The Vienna Electrical Exhibition.

The Rev. Charles A. Stoddard, D.D., one of the editors of the New York *Observer*, is writing from abroad to his paper some very interesting letters descriptive of the places he visits, his experiences and observations as a traveler on the Continent. His last letter was from Vienna, and his account of the International Electrical Exhibition now open there is the best we have read. Mr. Stoddard pronounces the exhibition complete and beautiful, and says: "Aside from the telephones, telegraphs, and countless varieties of electrical appliances for generating and applying power, the two striking points of the exhibition are the Siemens electric railway and the numerous practical methods of lighting which are exhibited. The railway seems to be a success, its car runs back and forth constantly, carrying crowds of people to their own satisfaction and to that of the onlookers. It differs from the electric railway which was constructed in the environs of Berlin, in that the electricity is stored for the trip, beneath the car. In the Berlin railway it was communicated by means of a cable on posts along the line. The car runs rapidly and noiselessly and is easily controlled by the conductor.

"The lighting of the buildings by electricity is on a vast scale. There are numerous steam engines which drive the machines furnishing the electricity, and the immense hall when lighted was as bright as day. There are English and American and German systems exhibited, and a series of rooms fitted up with extreme elegance illustrate the practical application of the electric current to the purposes of house lighting. No more beautiful and brilliant suites of apartments could be seen even in the palaces of kings. The Edison, Brush, Maxim, and Swan systems are each magnificently represented. The Swan light is white and more agreeable than the Brush or Maxim, but the yellow light of the Edison system, while it is accompanied by some heat, is upon the whole the most agreeable; all are brilliant, and all are painful to the eye after a few hours, but they are vastly superior to gaslight, and in due time the gas companies will pass away and their meters will be exhibited in the same museums with the instruments of extortion used by the Inquisition. The accuracy and perfection of some of the electrical machines made upon the Continent was worthy of notice. They were so steady and constant in the light which they furnished as to excite the admiration of all beholders. These lamps are called by different names, known to experts as the Pilsen, Ganz, Schuckert, and Schwerd machines. The Ganz lamp is the simplest in its construction and gives a steady light. It is a lamp with a single solenoid; the electric current enters through a lower, fixed carbon, passes into the solenoid's iron core, and by an ingenious but simple contrivance forms the arc upon a positive carbon.

"The possibility of turning on and off any number of incandescent lamps in one circuit, without regulating the main current, is shown in a very successful way. This will reduce the expense of electric lighting by removing the necessity for special apparatus designed to introduce a greater or less resistance into the circuit; and thus the main obstacle to the introduction of electric lighting, its great expense, bids fair to be modified by the inventions presented at the Vienna exhibition. Some of the designs shown are most beautiful. Besides ordinary chandeliers and brackets, there are bouquets of glass flowers, from which the light proceeds; fountains in the center of a room that seem to be throwing out crystal streams of light; rays of light flowing into the room without any jet or fixture being visible, a beautiful boudoir whose ceiling is pierced in manifold places in the form of little stars, and behind each opening an incandescent lamp is placed, so that the apartment seems starlit. To recount the wonders which have already flowed from the practical application of electricity, and which are on view at Vienna, would require," says Mr. Stoddard, "the knowledge of an electrician, the terminology of a machinist, and several issues of the New York *Observer*."

A Deep Artesian Well.

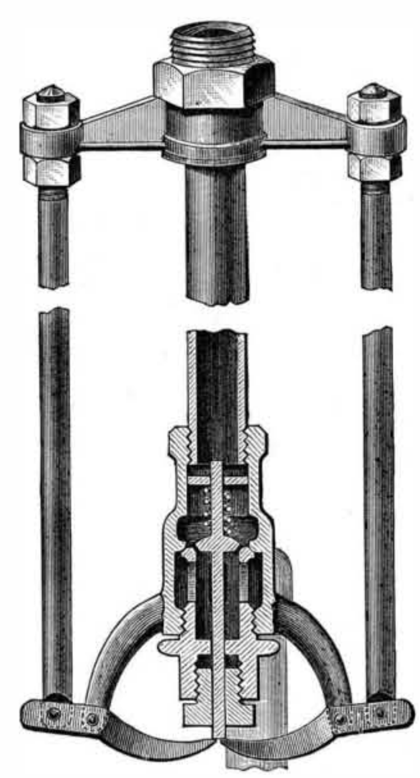
The artesian well now being drilled in the cellar of Cyrus W. Field's new building, at No. 1 Broad way, will be one of the deepest and largest in this country, and the tools used are among the heaviest ever made for this purpose. The bore is 8 inches in diameter, the usual size being from 4 to 6 inches. The hole in this well is between 300 and 400 feet deep, and progress is being made at the rate of 100 feet a week. An abundance of water has been reached, but not in sufficient quantity to justify a discontinuance of the drilling. The auger and bit weigh 4,800 pounds, and are lowered into the hole by a cable. One end of the cable is attached to an immense walking beam, by which it is raised and let fall with every stroke. A man stands constantly at the mouth of the well, turning the cable as the bit is raised, so that the boring is as perfectly done as if the rock were of pine and the auger of steel.

