

## EXTRAORDINARY INSECT ENLARGEMENTS.

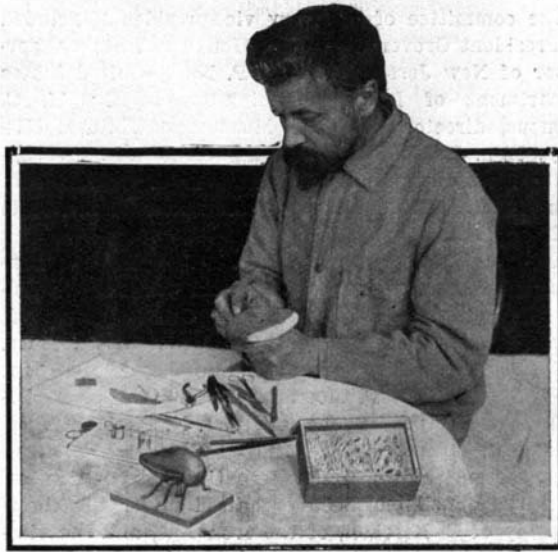
BY WALTER BEASLEY.

Among the noteworthy and curious objects shown during the recent meeting of the American Scientists at the New York Academy of Sciences Exhibition held in the Museum of Natural History, New York, was a remarkable series of enlarged wax models of the little-known and peculiar-form insects called tree-hoppers (Membracidae) of the family of Hemiptera. Nothing on so large a scale and so satisfactory in the way of graphically portraying the unsuspected and hidden wonders so strikingly possessed by these tiny fantastic creatures has hitherto been attempted in entomological work. In fact, they are new and surprising revelations in craftsmanship. The production of these unique creations is due to Mr. Ignaz Matausch, a handicraftsman in the Section of Preparation in the Museum of Natural History, and working under the direction of Dr. B. A. Dahlgren, assistant curator of invertebrate zoölogy. The models were executed at leisure hours away from regular routine duties, and are intended largely as an experiment in an original and difficult class of work, designed principally for college and museum exhibits. In a recent interview with Mr. Matausch, in his home studio, the writer obtained the first series of photographs of his remarkable wax models, together with a general description of his methods and technique.

For some reason scientists seem never to have tabulated in full their observations of these curious creatures. Prof. William Morton Wheeler, curator of invertebrate zoölogy of the American Museum of Natural History, kindly favored the writer with some highly instructive and interesting notes as to their life habits. He says: "The insects known as tree-hoppers (Membracidae) belong to the great group of Rhynchota which have sucking mouth-pieces and an incomplete metamorphosis. They live on the juice of plants which they extract from the stems by means of their sharp beaks. When fully grown, they are provided with wings, but when young are wingless. They are especially interesting on account of the peculiar development of the thorax, which in grown specimens is provided with singular horns or protuberances. These horns are often so peculiarly and extravagantly developed that entomologists have hitherto been unable to account for their development and form. They remind one of some of the highly specialized horns and tusks in fossil reptiles and mammals. It is difficult to conceive of their being used by the animal in any way. It has been suggested that they represent a tendency of the animal in its development, to become monstrous and extravagant (hypertelic). These peculiar developments are not so clearly seen in tree-hoppers of temperate regions as they are in the species from the tropics of South and Central America, where they are often extraordinarily developed."

In the models the extraordinary developments mentioned by Prof. Wheeler are spectacularly evident. Nature has evidently devised and equipped them in one of her most rollicking and fantastic moods, for she has furnished them with topsy-turvy and contortionate bodies. They have four wings and four eyes, two of the latter large, and two partly developed. Many of these insects have humps on their backs; the prothorax is prolonged backward like a roof over the body, often quite covering it. Their two large eyes always have a keen, droll look and the line that separates the head from the prothorax gives them the

appearance of wearing glasses. In some instances, the prothorax is an elevated night-cap, in others it is shaped like a Tam O'Shanter, and sometimes it has horns, one on each side. The mouth points are formed for piercing and sucking, and have the appearance of a beak. This beak consists of four bristles, inclosed in a fleshy jointed sheath. The young nymphs re-



