The guard rail used on the curves is formed of an old tram rail formerly used by the company. The mode of using it is shown in the sectional view, Fig. 3. The results following the construction briefly outlined here have been highly satisfactory to the company. The engineers state that not a solitary joint in the forty-five miles of track laid last year has given them a particle of trouble. They stand up to their work in admirable fashion, as one may ascertain by riding over the line.

The street railway system, of Milwaukee, as already stated, will eventually be controlled and operated by Milwaukee Street Railway Co. While they have secured by contract both the Becker and the Hinsey lines they have not yet passed into the company's possession. When they assume control, power will be furnished from the station on River Street. The other power stations now operated will then in all probability be abandoned.

In the power station will be located the electric generating apparatus owned by the syndicate which controls the electric lighting, both arc and incandescent, and the street railways operated by the Milwaukee Street Railway Co. At the present time the incandescent dynamos, which are Edison multipolar machines, are located on the second floor. A temporary plant furnishes current for the street railway system, but work is now in progress for erecting three 200 K. W., Edison multipolar generators which will constitute the first installment of apparatus. The Milwaukee Street Railway Co. operate at the present time about forty Edison double reduction motors which have proved highly efficient in service. Since October last when they were first put in operation not an armature or field has been burned out.

The Trolley for Detroit.

The Detroit Citizens' Street Railway Co., have finally made positive arrangements for the introduction of the trolley system into Detroit, and have closed a contract for electrical apparatus with the Detroit Electrical Works. The portion of the line selected for operation by electric power is that on Jefferson Avenue as far as Baldwin Avenue, and it is stated that the line will certainly be in operation by August 1. The contract includes the entire power plant, station, overhead lines and motor equipments.

The power station steam plant will consist of three horizontal, return, tubular boilers, sixty-six inches in diameter, sixteen feet long, each to have sixty four inch flues, and three 14-24 × 14 Westinghouse automatic, compound engines, with all necessary apparatus, such as feed water heater, pump, injectors, piping, smoke stack, etc.

The power station electric plant will consist of three 100 K. W. multipolar railway generators of the Detroit Electrical Works' latest type, as well as slate switchboards of the latest and most improved design, with all instruments and attachments necessary to make a complete electric plant.

The overhead construction will consist of two No. 0 B. & S. hard drawn copper trolley wires, with necessary feeders and guard wires, supported on Milliken iron poles. The standard pole of this firm will be used for that portion of Jefferson Avenue which is seventy feet from curb to curb, and the Milliken extra heavy pole where Jefferson Avenue is eighty feet from curb to curb.

The motor equipment will consist of twelve forty H. P. motor equipments of the Detroit Electrical Works standard type.

Power Plant of the Columbus, O., Consolidated Street Railway Co.

About one year ago the Columbus Consolidated Street Railway Co. of Columbus, O., decided on changing from horse to electric power. Their station, which is described herewith, is especially interesting because at present it contains both high and low speed engines, and the relative advantages of the two, as installed, can be easily compared.

The power house is a substantial brick structure 120 × 126 ft. The engine room is 66 × 120 ft., and the boiler room 55 × 120 ft. The brick chimney is eight feet inside diameter and 170 ft. high, on foundations twenty-eight feet deep. The stack proper contains 1,000,000 bricks. For the first thirty feet the stack is built square; above this it is circular and is circular inside its entire height.

