above the level of adjacent lands, so as to avoid trouble on account of snow.

Bridges.—The bridges across all streams are constructed either with concrete arches or steel girders with stone abutments. The upper structures are of steel of a capacity sufficient to carry a train of cars with a gross weight of one hundred tons for each car. All abutments are built for double track; the superstructures at this time are laid for one track only. Provision is made for the increased demand for size of cars and length of trains likely to come in the near future.

Track.—The road is laid with double track in the city of Rushville, and on all highways; but on the private right-of-way, while the grade is prepared for double track, only one has been laid, as a second track can be more conveniently and economically put down later, when a sufficient portion of the road is in operation to require a double track. All ties are first-class, no culls or seconds, white oak, burr oak, and a few chestnuts, 6-in. by 8-in. by 8-ft. long, 3,280 to the mile. The bridge ties are of long leaf yellow pine. The track is laid with 70-lb. T rail, in 60-ft. lengths, connected with Weber rail joints, and bonded at the joints with No. 0000 10-in. copper bonds, with ⅞-in. terminals under the plate so as not to be exposed. Cross bonds are put in every half mile and long bonds under all special work. The switches are built according to steam railway standards. Turnouts and cross-overs are constructed so as to avoid danger of open switches. The road is to be ballasted with gravel 8 inches under the ties and level with the top of the rail. In the streets of Rushville, an 8-inch layer of broken stone was placed under the ties.

Trolley Construction.—The trolley wire is suspended along the private right-of-way from poles set in the centre of the grade one hundred feet apart, with a bracket made of angle iron looped at the end, so as to carry a large, flat porcelain insulator, from the top of which is run a 7-16-in. steel strand cable or "messenger" wire. The No. 000 grooved copper wire is carried 8-in. under the messenger cable, to which it is attached every 10 feet with specially made steel clamps, a construction known as the catenary suspension. The steel messenger wire is drawn tight. With this construction danger from trolley breaks is reduced to a minimum. The insulators are large and strong and are not likely to break, but, if they should, the steel cable would remain suspended from the top of the bracket. As the trolley is attached to the steel cable every 10 feet, breaks will be very infrequent, and, if one should occur, not more than 10 feet of the trolley would be loose. The catenary construction provides a practically level trolley with no sudden bends at the insulators as is found with the ordinary suspension, a point which is of great advantage to fast running cars. The trolley wire is suspended 18 feet above the top of the rail. Where the tracks are in the streets, the poles are set on the sides of the streets and the trolley is suspended from span wires. Otherwise the construction is the same as along the private right-of-way. The overhead material for the entire line construction was supplied by the Westinghouse Electric and Manufacturing Company.

High Voltage Lines.—The system of electrical distribution requires transformer stations about ten or twelve miles apart, and the alternating current is transmitted from the power-house to these transformer stations at 33,000 volts, single-phase, 25 cycles per second, and is reduced and fed into the trolley at a potential of 3,300 volts. The high tension current is carried from the central power station to the transformer stations on No. 4 bare copper wires, two wires to each transformer station. They make a complete circuit and permit the placing of the circuit-breakers and switches at the central power house, so as to do away with the necessity of attendants at the transformer stations. The high tension lines are carried on a separate line of poles set near the edge of the right-of-way, provided with carefully and strongly constructed cross arms and equipped with large porcelain insulators on iron pins.

Telephone Lines.—The entire system is provided with two metallic circuit (4 copper wires) telephone lines, one of which is used exclusively by the train despatcher. The other line is used for general company business. Each car is provided with a telephone, by means of which the conductor can talk with the train despatcher at fixed points Jack boxes are placed on the poles at intervals of 2,000 ft., from any of which the conductor of a car or any one else with a telephone can call up to report an accident or for any other purpose. The four telephone wires are carried by porcelain insulators on cross-arms near the top of the trolley poles, and are thus far removed from the high tension lines. The wires are transposed every 500 feet in order to avoid disturbances from the current in the transmission lines.

Poles.—The poles are all of select white cedar. Those for the centre trolley construction are 40 feet long with 7-inch top. The side poles for the high tension lines are 35 feet long, with 7-inch top. All are set 6 feet in the ground and are carefully tamped. Along streets on the side where there are no feed wires and the poles are used only to support the span wires, 30-foot poles are used, while on the other side, where the high tension line runs, the poles are of varying height from 40 feet to 60 feet, so as to carry the feed wires above the shade trees. All of the side poles along the streets are neatly shaved and painted and are set in concrete. The tall 60-feet poles are of Idaho cedar, beautiful, smooth and straight as if turned in a lathe. The work is of such excellent character throughout as to attract the attention of even casual observers, and among experienced linemen it is conceded to be superior in its substantial character and artistic appearance to any other line in the country.

Trolley Voltage.—Within the limits of the city of Indianapolis, a distance of approximately three miles, the cars will be run over already existing lines, and will be operated by direct current at 550 volts. Within the limits of the city of Rushville, they will be operated by alternating current at the same potential; on intervening sections the trolley will be fed by alternating current at 3,300 volts, 25 cycles per second, single phase. Thus the first single phase railway exemplifies the possibility of operating the same equipment from both direct and alternating current lines and illustrates the voltage flexibility of the system, one of its most advantageous features. The power station from which it is intended to operate the entire road is at Rushville. From this plant 33,000 volt transmission circuits are run to the points of transformation and there reduced to 3,300 volts before connection to the trolley.

Transformer Stations.—As has been stated, the road is divided into sections of ten and twelve miles, each of which is supplied with current from a transformer station. The transformer houses are very small, measuring but 21 feet by 23 feet, but are carefully and substantially built. The foundations are of concrete; the walls are of brick laid in cement mortar; and the floors for both the first and second stories are of concrete upon steel beams. The roof is built upon concrete base. The doors and windows are provided with steel shutters, and the whole structure is made thoroughly fireproof and can be closed and left alone with safety. In each of the transformer stations there are at present installed two 300-K.W. oil-insulated step-down transformers, 33,000 to 3,300 volts. Space has been provided for an additional transformer of the same capacity. On the second floor of each transformer station there are installed the lightning arresters and disconnecting switches. There are no automatic switches of any type in these stations, as they are controlled only through the switchboard in the power station. There is nothing at the station which requires constant attention and only occasional inspection will be necessary. This does away entirely with the expense usually incident to the sub-station of other systems, which usually amounts to the wages of three men at each sub-station, aggregating not less than $6 per day. The annual saving in wages on the three transformer stations between Indianapolis and Rushville made possible by the alternating current system amounts therefore to $6,570, or a total annual saving of the ten transformer stations between Indianapolis and Cincinnati in wages alone of $21,900. In addition to this, there will be a large amount saved in the maintenance and repair of machinery. The electri-