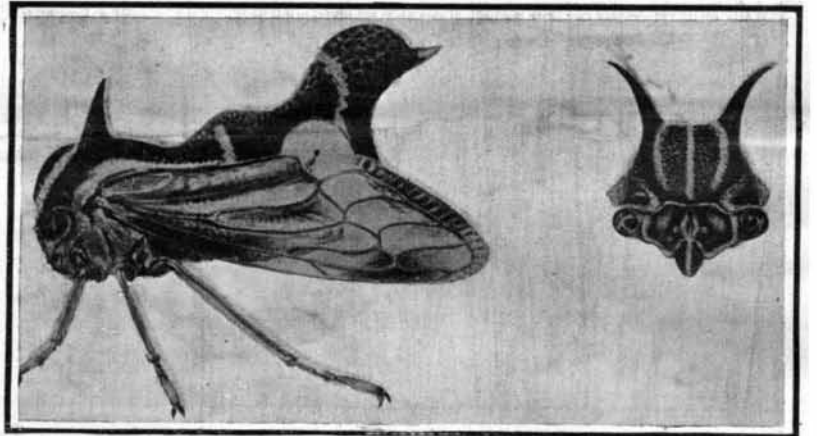
Mr. Matausch at Work.

semble the adults more or less closely in form. They live on plants, bushes, and small trees. They are great leapers—hence their common appropriate name of "tree-hoppers." Some species deposit a sort of honey-dew and their presence is usually followed by ants. They are not usually found in sufficiently large numbers to constitute pests, like others of the same order.

When about to construct a model, the artist selects the particular insect from a small wooden box, where each individual is kept labeled and mounted. They vary in size from that of an ant, more or less, and nearly all require the use of a microscope and pocket lens to work out and clearly define their minute organism. The specimens are all obtained from one special dealer in Germany, having agents in various tropical parts of South and Central America, Mexico, India, and elsewhere. The trapping of these hopping and wiry creatures, whose presence none but the ex-

size of the intended model of the insect. This is followed by removing the wings and legs. Then the body of the insect is divided or split in two parts. Each of these separate dissected parts is measured, drawn to certain dimensions, and afterward worked up in clay to correct proportions, from which models plaster casts are made. These rough casts are next cleaned and assembled, forming only the general outline and crude exterior of the insect. This is followed by an application of the plastic material, a special wax preparation, which is worked up and modeled to the finest detail, so that in measurement and shape it corresponds in every point with the finished sketch. This requires the most patient, skillful, and delicate modeling in order to bring out the hundreds of indentures, cavities and lines which go to make up the marvelous outer livery of these creatures. The final process is that of painting, and in this Mr. Matausch is especially clever in perfectly reproducing nature's color scale in the outer coat of the models. To give greater permanency and also to improve the colors, the painted surface is gone over either with a dull or shiny varnish. The figures are enlarged fifteen diameters, more or less, according to natural size. Of the six here shown five are from different tropical parts and one native from Ohio, the latter in decided contrast, being a species without the peculiar development possessed by the exotics. The accompanying pictures show to clear advantage the grotesque appearance and the peculiarly shaped bodies without further detailed description. Special mention should be made, however, of the extraordinary and fantastically shaped individual from Sikim, India, having an immense, long, curved, tusk-like continuation of the prothorax, extending the full length of the body. Probably the most wonderful and mysteriously shaped of all is the specimen from Mexico, with four large spindle-shaped balls, two having long, pointed projections. For a droll and comic look with imitation spectacles the Brazil specimen is decidedly unique.

An idea of the expenditure of time bestowed upon this class of work may be imagined from the fact that nearly a month of patient and critical labor, requiring superior skill, delicate sculpture, modeling,

Water Color Drawing of *Heteronotus abbreviatus*, from Mexico.

drawing, painting, and plaster casting, was consumed in the production of a finished model.

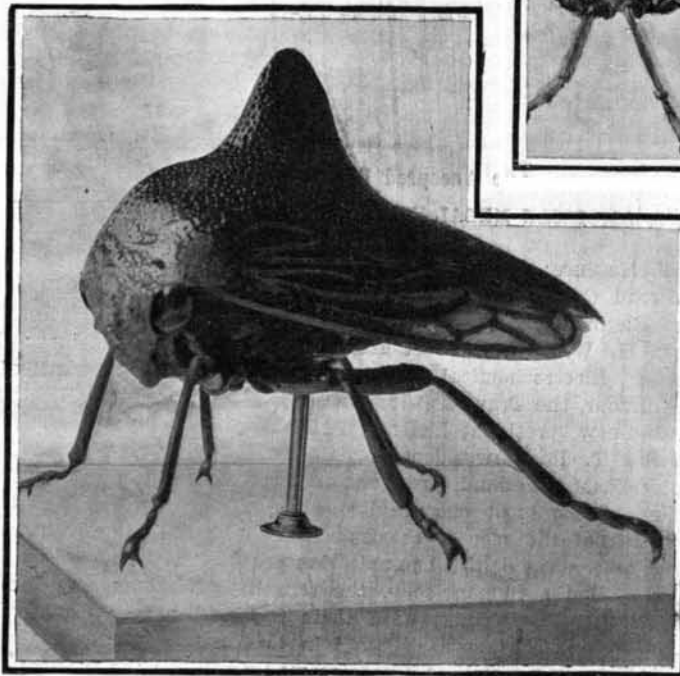
## Terminal Problems in New York.