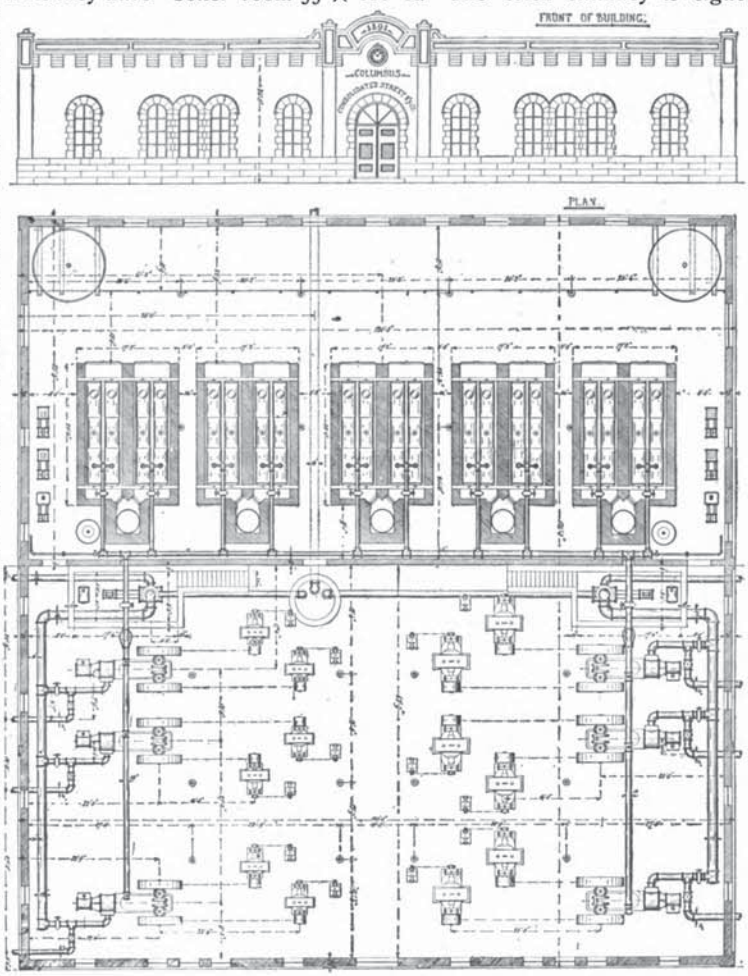

FIG. 1.—ORIGINAL PLANS FOR COLUMBUS, O., CONSOLIDATED STREET RAILWAY POWER STATION.

The plant is compound, condensing, the water being taken from the river 120 ft. distant, through a tunnel opening into a covered well located under the coal bin. From this point the condensing water is taken through pipes to the condenser, located in a sunken pit in the engine room.

The railroad track runs in front of the boiler room, discharging coal from the cars into the coal bins immediately in front of the boilers. The latter are six in number, were furnished by the Babcock & Wilcox Co. of New York, and have an aggregate capacity of 1,076 H. P. The condenser and feed pump are of the Blake company's manufacture. The heater was supplied by Stilwell & Bierce, and the Robinson separators are used throughout.

The high speed portion of the engine equipment consists of three McIntosh & Seymour compound, condensing engines, special railway type, rated at 250 H. P. each, and having cylinders 13 and 23 × 17 ins. (see Fig. 2) each belted to three generators. This arrangement, it is claimed, gives great compactness combined with flexibility, i. e., each boiler unit is proportioned to the engine unit, and each engine runs its own generators, each engine being entirely independent of the others. Fig. 1, on the preceeding page, shows a plan and front view of the station, as originally designed, to use high speed engines throughout. The high speed engines, together with the rest of the steam plant already described, were furnished by Pierce & Thomas of New York, who also furnished the plans and did the original engineering and construction work of the plant entire, turning the same over to the railway company in complete running order. The original plan, as shown in Fig. 1, was that each engine should drive two M. P., eighty K. W. Thomson-Houston generators, but as the traffic of the road increased more power was found necessary, and a third generator was added to each engine, making the load 330 H. P. on each, which has been carried without the slightest trouble or derangement for some eight months.

The piping throughout is made with flanged connections, fitted with valves and all joints necessary to make the plant flexible, and any boiler or any engine can be thrown in or out of commission at will. The exhaust pipes from each engine are fitted with shut-off valves at their junction with the main exhaust pipes running to the condenser. In addition to this, each engine is provided with an exhaust opened to the atmosphere, controlled by a Wheeler automatic, atmospheric valve, enabling the engineer to work any engine in the battery condensing or non-condensing at will. All live steam cylinder jackets and receivers are drained by a Blake pump and receiver working automatically.