The hole is round and smooth, and almost polished by the constant friction. Every few hours the auger is drawn out and a large brass syringe inserted to suck out the rock sand which is made by the drilling. The bits are constantly being dulled by rocks, and a blacksmith's forge is necessary to sharpen and temper them to their work. One bit lasts usually about four hours, when it is removed and another one put in its place. Mr. C. J. Bushnell, the contractor for the work, estimates that the well will cost nearly $15,000, and will yield about 50 gallons of water per minute.—*Engineering News.*

THE CHAMPION STEAM TRAP.

This steam trap is simple in construction, effective in operation, and strictly automatic. It consists of a central tube of heavy brass passing through a crossbar, to each end of which is attached an iron rod by means of two nuts. The lower end of the brass tube screws into the top of the valve case. The rod of the valve is held in place at its upper extremity by a horizontal piece extending across the chamber, and its lower extremity passes through a stuffing box, and upon the outer end rest the two points of the curved levers. A spiral German silver spring tends at all times to close the valve.

From the lower part of two opposite sides of the case project two downwardly curving arms, whose ends are pivoted to two horizontally placed arms attached to the ends of



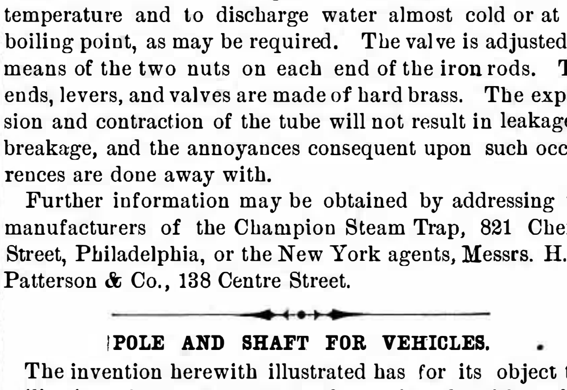
THE CHAMPION STEAM TRAP.

the iron rods. As the brass tube is expanded by the water passing through it the levers are depressed, the relative lengths of the long and short arms allowing the valve to move a great distance compared with the expansion of the tube. This enables the trap to act through a wide range of temperature and to discharge water almost cold or at the boiling point, as may be required. The valve is adjusted by means of the two nuts on each end of the iron rods. The ends, levers, and valves are made of hard brass. The expansion and contraction of the tube will not result in leakage or breakage, and the annoyances consequent upon such occurrences are done away with.

Further information may be obtained by addressing the manufacturers of the Champion Steam Trap, 821 Cherry Street, Philadelphia, or the New York agents, Messrs. H. T. Patterson & Co., 138 Centre Street.

POLE AND SHAFT FOR VEHICLES.

The invention herewith illustrated has for its object the utilization of the pole or shafts of a carriage for either when it is desired to use the same vehicle either for one or two



MARRETT'S POLE AND SHAFT FOR VEHICLES

horses, thus doing away with a separate pole and separate shaft. For this purpose a sectional construction is used, with socketed screw couplings, for uniting or disconnecting the sections of the pole and shafts, special devices being designed for other connections. This plan insures greater compactness when not in use, increased strength, facility of repair in case of breakage, and adaptability for stowing the parts away in the carriage when not in use. Figs. 1 and 3 represent the shafts and pole respectively. To change the shafts to the pole the whiffletree of the former is removed and two nearest couplings unscrewed, and the pole and its whiffletrees attached, the manner of making these connections being shown in the sectional drawings, Figs. 6 and 7. The two first sections of the shafts are then placed end to end and constitute the central portion of the pole, a side view of which is shown in Fig. 2. The screw coupling for the straight sections is shown in Fig. 4, and Fig. 5 shows the first joint of the shafts. All the details of construction will be readily understood from the engravings, in which like letters represent like parts.