BY A. S. ATKINSON.

The railroad terminal problems have always been difficult to solve in New York city, and in the past quarter of a century many millions of dollars have been wasted through mistakes and makeshifts. Not a single railroad until recently has adequately measured the traffic over a series of years, and there has been a frantic movement to do an enormous business with inadequate space and accommodations. Every railroad man recognizes the fact that the Pennsylvania tunnel should have entered New York ten years ago, and the Vanderbilts acknowledge their mistake in not enlarging their Grand Central depot and yards years ago, instead of patching it up in the effort to keep pace with the growing traffic.

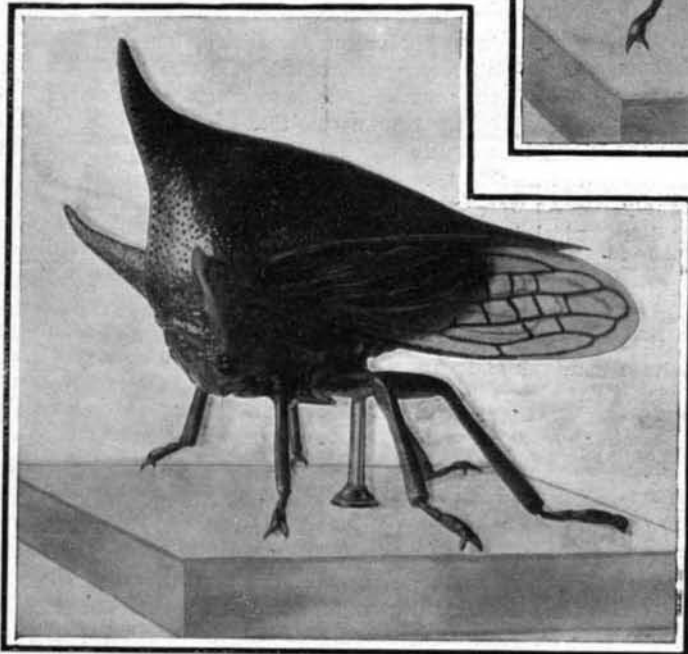
Expenditures within two years by the railroads entering New York city and Jersey City, together with new outlays planned by the same lines, will bring the fresh investments in New York terminals far above \$125,000,000. It is not too much to place this total at \$150,000,000, for already the companies are realizing that their first plans will need modifications, and new extensions will be required. The early estimated prices on the improvements of the terminals of the Pennsylvania, New York Central, Erie, Delaware, Lackawanna & Western, and the Long Island road have all proved too small. It is a question with some practical railroad men whether even the present huge expenditures for terminals will suffice for more than ten or fifteen years at the utmost.

The handling of the New York city traffic has al-



A Hump-Backed Specimen from Ohio.

perienced native collector can detect, is difficult, as many render themselves inconspicuous in order to escape the detection and vigilance of their enemies. They bore into the plants and their bodies frequently take on the color and hue of their surroundings. Mr. Matausch has over a hundred representative specimens at present. A keen interpreter of nature, a skillful modeler, and a perfect colorist, Mr. Matausch is able to transfer deftly and imitate correctly the brilliant and variegated hues of his miniature originals, and so to fashion his magnified portraits that no exaggeration in facial expression, shape, or luminosity mars or distorts their lifelike appearance. The first constructive step is that of making an enlarged scale drawing of the desired



A Three-Horned Type from Peru.

ways been a tremendously heavy expense to the railroads, but in the end it is most profitable. The mistakes have been due to lack of proper provision for the future. The growth of the city has been beyond all expectation, and no one has been able to forecast the future even approximately. The waste on tinkering with inadequate terminals is variously placed at \$30,000,000 to \$40,000,000, or about \$3,000,000 to \$4,000,000 a year in the past ten years. The New York Central has been the heaviest loser in this respect, but all of the roads have had their share in the waste. The present lavish expenditures of the roads have come all within a few years, when they should have been distributed over a long series of years. To make this great investment in improved terminals pay, the roads must increase their earnings something like \$6,000,000 a year. The question of whether this increase can be made is one that worries a few of the railroad officials, but others have perfect confidence in the future traffic.