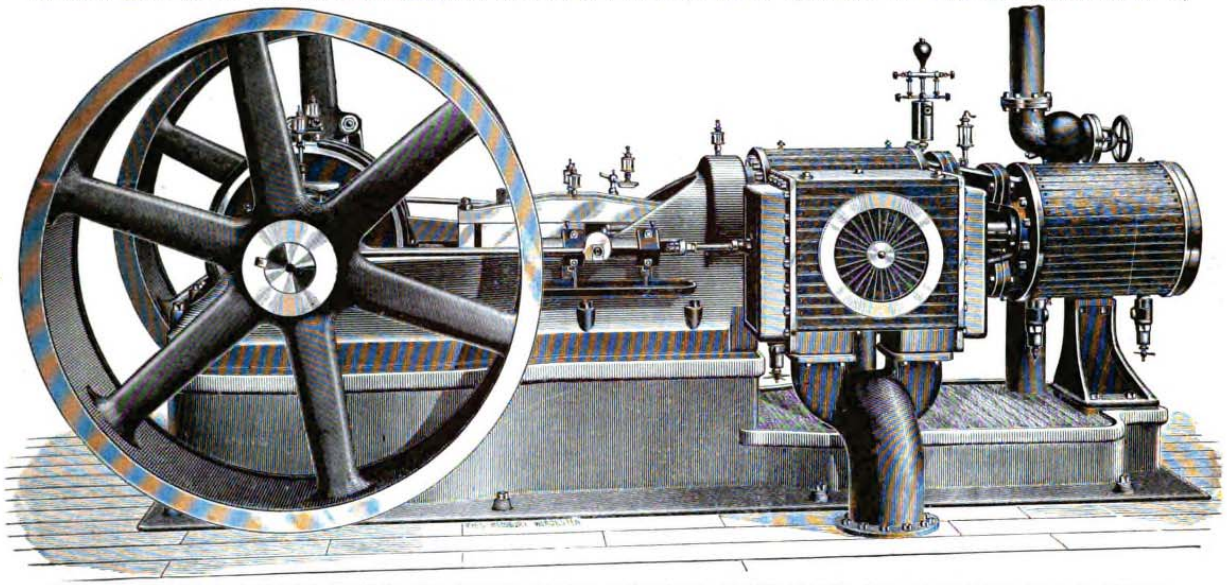

FIG. 2.—M'INTOSH & SEYMOUR TANDEM COMPOUND ENGINE—COLUMBUS CONSOLIDATED STREET RAILWAY POWER STATION.

Recently the trackage of this company has been increased, requiring more power, and the company decided to try slow speed engines. The new power equipment consists of two 800 H. P. engines (Fig. 3) built by the Buckeye Engine Co. of Salem, O. The high pressure cylinders are twenty inches diameter, low pressure cylinders thirty-six inches diameter by thirty-six inch stroke, and the speed is 120 revolutions per minute. The flywheels of the engines are fourteen feet diameter by twenty-one inch face, turned crowning for a twenty inch belt, as it is intended in the future to utilize the wheels for driving additional generators. One engine is directly connected by jaw clutch couplings to each end of an intermediate shaft, so either or both engines can operate the entire length of shaft at will. The general arrangement is clearly shown in Figs. 4 and 5.

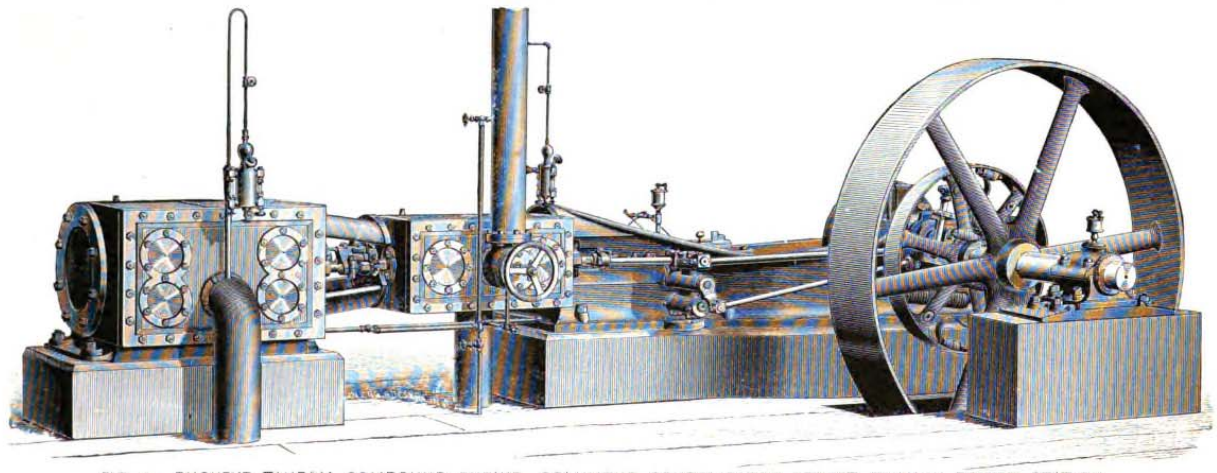

FIG. 3.—BUCKEYE TANDEM COMPOUND ENGINE—COLUMBUS CONSOLIDATED STREET RAILWAY POWER STATION.

