coal after travelling only four inches out of the six, the pick is not left there to push the machine and miner backward away from the work in such manner that the successive blows cannot do effective work; but the moment it has delivered its blow, and without delay, it is withdrawn for the next stroke.

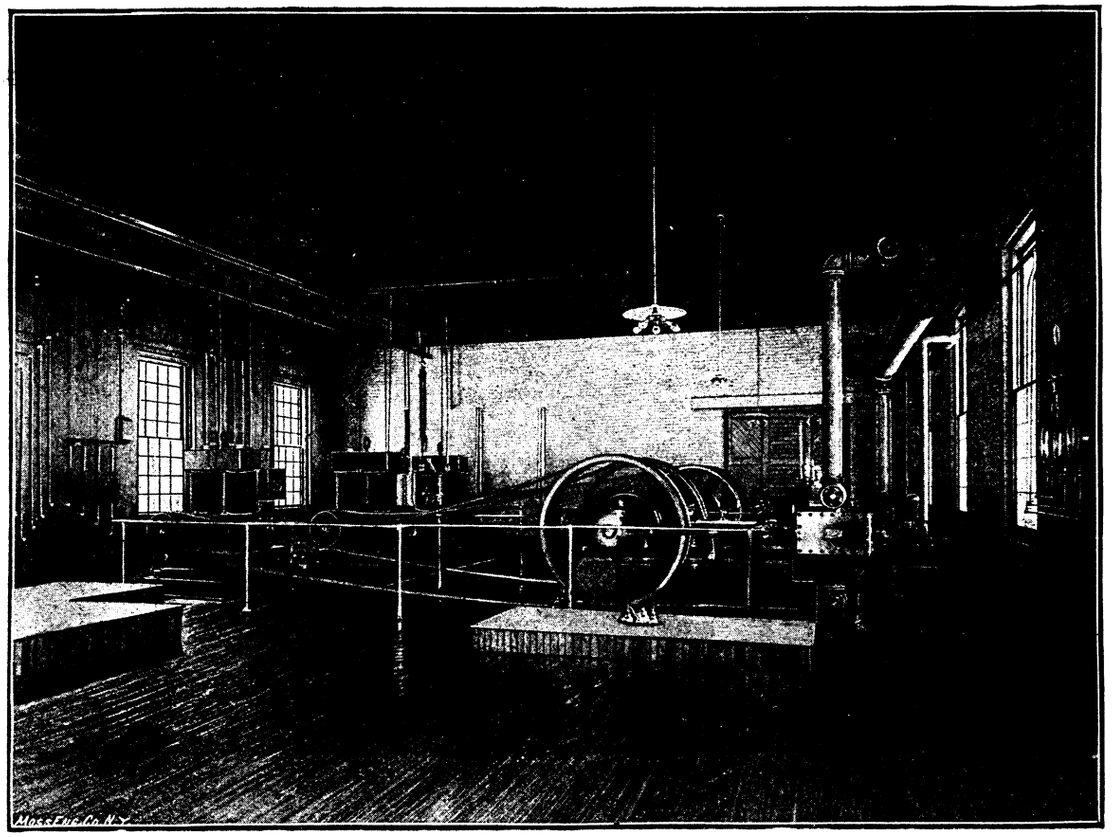
The flexible electrical conductors lead from the dynamo in the engine-room down the shaft and to the machine. It is claimed that the whole design is such that danger from the current is done away with, and that the machine, wires, generator, and every part, are free from danger either to life or property.

A UNIQUE ELECTRIC POWER STATION.

THE great advantages one method of conversion of energy possesses over another when favored by circumstances is illustrated in a striking manner at the power station of the People's Electric Railway of Scranton, Penn. At a short distance from this station is an almost inexhaustible supply of "culm,"—the screenings of anthracite coal, which until recently was considered practically valueless. This culm, which costs little more than the expense of carting it to the station, is the fuel used in generating steam for the engine which drives the dynamos, the boiler-furnaces being specially adapted to the economical consumption of such fuel. As a consequence of this cheapness of fuel, it is claimed by the officers of the road, it costs less to supply the electric motive power necessary to operate the railway than it would to furnish one horse with food and attendance. When it is known that there are twenty cars in operation on this line, and that the grades are not few in number, some of them being steep, the enormous advantages given to the electric system by such exceptional favoring circumstances are apparent at a glance. The results of two months' experience on the Scranton road makes prominent not only the fact that the electric railway is a good thing in its way, but also the further fact that many things now looked upon as useless will eventually prove to be of great economic value. The culm at Scranton is now a marketable product of the mines.