The latter base their confidence upon facts and figures of traffic which indicate what New York has actually lost through inadequate terminal facilities in the past. The drygoods merchants assert that New York has lost the handling of about \$25,000,000 worth of drygoods within the last two or three years through the delays due to shipping through the city, as the goods have been forwarded by other routes or by water. The trucking bill of New York is estimated annually at \$35,000,000, and much of this should have gone to the railroads in the past through better terminals and economical connections with each other's lines. The transatlantic lines are complaining that the import business has been seriously hampered in recent years by the inadequacy of the railroads to handle it. The steamship companies have gone to great expense to construct piers and docks in New York harbor, but if the roads cannot handle their freight satisfactorily, they will make some other port their terminal. Indeed, Baltimore, Philadelphia, and Boston have already taken a good deal of the transatlantic freight simply on this account. Out of \$776,000,000 worth of merchandise imported last year, only \$40,000,000 passed through without paying toll here, but the shippers have grumbled at the handling, and threaten to divert more traffic to other ports.

At the present moment a visit to the terminal yards of any one of the great railroads entering New York or Jersey City will show a most remarkable sight. Nearly every foot of the switches is occupied with loaded cars waiting to be unloaded. They are delayed in many instances because the piers are so loaded with freight that nothing can be done to relieve the congestion. A recent snowstorm in New York—the heaviest that has visited this section for many a year—served to demoralize the freight far more than the passenger traffic. This latter got in normal operation again within twenty-four hours; but not so the freight. The stalled cars could not move, because the trucking in the city was tied up. The cars standing on the switches could not discharge their cargoes, and others were strung out on miles of switches at nearly every way station thirty miles out. So

the trucking business is responsible often for freight congestion, and this needs improvement and enlarging as well as the railroad terminals. An underground system of freight tunnels would thus tend to relieve the situation mightily, and this would operate independent of storms and other accidents.

The cost of living in New York is high, and against it bitter complaints are often voiced. But the reason for this is not far

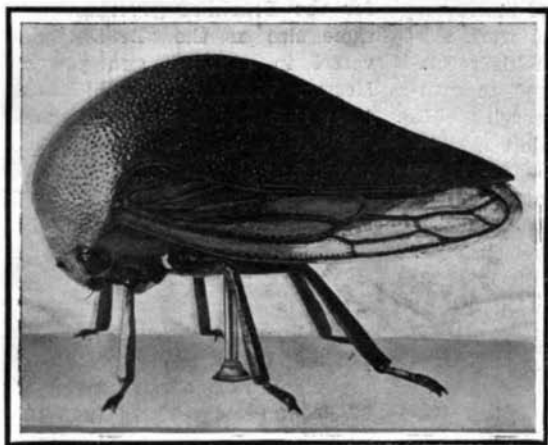
consumers—they pay the freight. With more adequate terminal and dock facilities, all of this long waiting in line could be prevented. There would be ample space for a dozen teams to load up where there is room to-day for only one. The cost of trucking

during snowstorms is frequently doubled in the course of a day. Some estimate the increased cost of foods through trucking during a snowstorm something like \$300,000 a day.

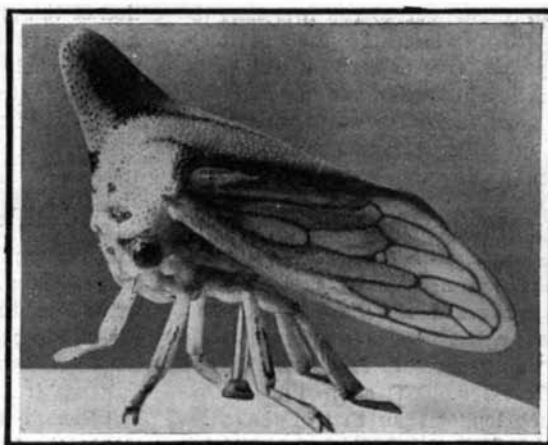
The importance of rectifying all of these evils is apparent not only to the railroads, steamship companies, and the merchants, but to the individual who may have no interest in any large concern. The congested condition of the freight traffic affects his cost of living, and the congested condition of the passenger traffic makes life a burden in riding from his place of business to his home. It affects the price of real estate, and thus produces high rentals. It makes every part of life in the city costly and unpleasant.

The remedy is being partly applied to-day by the railroads, city departments, and officials charged with this important work; but the undoing of the mischief of decades cannot be accomplished within a few short years. It will take the railroads several years to catch up with the traffic. Then, if there is another period of stagnation and inadequate provision for the future, the conditions will steadily grow worse. Not only must the present vast improvements in increasing terminal facilities be completed as shortly as possible, but new plans for the near future must be mapped out continually. In other words, if the city continues to grow at the present rate, an annual investment of millions for the next fifty years will be required simply to enlarge and improve tunnels and railroad terminals. The city will repay this generously in the increased traffic and by a satisfied spirit of its people. Travel must continue to increase instead of diminish unless railroad conditions become intolerable. Then people will elect to stay at home, and the railroads will lose just that much.

