttons, B and C.

This new type of apparatus will contribute toward the dissemination of a taste for stereoscopic photography among amateurs, who have often been discouraged by the often inconvenient manipulation of which we have spoken.

It is now several years ago that Mr. Drouin conceived the idea of applying this principle of prisms for placing the stereoscopic image in its true direction in examining it upon the ground glass of the camera. To this effect, the operator provides himself with two small total reflection prisms mounted upon a jointed support, and, when he is under the black veil, he can obtain an exact idea of the effect that will be produced and find out what is the best position to give the objectives in order to obtain the maximum of relief.—La Nature.

Roentgen Rays Foreshadowed.

Mr. John P. Moss writes to the Daily News under the heading "Nothing New under the Sun," quoting the following paragraph from Dr. Priestley's Electricity, 1769, which, as he says, is interesting at the present time in connection wfth the late discoveries in photography. It describes an experiment made by Mr. Hawkesbee in 1709. "He (Mr. Hawkesbee) lined more than the half of the inside of a glass globe with sealing wax, and having exhausted the globe, he put it in motion; when, applying his hand to excite it, he saw the shape and figure of all the parts of his hand distinctly and perfectly on the concave superficies of the wax within. It was as if there had only been pure glass and no wax interposed between his eye and his hand." It does not seem possible, says Mr. Moss, to doubt that the extraordinary result of Mr. Hawkesbee's experiment originated from the same natural law that produces the photographic effects which have recently so startled the scientific world, but we fail to follow the logic of Mr. Moss.

In connection with the X rays, says Industries and Iron, a curious reference to a new light is made in the course of a lengthy paper on magnetism, by Baron Reichenbach, of Vienna. The date of this is 1846. The paper itself can hardly be said to call for much attention, but the curious part of it is the assertion of a "magnetic light" proceeding from the poles of a magnet, which could actually be seen by some peculiarly constituted individuals. In the account appearing in the Dublin Journal of Medical Science, at that time, it is stated that Baron Reichenbach, "in order to be certain that there was actual light given off in these cases, made some very careful experiments with the daguerreotype, the result of which was that an iodized plate was acted upon when placed opposite the poles of a magnet. He was also able to concentrate it with a lens, but the focal length was found to be 54 inches, while, for a candle, it was only 12 inches. He could discover no action of heat with the most delicate thermoscope. When the hand was laid before the poles, the light streamed through the fingers."

ACCORDING to Nature, the phenomenal Eichener Lake, in the Grand Duchy of Baden, which has the peculiarity of appearing and disappearing at uncertain periods, has recently again made its appearance after a lapse of time.