This invention has been patented by Mr. Walter H. Marrett, of Brunswick, Maine.

Asphalt Pavement in St. Louis.

Pine Street, St. Louis, is being newly paved with asphaltum. The contract under which the work is being done, after providing for a foundation of cement, mortar, and concrete, provides that the pavement shall be completed as follows:

Upon the concrete foundation thus prepared shall be laid the wearing surface or pavement, the basis of which or paving cement must be pure Trinidad asphaltum unmixed with any of the products of coal tar. The wearing surface shall be composed of: 1. Refined Trinidad asphaltum. 2. Heavy petroleum oil. 3. Fine sand, containing not more than 1 per cent of hydrosilicate of alumina. 4. Fine powder of carbonate of lime.

The Trinidad asphaltum (so called), whether crude or refined, as found in this market, contains from 20 to 35 per cent of impurities, and is especially refined and brought to a uniform standard of purity and gravity.

The heavy petroleum oil, which may be the residuum by distillation of the petroleum oils as found in the market, generally contains water, light oils, coke, and a gummy substance soluble in water. The petroleum oil is freed from all impurities and brought to a specific gravity of from 18° to 22° Baume, and a fire test of 250° F.

By melting and mixing these two hydrocarbons, petroleum oil and asphaltum, the matrix of the pavement, called asphaltic cement, is manufactured, which cement has a fire test of 250° F., and a temperature of 60° F. has a specific gravity of 1·19.

They are mixed in the following proportions by weight: Pure asphalt, 100 parts; heavy petroleum oil, 15 to 20 parts.

The asphaltic cement being made in the manner above described, the pavement mixture is formed of the following materials, and in proportions stated: Asphaltic cement, from 12 to 15; sand, from 83 to 80; pulverized carbonate of lime, from 5 to 15.

In order to make the pavement homogeneous, the proportion of asphaltic cement must be varied according to the quality and character of the sand. The sand and asphaltic cement are heated separately to about 300° F. The pulverized carbonate of lime, while cold, is mixed with the hot sand in the required proportions, and is then mixed with the asphaltic cement at the required temperature and in the proper proportion, in a suitable apparatus, which will effect a perfect mixture.

The pavement mixture, prepared in the manner thus indicated, shall be laid on the foundation in two coats. The first coat, called cushion coat, shall contain from 2 to 4 per cent more asphaltic cement than given above; it shall be laid to such depth as will give a thickness of half an inch after being consolidated by a roller. The second coat, called surface coat, prepared as above specified, shall be laid on the cushion coat; it shall be brought to the ground in carts, at a temperature of about 250° F., and if the temperature of the air is less than 50°, iron carts with heating apparatus shall be used in order to maintain the proper temperature of the mixture. It shall then be carefully spread, by means of hot iron rakes, in such a manner as to give a uniform and regular grade, and to such depth that, after having having received its ultimate compression, it shall have a thickness of two inches. The surface shall then be compressed by hand rollers; after which a small amount of hydraulic cement shall be swept over it, and it shall then be thoroughly compressed by a steam roller, weighing not less than 250 pounds to the inch run, the rolling being continued for not less than five hours for every 1,000 yards of surface.

The powdered carbonate of lime shall be of such degree of fineness that 5 to 15 per cent by weight of the entire mixture for the pavement shall be an impalpable powder of limestone, and the whole of it shall pass a No. 26 screen. The sand shall be of such size that none of it shall pass a No. 80 screen, and the whole of it shall pass a No. 10 screen. In order to make the gutters, which are consolidated but little by traffic, entirely impervious to water, a width of twelve inches next the curb shall be coated with hot pure asphalt and smoothed with hot smoothing irons, in order to saturate the pavement to a certain depth with an excess of asphalt.

The St. Gothard.

The approaches to the St. Gothard Tunnel are really more wonderful than the great tunnel itself. To get up to the level of the tunnel the railway track makes many spirals, winding, in some instances, three times around a single mountain, on three terraces one above the other, through twisting tunnels. The curves are, however, so gradual as to be hardly noticeable unless one carries a compass. Then is seen the curious fact that the needle makes complete circuits, and is constantly shifting its position.

The Electric Railway at Brighton.

On the 4th of August there was opened at Brighton an electric railway about a quarter of a mile in length, running along the beach, from the entrance to the Aquarium to the Chain Pier. It was constructed very hurriedly, and only ordinary apparatus and materials used. The whole of the line, car, etc., excepting the engine, dynamo, and motor, were erected in about eighteen days; this included moving and fixing the engine and dynamo and adapting the dynamo used as a motor.