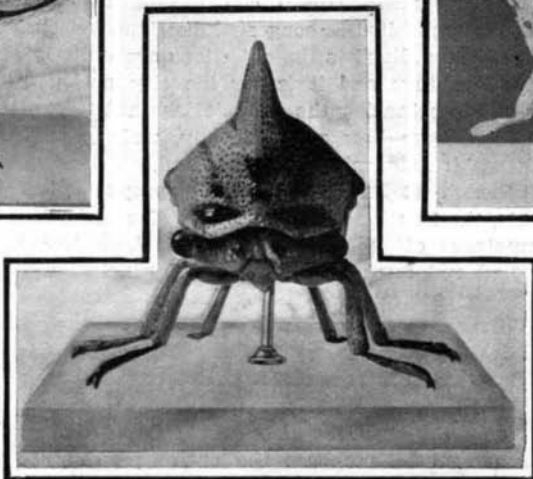
It is difficult to obtain correct figures on the total savings that can be effected in the production of iron by the application of gas power, but from 50 cents to \$1 per ton of pig iron made has been recorded in various European works. In central electric stations, which are located where no energy is available from near-by iron smelting plants or coal mines, the gas producer takes the place of the blast furnace and coke oven as the potential source of energy. Especially is the production of electric power at reasonable rates of importance for very large cities where the price of real estate in the centers of districts is high, and for isolated communities, country houses, and farms which are located outside the commercial radius of metropolitan or other central stations. The distribution of town gas for individual power purposes, while not so much restricted to central location within the city cannot, without loss, be extended over wide territories. Moreover, at the present price of illuminating gas, it cannot compete in the field of power production with the independent suction gas plant even if the latter use anthracite and coke.



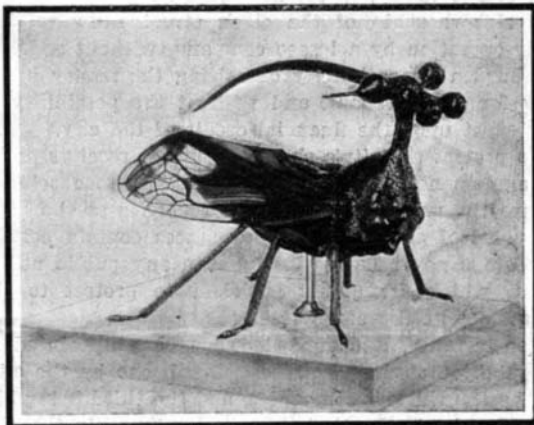
A Type of Tree-Hopper Found in Brazil.



A Peculiar, Brilliant, Yellow Specimen from Brazil.

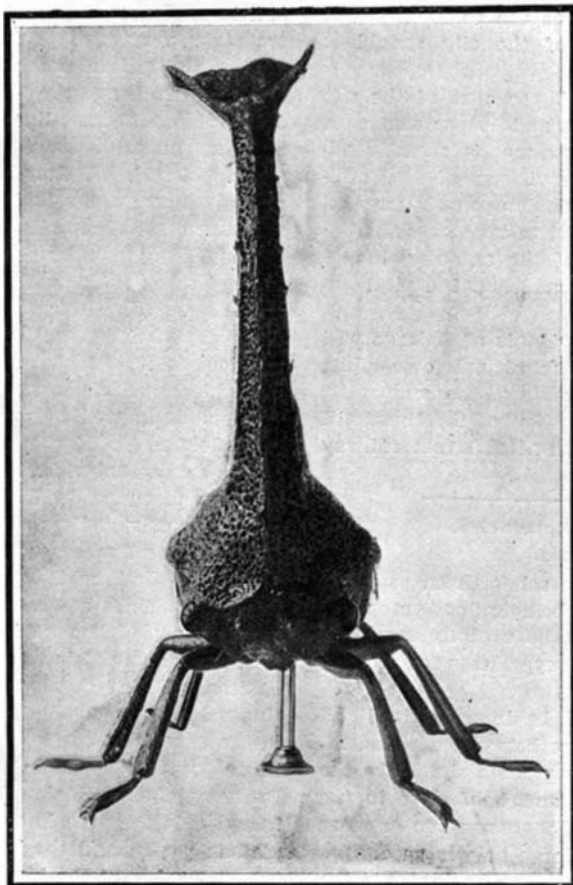


A Full Front View of a Brazilian Specimen, Characterized by Its Odd, Spectacled Appearance.