The friction clutch pulleys, which are the largest pulleys of the type yet made, are twelve feet diameter by thirty-eight inches face, and are made of wood with a steel rim on the outside. These are designed to drive generators of 500 H. P. each, and have been tested and found capable of carrying a much greater load. The shaft is in one piece, is thirty-six feet long and nine and a half inches in diameter. The friction clutch pulleys and couplings are all operated by worm geared shifters. The clutch pulleys and shaft were furnished by the Falls Rivet & Machine Co. of Cuyahoga Falls, O. This arrangement of one engine at one end and another engine at the other end with a clutch from each engine, permits of either engine driving any generator, or when necessity requires, the second engine can be connected to service without reducing the speed of the working engine in order to do so. The building being built before contract was placed prevented the addition of a friction cut-off coupling in the centre of shaft, so that one-half of the plant, including shafting and two pulleys as well as one engine, could stand idle if desired.

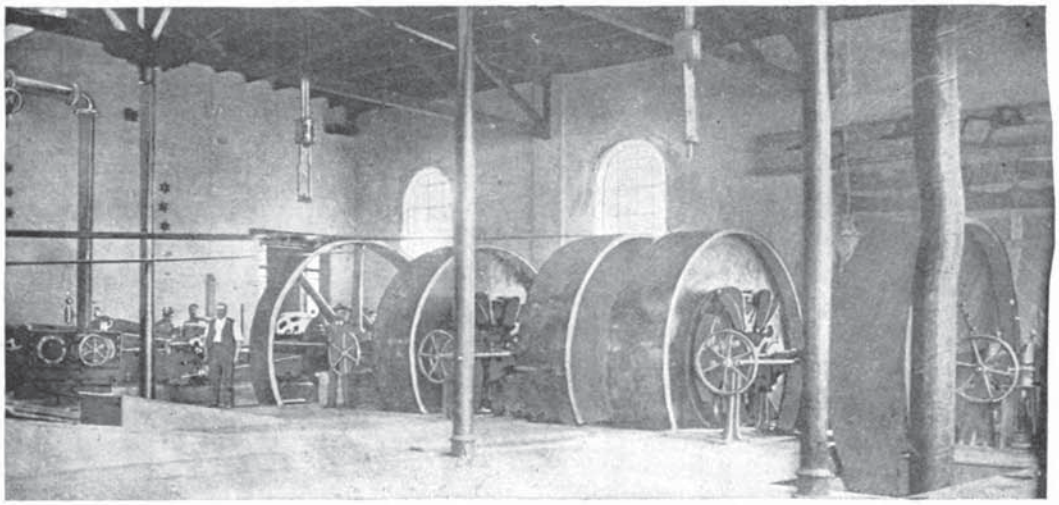

FIG. 4.—DRIVING SHAFT AND CLUTCH PULLEYS INSTALLED BY FALLS RIVET & MACHINE CO.—COLUMBUS POWER STATION.