The generator consists of a Siemens D_5 dynamo, electromotive force, 55 volts; current, 18 ampères; revolutions per minute, 1,700; the gas engine is Crossley's two horse power, having two flywheels running at 160 revolutions per minute; the dynamo used as a motor was made by Mr. Volk, the corporation electrical engineer; it weighs about 2¾ cwt., and runs about 700 revolutions per minute, and is connected by means of a belt to a countershaft and thence to a pulley fixed to one axle; the pulley on the motor is 5 inches in diameter, connected to a 10 inch pulley on the countershaft, thence from a 6 inch on the countershaft to a 12 inch pulley on the axle. The speed of the car up an incline of 1 in 100 is about 5 miles per hour, the return down the incline ten miles per hour. The car carried twelve passengers, exclusive of the driver, but has carried sixteen adults, and is illuminated at night by 20-candle Swan lamp.

The motor stands on one of the footboards covered by a box. The reversing is effected by a commutator switch which inserts several resistances before breaking the circuit, so that but little sparking takes place; the same handle that actuates the switch also alters the lead of the brushes, one pair only being used; the wear of these has been so slight that they were only shifted after three weeks' nearly continuous running. The track is about a quarter of a mile long, resting on the shingle; ordinary flange rails and longitudinal sleepers are used; the rails are connected by No. 8 copper wire loops bolted on with three-eighths inch bolts. The gauge is 24 inches.

The rails only are used as conductors, and the wet weather has not interfered with the working in the least; the loss even during rain does not exceed 10 per cent; and in dry weather it is less than 5 per cent. It may be interesting to compare this installation with the Chicago exhibit:

Engine 2 H. P. nominal, about 3½ indicated.

Current	18 amperes.
Electromotive force	55 volts.
Weight, motor	2¾ cwt.
" car	7 cwt.
Load, twelve persons	1 ton.
Gradient	1 in 100.
Speed, mean	7 miles per hour.
Daily journey	25 to 30 miles.
" average passengers	350.

Application is now being made to extend the system the whole front of Brighton under the Esplanade wall, a distance of two miles, and to run cars in both directions every ten minutes, and also to have an electric hoist to convey passengers up the face of the eastern wall, a height of 62 feet.

The expenditure to convey twelve passengers sixty journeys, of half a mile each, *i. e.*, twelve passengers 30 miles, or one passenger 360 miles, is as follows:

	s.	*d.*
Gas, ten hours at 3d	2	6
Oil and waste, total	0	8
Conductor	3	4
Laborer to clean and attend to engine, repair shingle track, etc	4	2
Depreciation, 15 per cent on 500*l.*, say	5	0
	15	8

or a trifle over ½ *d.* per mile; as the car is only running five minutes and standing five minutes, the carrying capacity can be multiplied by two, the only increased expense being 50 per cent extra gas, the cost in wages remaining the same, so that the cost is only a trifle over ¼ *d.* per passenger, supposing the car to run full every journey.—*Engineering.*

M. Pasteur's Instructions to the Members of the French Commission Sent to Study Cholera in Egypt.

"These instructions," M. Pasteur writes to the London *Times*, "all relate to cases in which the disease is supposed to be at a maximum of intensity. Besides, they are based on the supposition, which I consider very probable, if not certain, that cholera does not enter the human system through the organs of respiration, but through the digestive organs alone, except under very exceptional conditions."

1. Not to use any of the drinking water of the locality in which the members may be pursuing their researches without having previously boiled it, and when cold fill a bottle to one-half its capacity, cork well, and shake for some minutes.

The water of the locality may be used, provided it is taken from the spring and is put into what he calls *vases flambés*, that is, exposed for some minutes in air heated to 150° C. (302° Fahr.).

2. Natural mineral waters may be safely used.

3. Wine heated in bottles from 25° to 60° C. (77° to 140° Fahr.), and used from glasses *flambés*, may be taken.

4. Use only food that has been well cooked and fruit which has been washed in boiled water preserved in the vessels in which it has been boiled.

5. Use bread which has been cut into thin slices and then exposed for twenty minutes to a temperature of 150° C.

6. All the vessels (*vases*) employed for alimentary purposes (*aux usages alimentaires*) should be heated to 150° C., or more.