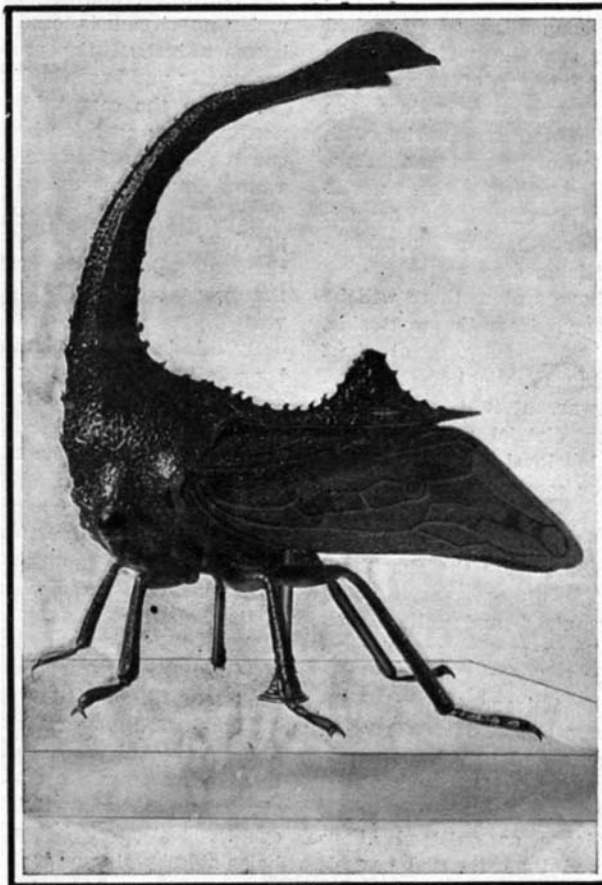


A Curiously Shaped Insect from Mexico.

to seek. The same congestion which makes even a small snowstorm a dreaded visitation causes the soaring of prices for almost every article of food. It costs \$7 a day to maintain a two-horse truck. Such a truck will often stand from four to six hours at a pier or railroad terminal waiting for its turn to cart away freight. Who pays for this waste of time? Certainly not the teamster nor the owner of the goods. The



Front View of an Insect from Sikim, India.



Side View of the Insect from Sikim, India.

EXTRAORDINARY INSECT ENLARGEMENTS.

### How Chicago is Solving Municipal Ownership of Transportation Facilities.

BY A. FREDERICK COLLINS.

Chicago is the second city in the Union, yet for the past decade it has had the most abominable transportation facilities of any city in the United States. This untoward condition is chiefly due to the fact that the principal franchises under which the various street railway companies operate have expired, and the city, heeding the cry of the radicals for municipal ownership, would not renew their corporate privileges. Hence, under these unstable circumstances, the corporations could not see their way clear to rehabilitate their run-down lines.

The problem of serving the population of Chicago has always been an aggravating one, for the transportation system has been necessarily laid out and developed on what is termed the "radiating plan," since the city embraces a territory having on one side a water front. In this respect it is not unlike St. Louis, Boston, and Brooklyn. The shore line of Chicago is, however, much longer than that of the cities just cited, being about 26 miles, while the limits extend inward for a distance of 10 miles. This great area is divided by the confluence of the two branches of the Chicago River into three portions, commonly known as the north, south, and west sides, with the heart of the business district on the extreme northern part of the south side. To this center all the various lines converge. This segregation of the city has resulted in numerous lines operated by a number of companies; so that Chicago, from its transportation viewpoint as well as in some other things, is really to be regarded as three cities instead of one, and as a consequence a passenger often finds that he cannot be carried over the most direct route between the two points within the city limits for a single fare.

The traction question has been a political football for many years; the citizens and the companies here looked askance at each other, and municipal ownership seemed to many to be the only hope; while the more conservative believed there were other and better solutions of the problem.

This, in brief, was the status of affairs when the city council employed Bion J. Arnold, the noted electrical engineer, as the man best suited for impartially investigating the situation and recommending measures for relief. Mr. Arnold was engaged to procure information and to furnish estimates and opinions relating to the cost of operation and the earnings of the companies, their capitalization, their valuation and cost, together with estimates of a new system, and all other details of a scientific and financial nature.

