BEAUTIFYING THE ROADBED BY SODDING.

What an ideal roadbed should be, both for wearing qualities and appearance, is shown in four stretches of the main line of the Pennsylvania Railroad between Philadelphia and Pittsburg. Grassy banks sloping smoothly down, when the tracks are in a cut, are the features that strike the passenger's eye. It might be supposed that these sodded slopes are put there solely to please the eye, to make the Pennsylvania a good road to look at as well as to ride upon. This is a mistake—the grass is more useful than ornamental, and eventually it will mean the saving of thousands of dollars now spent on "maintenance of way."

"Water," said a prominent railroad official in a recent lecture, "is the greatest enemy of the roadbed." Water flowing down unsodded slopes causes erosion, washing dirt and stones into the ditch beside the track, and choking drainage. Perfect drainage is one secret of success in the maintenance of roadbed.

It was in the summer of 1905 that President Cassatt suggested the present improvement, in order to reduce the cost of maintenance as well as to make travel for the patrons of the Pennsylvania safer, more comfortable, and altogether more agreeable. He appointed a committee of engineers of the company to prepare plans for a roadbed with draining facilities as near perfect as possible, and the fifteen miles of new roadbed is the result of the committee's report. One of the two five-mile stretches of roadbed is near Lancaster on the Philadelphia division, and the other near New Port, on the middle division. The two shorter stretches, two and a half miles each, are on the Pittsburg division, one near Cresson on the western slope of the mountain, and the other about fifty miles east of Pittsburg, at Hillside.

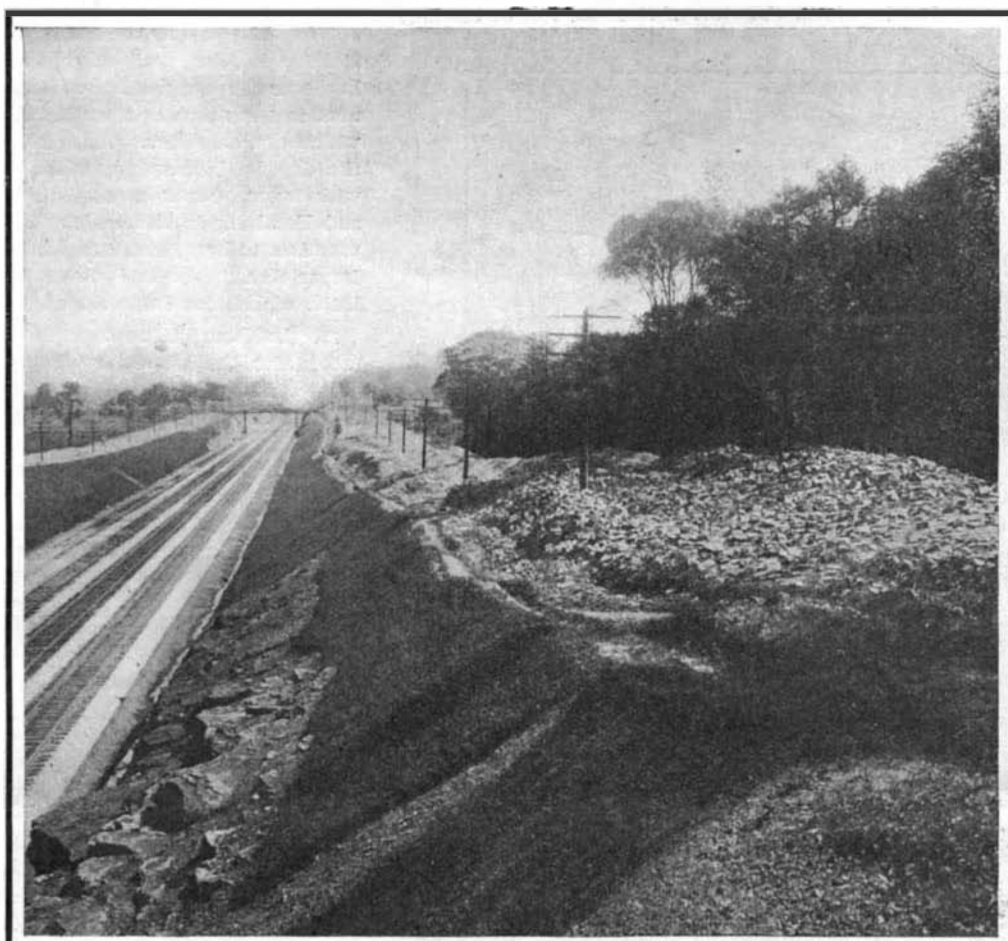
The Pennsylvania requires a ditch, ten and a half feet wide, on each side of a four-track road, and the bottom of the ditch must be three and a half feet below the level of the top of the tie. That means that there must be a decided slope from the lowest part of the roadbed to the ditch, so that water settling through the ballast will flow off rapidly.

The ditch itself is of ordinary soil, but the company has tried the experiment, in some places, of sprinkling it with oil to keep down both weeds and dust. Whatever method is adopted, the important object is to keep the ditch clean and unobstructed. It has been found that the sodded banks assist greatly in this. When it rains, the water pours down over them without bringing anything with it, and follows the ditch to the nearest outlet.