7. Bedclothes and linen used on the person (*linges de toilette*) should be soaked in water above the boiling point (*très bouillante*), and then dried.

8. Water used for the toilet should be previously boiled, and then, when cold, there should be added to it one five-hundredth part of thymic acid, or one-fiftieth part of carbolic acid (*acide phenique*).

9. Wash the hands and face several times a day with water to which thymic acid dissolved in alcohol, or carbolic acid in water, has been added.

10. Only in cases in which it becomes necessary to handle the corpse, the soiled clothing, or the excreta, will it be necessary to cover the mouth and the nostrils with a mask formed of two layers of fine wire cloth. Between these is placed a moderately thick layer of cotton. This mask before use is to be exposed to a temperature of 150° C., and is to be disinfected and purified by exposure to the same temperature every time it becomes necessary to use it.

The *Journal d'Hygiene* remarks upon them in substance as follows:

It seems like a dream to read such details. Why not advise the commissioners to shut themselves up in a heated oven for twenty-four hours? If, indeed, so much time is required for the commissioners to protect themselves, what time can they find for scientific investigations? Truly, an admirable illustration of the difference between the mere experimentalist in dealing with epidemic diseases, and the courageous physician who comprehends their nature in general terms, and proceeds to get clear of them by the use of destructive agents.

Bronze and Speculum Metal.

Copper alloyed with from 1 to about 5 per cent of tin is much harder than before, the color yellow with a cast of red, and the fracture granular. It is still considerably malleable. This seems to be the usual composition of many of the very ancient copper tools and weapons before the common use of iron; whence it appears that the ancients did not (as has often been supposed), possess any peculiar art of hardening pure copper, otherwise than by mixture. It is certain that the quenching of red hot copper in water will not at all make it harder, or have any such effect as it has upon iron. An alloy in which the tin is from one-tenth to one-eighth of the whole is hard, brittle, but still a little malleable, close grained, and yellowish white. When the tin is as much as one-sixteenth of the mass, it is now entirely brittle, and continues so in every higher proportion. The yellowness is not entirely lost until the tin is about seven twenty-thirds of the whole.

Copper, or sometimes copper with a little zinc, alloyed with as much tin as will make from about one-tenth to about one-fifth of the whole, forms an alloy which is the principal, and often the only, composition for bells, brass cannon (so called), bronze statues, and several smaller purposes, and hence it is called bronze, or bell metal (always observing that there is no perfect uniformity in the different alloys under these names, either in the preparation or the actual number of ingredients), and it is excellently suited for these purposes, by its hardness, density, sonorousness, and fusibility, whereby the minute parts of hollow moulds may be readily filled before it fixes in cooling. Bronze cannon are much less liable to rust than those of iron, but in large pieces of ordnance, by very rapid firing, the touch-hole is apt to melt down and spoil the piece; also on account of the sonorousness of bronze, these cannot give a much sharper report than those of iron or steel, which for a time impairs the hearing of those working them.

A common alloy for bell metal is about 80 parts of copper to 20 of tin; or where copper, brass, and tin are used, the copper is from 70 to 80 per cent, including the portion contained in the brass, and the remainder is tin and zinc. The zinc certainly makes it more sonorous. Antimony is also often found in small quantity in bell metal. Some of the finer kinds used for small articles contain also a little silver, which much improves the sound.

When the tin is nearly one-third of the alloy it is then most beautifully white, with a luster almost like that of mercury, extremely hard, very close grained, and perfectly brittle. In this state it takes a most beautiful polish, and is admirably adapted for the reflection of light for all optical purposes. It is then called speculum metal, which, however, for the extreme perfection required in modern astronomical instruments, is better mixed with a very small portion of other metals, particularly arsenic, brass, and silver. But the basis of these compounds is copper alloyed with nearly half its weight of tin. The use of this alloy for the same purpose is of great antiquity, and certainly was in frequent use in the days of Pliny. Klaproth analyzed a portion of an ancient speculum, which he found consisted of 62 parts of copper, 32 of tin, and 8 of lead, which last was probably an adulteration of the tin, and not added designedly.

When more tin is added than amounts to half the weight of the copper, the alloy begins to lose that splendid whiteness for which it is so valuable as a mirror, and becomes more of a blue gray. As the tin increases, the texture becomes rough-grained, and, as it were, rotten, and totally unfit for manufacture. The speculum metal is therefore in the highest proportion of alloy of tin that copper will admit for any useful purpose.