An interior view of the electric power station spoken of is given in the illustration on this page. The electric current is furnished by three Edison dynamos, of 80,000 watts capacity each, wound for an electric pressure of 500 volts at a maximum. The station is most complete in all its appointments, and is furnished with electric lights, current being taken from the dynamos used to supply the motive power for the road.

The twenty cars with which the road is equipped are of the Sprague system, and ran uninterruptedly during the severe snowstorms which have visited Scranton since the road was opened. The Sprague Company and the people of Scranton, as well as the officers of the road, have reason for the satisfaction they express over the working of the road. The extraordinary economy in working expenses, if nothing else, makes this a notable electric railway.



THE ELECTRIC POWER STATION, SCRANTON, PENN.

A COTTON FABRIC.

A COTTON fabric which has been patented in England is thus described by the *Canadian Journal of Fabrics*: "It has the appearance and soft feel of chamois leather, and, it is guaranteed, will not lose its special qualities when washed. In making the cloth, cotton yarns form the warps, these being dyed a fast color, a chrome yellow tint being preferable. They are sized and dressed in the usual manner. The weft is spun soft, and is used in the undyed state. The fabric is woven from these yarns, and is then passed several times through cylinder teasing or raising machines, whereby the surface is broken and a good ground nap is produced on one side or both sides thereof. The fabric is then 'soap' finished, to impart to it the desired appearance and soft, cold feel of chamois-leather. It is applicable for either wet or dry cleaning purposes and also as a polishing cloth, and especially suitable for underclothing and for linings of the same, and for general use as a

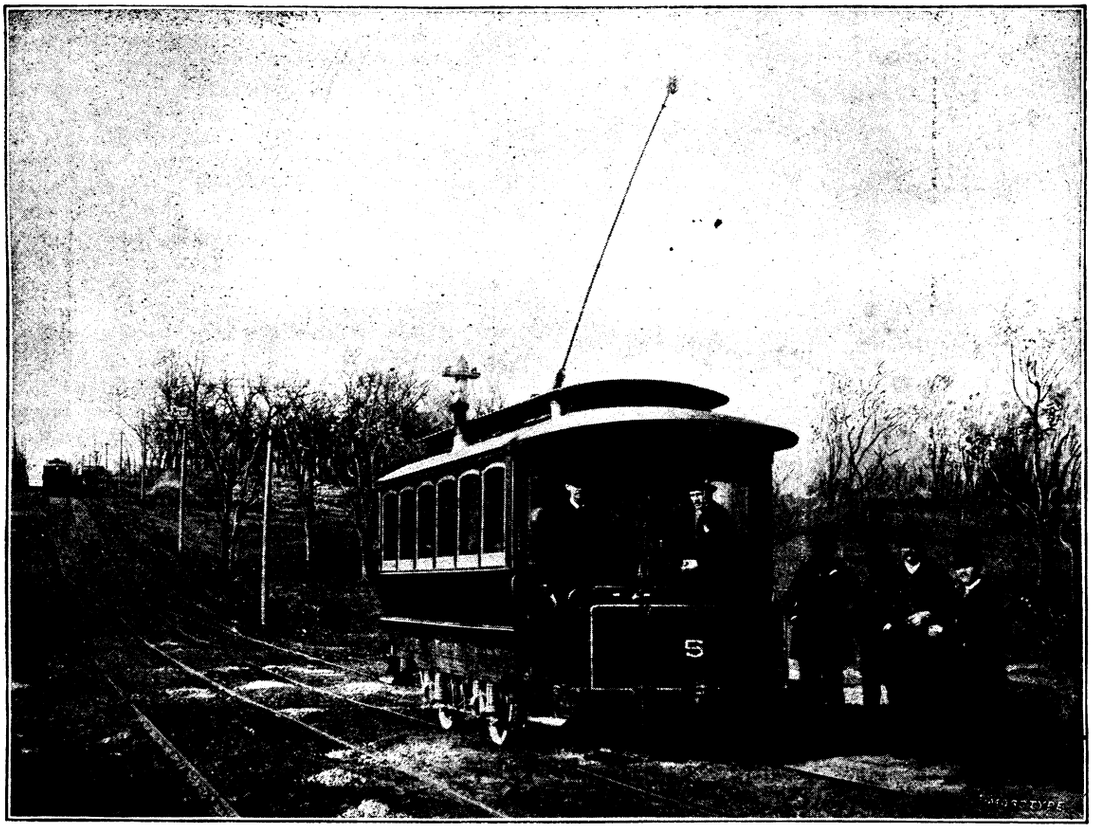
substitute for the chamois-leather now used for these and for analogous purposes. Being, moreover, of a woven texture, and absorbent, it is more healthy for use in garments than chamois-leather, and does not require to be perforated. Unlike leather, also, which gets stiff after washing, this improved material so produced is capable of being repeatedly washed without stiffening, and is found to retain its softness perpetually."