Among the most important recommendations proposed by Mr. Arnold were the "one-city-one-fare" proposal, with all divisional lines as far as possible obliterated; so that a passenger could be carried over the most direct route between two points for a single fare. Of the three plans submitted, the best one, though not the easiest to execute, contemplated the complete unification of ownership and management. The through route principle was strongly advocated, which means that routes through the business district should be substituted for down-town terminals, wherever possible, while outside the business district better results would follow by connecting the detached lines and operating cars over such lines from end to end. The scheme includes a system of subways to accommodate the street-car traffic and relieve the street surface congestion in the business district, with galleries for the accommodation of present and future underground utilities. The plan calls for three north-and-south subways from Fourteenth Street on the south to Indiana Street on the north. These are high-level subways throughout, with no dips.

In combination with the above system there will be three or more low-level subways from the west side, passing under the north-and-south subways at right angles to them, and extending to Michigan Avenue. Should future developments warrant it, these may be extended under the Lake Front district, now known as Grant Park. These latter low-level subways would require the use of elevators or escalators. Under this plan there will be a surface system and eventually a subway system connecting all the depots and the entire system designed to accommodate the short-haul traffic in the business district.

This plan for a new, reorganized, and unified combined surface and street railway system would comprise the lines of the City Railway Company, the Union Traction Company, the Chicago General Railway Company, and the Chicago Consolidated Traction Company within the city limits and new lines necessary to properly connect the disconnected parts of the system.

The total single-track mileage as outlined above would be about 745 miles, and its estimated cost, if constructed new, with everything first-class throughout, but exclusive of the subways, would be \$70,000,000; adding \$20,000,000 for the cost of the subways would make the total cost of the new system complete \$90,000,000. Under the low-level subways will be the

freight subway, while above the street surface will run the elevated lines, making, in all, five lines superimposed at various street intersections. Altogether, it will form the most comprehensive city railway system in the world.

Mr. Arnold's plans further provide for the utilization of the present river tunnels as parts of the future subway system. At the time these plans were submitted, cable power was employed, but on his recommendation the cable systems were changed to overhead electric systems which are now in service. He stated that the electric underground conduit system, such as is installed in New York city, is practicable and feasible from an engineering point of view and that the overhead trolley construction should eventually be prohibited in congested districts, but that outside of these districts the objections are entirely of an æsthetic nature and it is for the city authorities to say—after balancing the financial against the æsthetic considerations—how much, if any, underground conduit construction should be required.

Although at first hostile to the proposed improvements, the traction companies have since admitted the correctness of the conclusions, and these have been adopted and form the basis of the principal physical elements entering into the ordinances recently passed in Chicago. The principles above laid down were ratified by a 33,000 majority of the citizens of Chicago on a referendum vote of the entire city.

The financial provisions of these ordinances are precisely the same as they would be if the city of Chicago should purchase the entire property of the companies, undertake its reconstruction and rehabilitation, and then lease the lines for private operation, upon a division of the net receipts with the lessee company. These ordinances in fact give the people of Chicago to-day, in all the essential principles, municipal ownership of the city's street railways, and their operation by a lessee company, without saddling the burden upon the city of raising the money necessary for the purchase, and without the possibility of any effect upon the financial credit of the city.

To protect the city's share of the net receipts under its agreements with the companies, and to absolutely assure the maintenance of the properties at the highest point of efficiency, the ordinances contain certain provisions never before included in any public utility grant, which are amply sufficient to protect to the fullest extent the city's interest.

For instance, a commission has been appointed in which three engineers are appointed, one by the city, one by the railway companies, and the third being Mr. Arnold, who is the chairman, and represents the city and the companies jointly. This commission has general supervision of all the principal street railway lines in the city of Chicago.

Other provisions of the ordinances are: that the city should have 55 per cent of the net profits of the companies; that there must be daily deposits of the gross receipts to be used for the payment of maintenance and repairs, and a separate special fund of 8 per cent of the gross receipts for renewals and depreciation; and that the companies must supply whatever additional money may be required for these purposes. Any surplus remaining in either of these funds can, under no circumstances, revert to the companies, but becomes instead the property of the city should it eventually purchase the lines.

In turn the companies get 45 per cent of the net profits, 5 per cent for brokerage and 10 per cent as a construction profit upon the new money actually advanced by them under the provisions of the ordinances. The city is given the right, upon six months' previous notice to the companies, to take over the entire properties upon payment of the agreed value of the present property and the additional capital invested.

By this ingenious plan the residents of Chicago will have all the advantages of municipal ownership, secure 55 per cent of the net profits of the companies, and, at the same time, the operation of the lines will be under the management of practical street railway men.

### A Substitute for Spectacles.

BY E. M. DOUGLAS.

