

# AN EPOCH MAKING ADVANCE IN ELECTRIC TRACTION



**TWO ELECTRIC LOCOMOTIVES HAULING A 2,000 TON TRAIN UP A 2 PER CENT. GRADE, A TASK FOR THREE MOGUL ENGINES.**

**T**WENTY-FIVE years ago the electric railways of the United States did not exceed a total length of 1,000 miles. Now the increase of such roads is at the rate of quite 2,000 miles annually, and things are being done that even the most enthusiastic optimist would scarcely have dared to predict a decade back.

Fresh in the public memory still is the opening for service of the first of the electrified divisions of the New York Central and the New Haven Railroad; and yet these accomplishments, big as they then were and large as they have grown since, are really modest compared with what has been done elsewhere in the United States. More than this, the technical man hesitates to place limits upon this order of electrical service.

The steam horse has now a very formidable rival in the electric locomotive, and the newcomer is in fact able to do things that are quite beyond the capacity of its older competitor, measured pound for pound. The electric loco-

motive is indeed the latest thing in the way of efficiency. Technicians declared only four or five years ago that the electrification of trunk lines was only a dream. For suburban service this method of traction might do very well, they said, for there the volume of traffic was large and reasonably continuous, thus permitting the profitable running of frequent trains.

In the face of this opinion the engineering world and the laity must acknowledge the courage of the Chicago, Milwaukee and St. Paul Railway Company in first projecting and then putting into execution the electrification of 440 miles of main line through the most trying part of its mountain division. The work has involved an outlay of quite \$20,000,000 and has consumed three years for its completion. This is not the end, but only the beginning of a still bigger undertaking.

Coal out in that part of the West is an expensive fuel, and the yearly price of a horse-

power mounts discouragingly high compared with more favored railroad territory. Steam haulage has many disadvantages to contend with, and yet the connecting links of this great transcontinental route had to be maintained in this fashion. All the while, however, thousands of tons of water sped wastefully onward over the Great Falls of the Missouri high up in Montana until a hydroelectric power plant was established there and nearly 50,000 horse-power of energy in the form of electric current was made available for multiple uses. This is the main power plant for the electrified section of the Chicago, Milwaukee and St. Paul Railroad.

This current is sent over the conductors at a pressure of 100,000 volts and is distributed to fourteen sub-stations at points throughout the mountains. There great transformers deal with the current and turn it out upon the feed lines at a potential of 3,000 volts, direct current. It is this energy that the great electric locomotives

tap, and each of these giant tractors is far ahead of any of its steam competitors.

For instance, during a trial test calling for the hauling of a 2,000 ton freight train up a 2 per cent. grade two of these electric locomotives pulled the load along without trouble, where ordinarily three monster Mogul engines were employed! No wonder they call these modern tractors Moguls of the Mountains. Each of these great locomotives costs a matter of \$100,000.

The electrified mountain divisions reach from Harlowton, Mont., to Avery, Idaho, spanning territory lying among the Belt, Rocky and Bitter Root ranges. The route penetrates great cañons, leaps tremendous chasms, burrows into the bowels of the towering ranges or skirts



## REAL GREEK GOAT FARM IN NEW ENGLAND



**THE HERDS GRAZING THROUGH THE SNOW.**

**A** BIT of real Greek landscape with 600 goats grazing, watched by a native goatherd with a veritable shepherd's crook, is the scene that greets the traveller's eye near Manchester, N. H. Only Pan with his reed pipes is needed to complete the picture of Old Ephraim transplanted to the New Hampshire hills. The picturesque sight is the 800-acre farm of N. J. Nassaukas, who is a man of considerable importance among his race in America, being the most extensive maker of Greek cheese in the United States.

The task of herding, feeding and milking 600 goats daily would appear to the average man as a labor fit to rank with those inflicted upon Hercules, but Mr. Nassaukas regards it lightly. His brother tends 2,000 goats on his farm in Greece, and the New Hampshire cheese maker

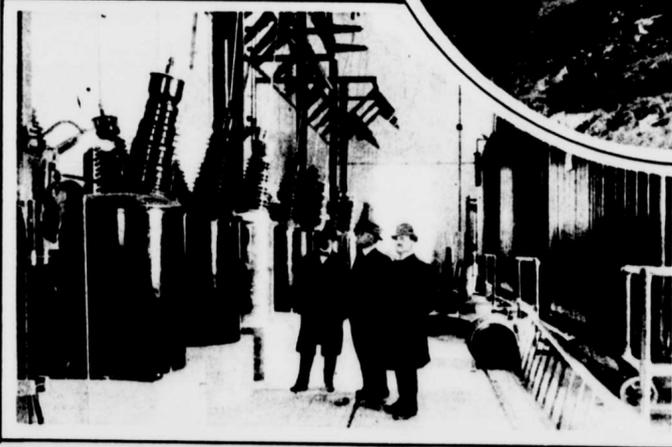
expects shortly to see his own herds increase to 1,000. In his daily watch over the herds, besides the crook to catch a refractory goat by the hind leg, he is armed with a rifle as a safeguard against wolves and dogs, which, however, will not attack goats as quickly as they do sheep.