A perfect speculum metal should be quite white without showing any cast of yellow when polished, not very liable to tarnish, quite free from pores even when examined by a lens, of a certain coherence or toughness to bear the grinder, and, for the convenience of working, as soft as may be consistent with the other requisites.

Mr. Mudge, whose specula were celebrated for their goodness, observes, that the extreme of whiteness is given by 32 parts of copper and 16 of tin, but this is excessively hard and brittle; that 32 of copper and 14½ of tin is still quite white and as hard as can be wrought. He also observed by many trials, that the metal to turn out free from pores should be twice fused, that is, the first time for the purpose of mixture (in which the copper is to be first melted separately), and then remelted with as little heat as possible for casting. As there is always some loss by the calcination, chiefly of the tin, a little allowance in the proportion of this latter may be made on account of the double fusion.

An alloy containing 6 of copper, 2 of tin, and 1 of arsenic was nearly the proportion of Sir Isaac Newton's specula, which was very good, but polished somewhat yellow.—*Glassware Reporter.*

The Colored Curtain in the Eye.

BY WILLIAM ACKROYD.

This ring-like curtain in the eye, of gray, green, bluish-green, brown, and other colors, is one among the very many remarkable contrivances of the organic world. The eye cannot bear too much light entering into it, and the colored curtain so regulates its own movements that too much light cannot enter the eye. The dark circular aperture in the center, known as the pupil, is consequently for ever altering in size; on a bright, sunshiny day, out in the open, it may be only the size of a pin's head, but at night, when there is no light stronger than starlight, it is even bigger than a pea.

This colored ring curtain is fixed at its outer edge, and its inner edge expands or contracts so readily and, apparently, so easily, preserving its circular outline all the while, that it is quite provoking to the inventor, who has been trying to invent movable "stops" or "diaphragms" for years, and after all his labor cannot even approach it in perfection, and his despair is complete when he learns that the movements of this eye curtain are automatic and quite independent of the will.

It is unlike the ordinary window blind, which is generally of a rectangular shape, and is drawn up or let down according to the amount of light entering the room. The eye curtain or iris is of ring shape, and possesses a wonderful power of expanding itself so as to diminish the area of the pupil, and of shrinking in, so as to enlarge the area of the pupil. Its movements may be watched in a variety of ways, some of which we shall describe.

The common way of watching the movements of the iris is to regard it closely in a looking glass while the amount of light entering the eyes is varied. Place yourself before a looking-glass and with your face to the window. Probably the iris will be expanded, and there will only be a very small opening or pupil in the center. Now shut one eye suddenly, while narrowly watching the other in the glass all the time. At the moment the light is cut off from one eye, the iris of the other contracts or is drawn up so as to enlarge the pupil. This shows that there is a remarkable interdependence between the curtains of the two eyes, as well as that they are affected by variations in the quantity of light falling on them.

Perhaps one of the most interesting ways of watching the movements of these sympathetic eye curtains is one which may be followed while you are out walking on the street these dark winter nights. A gaslamp seen at a distance is, comparatively speaking, a point of light, with bars of light emanating from it in many directions. These bars, which give the peculiar spoked appearance to a star, are probably formed by optical defects of the lens within the eye, or by the tear fluid on the exterior surface of the eye, or by a combination of all these causes. Be that as it may, the lengths of the spokes of light are limited by the inner margin of the eye curtain; if the curtain be drawn up, then the spokes are long; if the curtain be let down, or, in other words, if the pupil be very small and contracted, then one cannot see any spokes at all. Hence, as I look at a distant gaslight, with its radiating golden spokes, I am looking at something which will give me a sure indication of any movements of the eye curtains. I strike a match and allow its light to fall into the eyes; the spokes of the distant gas-lamp have retreated into the point of flame as if my magic; as I take the burning match away from before my eyes the spokes of the gas-lamp venture forth again.

The experiment may be utilized to see how much light is required to move the window curtains of the eyes. Suppose you are walking toward a couple of gas-lamps, A and B; B about fifty yards behind A. Then, if you steadfastly look at B and at the golden spokes apparently issuing from it, you may make these spokes a test of how soon the light of A will move your ires. As you gradually approach A you come at last to a position where its light is strong enough to make the spokes of B begin to shorten; a little nearer still and they vanish altogether. I have found that about a third of the light which is competent to contract the pupil very markedly will serve to commence its movement.—*Knowledge.*

CATERPILLARS are seriously damaging Louisiana's cotton crop.