The use of a pinhole lens was set forth on page 270 of the SCIENTIFIC AMERICAN for bringing out an optical illusion. The same device can be usefully employed by elderly persons dependent on eyeglasses for reading ordinary print.

The print to be read should be in a bright light, and can be held at any distance between one and fifteen inches from the eye. The pinhole should be the size of an ordinary toilet pin and held close to the eye, the best effects being lost if there are two or more holes side by side or if a very large hole is used.

By fitting a card over the nose so as to cover the eyes, with a pinhole opposite each, both can be used at the same time, but with some difficulty and without apparent benefit.

It would be well for every one to remember this sim-

ple device, so that when temporarily deprived of glasses reading may not be entirely impossible.

### The Three Brazilian "Dreadnoughts."

Contracts have been placed with British naval shipbuilders for the construction of three war-clads for the Brazilian government which though of the same size as the "Dreadnought," will eclipse that vessel in effective gun power. A short time ago Messrs. Vickers, Sons & Maxim received an order from this South American government for the construction of a battleship, but the construction of this vessel has been superseded by one of the three above mentioned. The vessel will be 500 feet in length by 82 feet beam, and will be armed with ten 12-inch guns, several weapons of smaller caliber, together with quick-firers and submerged torpedo tubes. The protective armor is to be of an unusually heavy description. Several new departures in warship design are to be adopted, the most important of which will concern the disposition of the main armament so that the whole of the ten 12-inch guns can be brought to bear on either broadside at one time. In the case of the "Dreadnought" only eight of the ten guns of this caliber can be fired on either side. In the Brazilian warships the heavy guns are to be placed at different levels. They will be mounted in pairs in strongly armored turrets, those fore and aft being at a lower level than those mounted on the center line. The distribution of the gun power, however, is such that absolute balancing will be insured, the guns discharged from the starboard side over the port quarter counteracting the effect produced on the vessel due to the guns rebounding on the port side after firing. This arrangement necessarily entails several modifications of design in order to obtain the requisite stability, while the structural work will be of great strength. The departure, however, marks an important step in the general war-clad design and will contribute materially to the destructive powers of the ship, the broadside firing efficiency being increased thereby by no less than 25 per cent.

### The Closure of the Colorado River.

The United States Weather Bureau has sent to Yuma, Ariz., Frank H. Bigelow, a meteorologist connected with the Weather Bureau, and C. E. Grunsky, of the Reclamation Service, for the purpose of conducting a series of elaborate tests in the Salton Sea. With the final closure of the Colorado River, the great Salton Sink, which was inundated as the result of a poorly-constructed headgate of an irrigation canal, and rapidly converted into an inland sea, will gradually dry up. Inasmuch as there are practically no outlets for this vast body of water, the Sink must naturally evaporate to dryness. It is for the purpose of ascertaining the rate of this evaporation that the government officials have been sent to Yuma. Such tests will be valuable because they will give definite evaporation data, which will be of considerable value in the Reclamation Service. According to one opinion, the Salton Sea will dry up in about eight years.

### The Current Supplement.

The current SUPPLEMENT, No. 1638, opens with an article on domestic pottery and its manufacture, illustrated by very good photographs. William Maver describes the silicon detector and the measurement of electric wave energy. There seems to be a general impression that sand-lime brick is a new and untried building material scarcely out of the experimental stage. Mr. E. W. Smythe removes that impression, and gives many a valuable bit of information on the structural use of sand-lime brick. The Boyd automatic tide signaling apparatus, which is used at the entrance to the harbor of the Scotch port of Irvine, is described and illustrated. After a ten years' test of cement cylinder piers at San Francisco by the State Harbor Commission, it is accepted that that form of dock construction has come to stay, and that in all probability no stone docks would ever be built on the Pacific ports. Prof. Johann Koenigsberger writes on the temperature of the earth's interior. Some properties of vanadium steel are discussed by E. F. Lake. He tells how small quantities of vanadium affect different mixtures of iron and steel, and when vanadium is most useful. Prof. Alexander Graham Bell writes on aerial locomotion, with a few notes of progress in the construction of an aerodrome. "Schools of Airship Instruction in Germany and France" is the title of an article which will be read with interest by aeronauts. Joel A. Allen concludes his paper on the influence of physical conditions in the genesis of species. Another biological article of value is that entitled "Parasitism and Mutualism." In the opinion of Harlan I. Smith the territory roughly included in the area known as the "Great Plains," the plateau region and the barren lands which form such a vast portion of the North American continent, offers an extensive field for co-operative archeological research, since its prehistoric ethnology is practically unknown. He discusses the chances of this region in an interesting article.