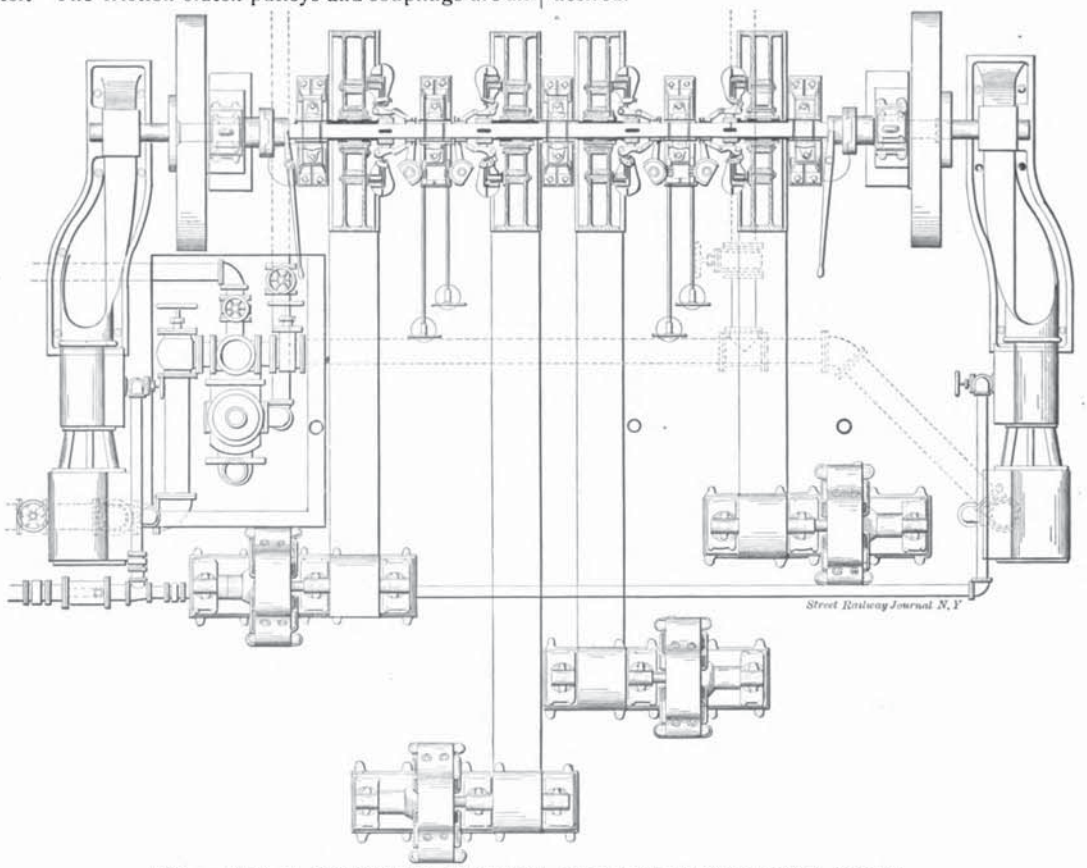

FIG. 5.—PLAN OF SLOW SPEED EQUIPMENT—COLUMBUS RAILWAY POWER STATION.

The engines are supplied with a Conover condenser. The four generators driven by the slow speed engines are also of the Thomson-Houston M. P. type and of 350 to 500 H. P. capacity each. Schieren belts are used throughout.

Compactness is a special feature claimed for the new portion of the plant, as the available space was the width of the building, sixty-five feet by fifty-five feet in length. At the same time there is ample room for passage ways around the engine and shafting and between the generators. The belts offer no obstruction, as the upper side of the belt is eight or ten feet above the floor, and the lower side, after passing through the floor, is neatly boxed, and except within a few feet of the generators the boxing is not so high above the floor as to prevent stepping over it.

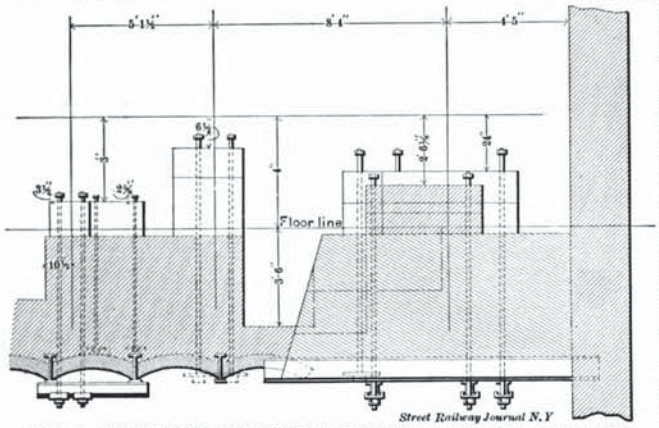

FIG. 6.—TRANSVERSE SECTION OF ENGINE FOUNDATION—COLUMBUS RAILWAY POWER STATION.

By this system either or both engines are available for driving a combination of any or all of the generators at one time, easily and conveniently meeting all the conditions of variable power occurring at different hours during the day.

Figs. 6 and 7 show the method employed in constructing the engine foundations. The building is located on made ground, the floor line being some twenty-two feet above the subsoil. It was the original intention to build up foundations for any engines which might be added, and sub-foundations for this purpose had been built of rubble work fourteen feet in height. It was decided, however, by the engineers in charge of the last installation that the walls of the building were of ample thickness and strength to carry a large percentage of the load of the foundations and machinery, so that it was determined to construct the foundation for the new plant on I beams with brick arches, supported partly by the walls and partly by the sub-foundations already in place.

