the Census Bureau had been stopped, at least until the next session at Congress. Great indignation was manifested by the delegates at hearing this, and it was decided that a committee of not less than three, five if possible, be formed to go to Washington to see into the matter and to have a bill presented at the next session of Congress, asking for the appropriation to continue the work. It would be a shame indeed if the great increase in electrical industries within the last ten years should go unrecorded.

The report of the committee on Safe-wiring was then taken up, the rules being read separately so that any errors might be detected. Most of them passed, but there was some opposition on inside-wiring.

Mr. C. J. Field's paper on "Electric Railroad Construction and Operation" was then read. This paper was of great value to those interested in Electric Railway work, not perhaps from a popular point of view, as was Mr. Griffin's, but as a technical guide to operating and fitting up a railway. An interesting introduction, however, gave a brief historic sketch of the electric railway. He spoke of the steam plant, with advice as to the size of the engine to be employed, and the best method of connecting the dynamo to it. He condemned the use of the counter-shaft, and held that generators should be belted direct to the engine. Two interesting diagrams were given illustrating the rapid changes in load. He stated that the best engine to be used would be between a high-speed engine and a Corliss, which will combine many of the advantages of both. Two photoprints were given which illustrated an electric car of the Buffalo Railway Co., and the interior of the power station. Then followed some valuable statistics on the relative commercial economy of engines and costs, and the capacity of engine requisites for different generators. Then followed a description of the electric plant. He urged the use of large and efficient generators so as to prevent the over-loading, as is often the case with small machines. He stated that a fair basis on general conditions for 16 to 18 foot cars is 20 to 25 horse-power per car, and the cost for generating this power for 16 and 18 foot cars is three to five cents per car mile. He says that experience shows that a 32 or 33 foot car requires 50% more power, while a trail car attached to the motor car, adds 50% to the amount of work.

Then followed an account of electric cars and their equipment. He stated that the limit of length for a car run on a single track is 20 feet. He objects to the use of a vestibule on street cars as it prevents the free exit of the people. The cost of a single car including the car body truck and motors is from 3,000 to 3,500 dollars, and the cost of generating plant from 35 to 45 dollars per h. p. Valuable statistics were given of line construction, and a table of the cost of electric equipment for street-railway systems. The general construction of road-beds are girder-rails of from 60 to 100 lbs. per yard. Then followed an illustrative example showing how and with what profit an electric road may be operated. A description was then given of central stations in connection with Electric Railway work. The meeting then adjourned.

FIFTH SESSION, Friday, September 11th.

It was found necessary to hold a fifth session in order to transact all the business, and the delegates met to hear Mr. Ayer's valuable paper on "Some Details on the Care and Management of an Arc Lighting System as Practiced in the 'Municipal' of St. Louis." Mr. Ayer gave a paper describing arc lighting in St. Louis which contained much valuable information to those interested in the practical working of a large lighting station. The capacity of the plant was estimated at 6,000 arc lamps, of which 3,500 are operating daily. Two thousand of these lights are distributed over an area of 60 square miles for street lighting, while 1,500 more and a number of constant current motors are supplied to private consumers. The circuits supplying the lamps contain about 1,200 miles of wire. In the station the power consists of six 600 horse-power Corliss engines driving 65 60 light and 12 80-light 2,000 c. p. arc dynamos. In the boiler-room are nineteen 300 h. p. boilers. The trimmers are each supplied with a horse and cart and travel about 500 miles per day to supply carbons to the street lamps. He specified the following testing apparatus: two Thomson indicators for the engines, a recording steam gauge, two standard ammeters and a volt meter reading to 5,000 volts, a Wheatstone's bridge, magneto bells, etc. Tests are made very often to show that the apparatus is in good order. All the circuits are tested four times each day. The stopping and starting of engines, boilers, pumps, dynamos, and circuit are all recorded. The time recorded as lost during the first year's operations, due to open circuit, was 65 minutes. All circuits are more than 10 miles in length. He pointed out the marked loss when there is but a slight increase in current above the normal. Then followed valuable advice as to the testing carefully of the machines. He spoke of one case where the false reading on an ammeter resulted in the increase of the cost of fuel of about $16 per day. He also pointed out the advisability of having the consumer pay for his own wiring in arc lighting. A slight discussion followed on a few special points.

Mr. Warner's paper on "Different Forms of Carbons Used in Arc Lighting" was read, but no discussion followed. Mr. Warner gave an interesting account of the different forms of carbons used in the earlier arc lights. He pointed out that the form of cylinder or pencil carbon was used by Sir Humphrey Davey in his earliest experiments. Archereau, who was the first to produce a practical arc lamp, adopted the pencil form of carbon, while Wright and others used carbon discs brought edge to edge, and made to rotate as consumed. Wallace and Farmer used flat plates of carbon placed in a vertical plane one above the other, the arc forming between the edges as they are drawn apart, and shifting back and forth from one end to the other. Jablochoff used cylindrical pencils in his famous electric candle. He spoke of the double carbon lamp, produced by Mathias Day in 1874, and praised the ingenious way in which it was made. He also showed that Jablochoff, closely followed by Brush and Weston, took the lead in commercial arc lighting using cylindrical carbons. The first carbons produced for commercial use were some 32 inches in length. These were soon found to be too long, so were cut down to 22 inches. He recommends the use of the single carbon arc-lamp, using carbons 14 inches in length and $\frac{5}{8}$ inch in diameter, as a great deal of light is lost in the double-