Two quarts of milk a day, he says, is a fair yield a goat. The milk is far richer than cows' milk and commands a ready market at 20 cents a quart. Mr. Nassaukas, however, does not care to seek a market for his supply, as he finds it more profitable to use it in his cheese making operations.

These goats, while the problem of feeding is a simple one compared with other domestic animals, belie the popular superstition that a goat can subsist on tin cans and discarded corset stays.



**THE GOATHERD WITH CROOK AND RIFLE.**



**SUB-STATION AT JANNEY, MONT., SHOWING THE GREAT TRANSFORMERS THAT STEP DOWN THE CURRENT FROM 100,000 VOLTS TO 3,000 VOLTS.**

their rockribbed sides while gliding along in the sunlight or slipping through the shadows of silent forests. Thus, within the region known as the Continental Divide, steam as a motive power has been permanently abolished. This means a revolution in other ways.

Gone is the wracking exhaust of the steam locomotive laboring up grade. Gone also is the uneven motion incident to steam traction on mountain sides. Swiftly, evenly, silently and smokelessly the electric locomotive travels up hill and down dale, undisturbed by the changing slope. But there are material savings besides.

An important economy resulting from the substitution of electric traction lies in the practical elimination of yards at intermediate points—supply places for steam locomotives. It has been found possible to run the present electric locomotives on this road straight ahead over two of the old steam divisions, that is, an uninterrupted lap of 220 miles, against 110.

According to the authorities an up to date electric locomotive can travel 2,000 miles without needing an overhauling, whereas a steam locomotive engaged on mountain work has to be gone over by "the doctor" at the end of every division. That is to say, this supervision takes place about eighteen times to the once required for the new tractor. This means both economy and efficiency. But this recital does not enumerate all of the virtues claimed for the electric locomotive by the experts.

It carries no tender, it uses no fuel and no water is required for its functioning. It operates efficiently in the coldest season, when steam locomotives are apt to freeze up; and therefore handles uniform tonnage irrespective of the state of weather. It hauls twice the load of the

**MAIN POWER PLANT AND DAM AT GREAT FALLS, MONT.**

steam locomotive at approximately half the cost. It is always ready to start, has no fires to nurse and only a switch need be turned to set it in motion. It is practically unaffected by snow troubles because of its great weight and power. It is clean, it is dependable in all atmospheres and easy on track and roadbed because of the equable distribution of its propulsive drivers.

When the summit of a grade is reached and the descent begins there is a noticeable absence of the speeding up and also choking down processes so common to steam traction on down hill work. The electric locomotive slips down the mountainside at precisely the same speed all the way, and while gravitation is helping its progress the locomotive is making a return to its owners. By reversing its giant motors they become electrical generators during the descent, and thus return to the supply wires overhead anywhere from 25 to 40 per cent. of the current it would use if climbing that grade.

That is to say, the locomotive bound down may thus be made to help its electric fellow bound up the mountainside and drawing current from the same conductors. This reversal of the motors actually exercises braking control over the speed of the train during the employment, substantially does away with the descent and then of air brakes. In other words, the air brakes are fitted only as an emergency equipment, and when not needed a substantial economy in power consumption is effected.

Some idea of what these electric locomotives are can be gathered from the fact that one of them, composed of two coupled units, weighs 282 tons and has an over all length of 112 feet. When hauling a 2,500 ton freight train one of these monster tractors can climb a 1 per cent. grade at the rate of sixteen miles an hour and when geared for passenger service it can mount the same grade with an 800 ton train at a speed of thirty miles an hour when fully equipped. This mountain division of the road will have forty of these electric titans.

Economically there is a great lesson in observation in this application of electric traction. Up to date the total power developed amounts to 68,800 kilowatts, and only 5,000 of this is the product of steam. The rest of the energy being drawn from falling water. Besides the power stations other hydroelectric power developments are under way, and it will not be long before there will be available in that mountainous region electrical energy of nearly 241,000 kilowatts. Instead of coal being burned to produce this energy the force of falling waters will serve instead and the nation elsewhere will benefit by the fuel thus conserved.

What this trunk line has done is a fair index of what may be expected on other railroads, especially where suitable hydroelectric plants can be established within convenient reach of the rail routes. Electric traction has had many difficulties to battle with, but technical cunning has dealt successfully with the great majority of these. Where favorable conditions exist for the substitution of electric haulage the days of the steam tractor are numbered.