The walls of the building were cut out for a depth of twelve inches on both sides and at the end, and the I beams at the building end were supported on steel plates twelve inches wide by eighteen inches long by one and one-eighth inches thick, the beams at the rubble work end being supported on plates of the same thickness, 18 × 24 ins., all substantially bedded in cement. The mason work is of select paving brick, all laid in German Portland cement with stone coping under the engines and pedestals supporting the shafting. The result is entirely satisfactory, as there is no vibration to foundations or building when the engines are in operation. Fig. 7 shows a side section of the engine foundation, and Fig. 6 an end section section of same with foundation of one shaft pedestal.

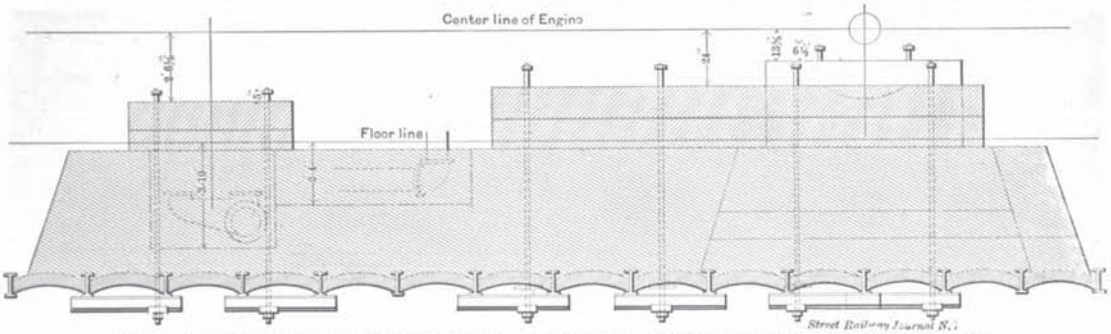

FIG. 7.—LONGITUDINAL SECTION OF ENGINE FOUNDATION—COLUMBUS RAILWAY POWER STATION.

The Botanical Garden Street Railway of Rio de Janeiro.

The Companhia Ferro Carril de Jardim Botanico has an exclusive franchise for one large section of the city of Rio de Janeiro, and it enjoys the distinction of being the best managed of any of the Rio street car companies.

In his last annual report the president of the company states: "The most notable event in the history of the company during the past year (1890) has been the extension of our franchise, granted by the City Council and approved by the minister of the interior in the name of the federal government in legal form, the papers bearing date of August 28, 1890. By this contract the Jardim Botanico Street Railway Co. secure an extension of franchise for forty years, dating from August 30, 1890. In return the Jardim Botanico Street Railway Co. agree: to pay at once, in cash, the sum of 1,500 contos of reis ($345,000); to pay an annual tax of 150 contos of reis ($34,500); at the end of this extension the entire property of the company shall revert to the municipality of Rio de Janeiro. Beyond these terms, the company agree to excavate a tunnel through Mount Copacabana, to construct some new and important lines, and to reduce the fares on some lines." The zone system of fares is in use.

The distribution of passengers as shown by the annual report was as follows: Number paying 100 reis (2.3 cents), 7,526,237; number paying 200 reis (4.6 cents), 4,991,749; number paying 250 reis (5.75 cents), 31,120; number paying 300 reis (6.9 cents), 208,130. The total receipts for the year were $444,524, and the total operating expenses, $206,103; number of cars, 107; number of mules, 1,399.

The cost of feed per animal per day was 12.31 cents, and the cost of taking care of each animal per day 5.21 cents.

A WRITER in a New York paper speaks of the curious conclusions sometimes drawn by foreigners. He mentions this incident: "I have in my possession a letter from a Chinaman, who asks me in all seriousness if the 'advertising cars run by electric power on the streets of St. Louis, really do profit by the rabble who jump on them from time to time and ride a greater or lesser distance. My Chinese friend had seen the advertising wagons on the street, and had seen men carrying advertising placards day after day, and he naturally concluded the street cars, which are pasted over with advertisements inside and out, belonged to the same category. He thought people got into these cars to read the advertisements, and when he was asked for his fare he wrote me to know if it was a 'square deal.'"