The cost of the improvement of even the fifteen miles has been very high. Seventy-three thousand cubic yards of new ballast were used in that short distance. This ballast was not to make the track more steady—the supply already there was sufficient for that—but to make the drainage perfect. The cost of sodding with blue grass was an even greater item. It was calculated by the engineers that sixty per cent of the entire cost was for cutting down and sodding the slopes.

The money will all come back, though, in saving of maintenance expenses. At present, work trains, crowded with laborers, have to be on the move all the time, for clearing ditches and putting in new ballast where it is necessary. In addition to the great cost of labor, the interference with traffic is a most important consideration in this constant overhauling.

Antimony has a hardening effect when added to lead; a small quantity of bismuth gives the alloy the property of expanding at the instant at which it solidifies, the result being a perfect cast from the mold.



BEAUTIFYING RAILROAD ROADBEDS AND PROTECTING SLOPES BY SODDING.

Engines Driven by Blast-Furnace Gas.

In order to show the great benefit which is obtained by operating low-carbon gas engines directly from blast-furnace gases we may cite some of the recent figures which have been taken from experiments made on the Continent, where many such motors are in use in blast furnaces for operating rolling mills and other machinery. In the blast furnace, the production of gas available for the engines is stated to be 2,700 cubic yards per ton of pig iron produced, making the necessary deductions for losses and for the quantity of gas needed for the reheating. The gas gives from 800 to 1,000 calories per cubic yard. This quantity of gas utilized in a steam engine, by burning it under the boilers, would give only an amount of energy available represented by 260 horse-power-hours, while in the case of motors which use the explosive force of the same amount of gas we find that the energy is three times the above amount. This is greatly in favor of the use of such engines, especially as they are now very reliable in their action and are built in large sizes. As the blast-furnace gas does not contain any products of distillation, but only a quantity of water vapor and dust which are easy to separate, the engines do not need to be cleaned as often as ordinary gas engines. With a good set of scrubbers for the gas, a motor can be operated several months at a time without needing to be cleaned. Seeing that the blast-furnace gas does not contain hydrogen, there is no danger of a premature explosion of the gas in the motor, even when working at a very high compression.

The native mass copper of Lake Superior has the highest electric conductivity of any known copper. A sample cut from the most compact portion of a mass, rolled and drawn into a wire of 0.104 inch diameter and annealed, gave a conductivity of 102.5 Mathiesson standard. Cathode copper, carefully deposited with a low current, and prepared in the same way, gave just as high a conductivity.

THE ANCESTORS OF THE ELEPHANT.

The ancestors of the elephants of the present day have become well known to palæontologists through the fossilized remains, and even frozen carcasses, which have been found practically all over the world. The two living species of elephant are the last survivors of a group generally known as mammoths or mastodons, which formerly spread over all the great continents and inhabited temperate and Arctic as well as tropical regions. Various species of these elephants or mammoths have been found in every country of Europe, in Asia and Africa, and in the western hemisphere from Alaska to Argentina. The remains of these giant creatures are so abundant in Siberia, that fossil ivory forms a fairly large article of commerce. The mastodons, distinguished from the true elephants principally by a less complete specialization of the grinding teeth, had an almost equally extensive range, but inhabited more especially the temperate regions during the Pliocene and Pleistocene epochs. Primitive mastodons lived in Europe and North America during the Miocene epoch. They were of smaller size than the later mastodons, and had small tusks in both upper and lower jaws. In some of the older species the upper tusks curved downward, and the lower ones upward, in a manner that indicates their origin from chisel-shaped incisors, like those of rodents. From this stage up to the present elephant a complete evolutionary series can be traced, but the earlier stages in the development of the Proboscidea are not known, though they are probably Asiatic. Mammoths have been found in the Arctic regions imbedded in masses of ice, which so preserved them that the flesh could be used as food for sledge dogs and even human beings. This preservation has enabled us to become familiar with the mammoth in every particular, even to the food upon which it lived, for quantities of this have, in certain instances, been found between the animal's jaws, or partially digested, in the s' ch.

Although the elephant can be considered an ungulate, nevertheless he presents such remarkable differences in the structure of the skull, that naturalists have given him an isolated position in the animal kingdom. The skull includes many prominent bones, and has numerous internal passages separated by partitions. The nasal bones are short, and the nostrils form an upwardly-leading duct. Compared with the size of the skull, the brain, although the largest found among the mammals, is exceedingly small and has strongly developed convolutions. As in the rodents, the teeth are composed of incisors and molars only. The modern elephants belong to the specially-created sub-class Proboscidea, which comprises only two varieties, and the elephant, therefore, stands alone in the animal world, a paradox in the natural systems based upon consanguinity or upon descent.

The first traces of pachyderms in any way related to the elephant are found in the Miocene period. In those days the climate of the temperate zone was subtropic, and together with the tapir, still found in Central and South America and in southern India, the dinotherium roamed the luxuriant forests of his habitat. Piece by piece the bones of this proboscidean have all been gathered, and show that he was an animal some 14 feet in height, with a trunk and long column-like legs. Most peculiar is the formation of the lower jaw, the forward portion of which is considerably elongated. This strongly-developed symphysis bends downward at right angles, and carries a pair of strong incisors turned backward, describing a curve not unlike that of the tusks in the upper jaw of