THE ELECTRIC RAILWAY IN ST. JOSEPH, MO.

ONE of the successful electric street-railways in the country is that in operation upon the Wyatt Park Company's line at St. Joseph, Mo., a view of which we give in this issue. This line at St. Joseph was the first one in the country to practically demonstrate the successful operation of an electric railway in a snow-storm. In the early part of this winter a blizzard from the Western prairies struck St. Joseph with all its force, and covered the streets in that city to the depth of from six inches to one foot, in many places drifting badly. The telephone, telegraph, and electric-light wires were borne down by the snow in all parts of the city. In spite of this general blockade, the electric railway ran uninterruptedly, and the cars ploughed their way through the heavy drifts on the line without trouble or stoppage, and without any aid from snow-ploughs.

The grades on the Wyatt Park Railway are in some points on the road as high as nine per cent; and the cars reach a speed of fifteen to eighteen miles an hour in the outside and suburban districts, reducing to a lower rate of speed when operating within the city.

St. Joseph, Mo., already has two street-railways operating by electricity on the Sprague system, and a great many manufacturing industries are kept in operation by the same power by means of stationary electric motors operated from the regular railway circuit. It is said that the two other street-railways in St. Joseph will soon be in operation upon the electric system, so that the horse shall be supplanted entirely for car service in that city.



SPRAGUE ELECTRIC RAILWAY AT ST. JOSEPH, MO.

A NEW FORM OF SELF INDUCTION AND REGULATING COIL.

IN the operation of electric lighting and other apparatus in which an alternating current is employed, it is frequently desirable to vary the current or electro-motive force through considerable range. With direct or continuous currents, a variable rheostat is usually employed for such purpose, and, where saving of energy is not an object, might be used also with alternating currents. But with such currents it is possible, by employing self-induction or inductive resistance in place of pure resistance, to secure such variations without much loss of energy, because the action of self-induction is really only a storing-up and giving-back of energy consequent on a displacement of phase of induced alternating impulses from the phase of impressed or supplied impulses. This is what is meant by "lagging of phase," and it is an effect of self-induction or inductive resistance. Any wire capable of producing magnetism is a self-inductive resistance to such currents. A coil wound on an iron-wire core or bundle is a good example; and, if the wire bundle be a ring core or closed magnetic circuit, its effects per unit of length of wire will be enormously intensified.

Hitherto the usual plan of constructing a variable inductive resistance has been to provide a hollow coil with a movable iron-wire core in its axis, so that the centres of coil and core could be made coincident for maximum effect. This arrangement for a given effectiveness is cumbrous and unnecessarily large, inasmuch as it employs only an open magnetic circuit, and not a closed one; and, even though the core be entirely removed from the coil, the self-induction is not neutralized, because of the numerous turns of wire in the coil itself. Besides, the true resistance of the wire as such is considerable.

With a view of obviating these defects, and securing the other advantages of compactness and ease of manipulation, the apparatus to be described was devised.