## WINTER OBSTACLES TO TRANSPORTATION.

BY WALDON FAWCETT.

As American railroad traffic has increased in volume and the exigencies of operating conditions have rendered essential a rigid adherence to schedule in the movement of both passenger and freight trains, the problem of keeping the tracks sufficiently clear of snow and ice to guard against possible interruptions of or delays to traffic has increased in importance. Of late years much thought and the expenditure of large sums for special equipment have been devoted to the speedy removal of nature's barriers to traffic, and as a result a really marvelous degree of efficiency has frequently been attained in keeping lines of communication open under adverse circumstances.

In the eastern part of the United States railroad tracks are seldom covered with snow to a depth exceeding two or three feet, and may usually be cleared by the employment of a wedge-shaped iron snow plow of the simplest form. Such plows vary in size from the mere scraper, little larger than the cow-catcher to which it is attached, to the ponderous plows in use by the Pennsylvania Railroad in the mountainous districts, and which almost equal in size locomotives of ordinary dimensions. In the case of all of these plows, the mode of operation is the same. The plow is forced forward by one or more locomotives, and by sheer force of impact makes a furrow, throwing the snow to either side of the track.

In the West, where snow constitutes a much more serious obstacle to railroad traffic than is the case in the East, the types of plows employed in the East proved inadequate. The first substitutes introduced were wooden shields of sufficient size to virtually overshadow the locomotives which pushed them. Then came the heavier device known as the "gouger"—a strongly-built box car with an immense flat scraper at its head, set sufficiently low to enable it to run under and into the snow like a wedge, and supplemented by wings set upon hinges and designed to assist in widening the opening made by the prow. The gradual increase in size of the "bucking" type of plow, as it was commonly denominated, continued until its culmination in what is known as the Congdon plow, a machine which requires the combined services of two or three of the largest locomotives for its successful operation.

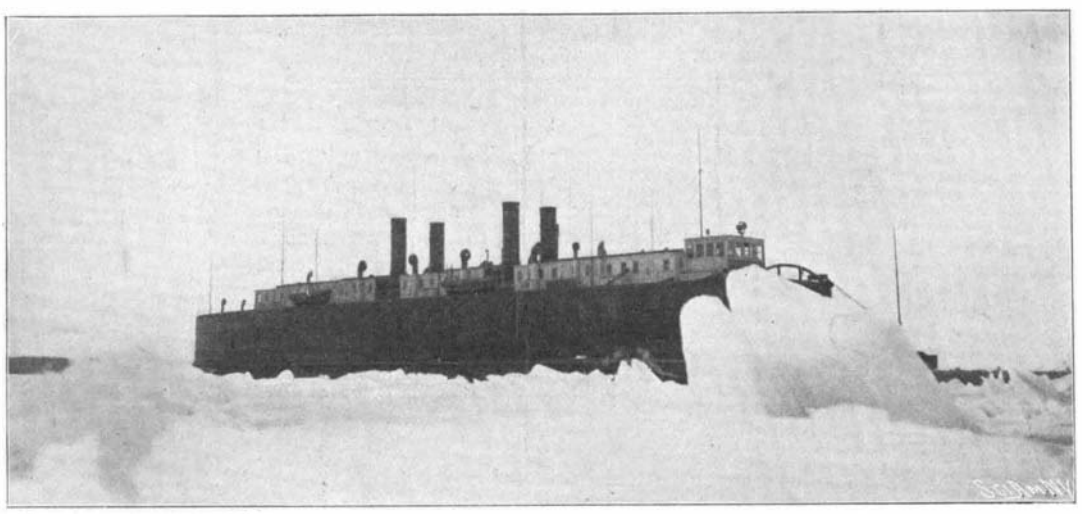
With these plows it was the custom to "charge" snow drifts by backing the plow and engines a distance of one or two miles, and then hurling the entire mass forward at a speed which approximated sixty or seventy miles an hour when the huge ram struck the drift. Of course, this was a decidedly hazardous method of procedure, inasmuch as many drifts contain masses of solid ice in the center, and indeed the element of danger involved was strikingly evidenced some years since at Truckee, Cal., when a train of eight locomotives propelling a large plow charged a solid drift, with the result that the plow was completely crushed, every one of the locomotives was more or less damaged, and over half of the men comprising the aggregate train crew were disabled.

Experiences such as this quickly demonstrated to the Western railroads that some more effective and less costly method of battling with the snow must be evolved, and the rotary snow plow was devised. The rotary plow, although of very heavy construction, involving a weight of about one hundred tons, is based on a very simple idea. A large, staunchly-constructed car with armored sides carries in front an immense steel wheel fitted with blades somewhat resembling the propeller blades of the ordinary steamer. This wheel, which is about twelve feet in diameter and is set in a shield, is actuated at high speed by a steam engine within the car. In a chamber at the rear of the wheel, and connected with it, is a fan from which communication is effected by a spout, capable of adjustment to either right or left.

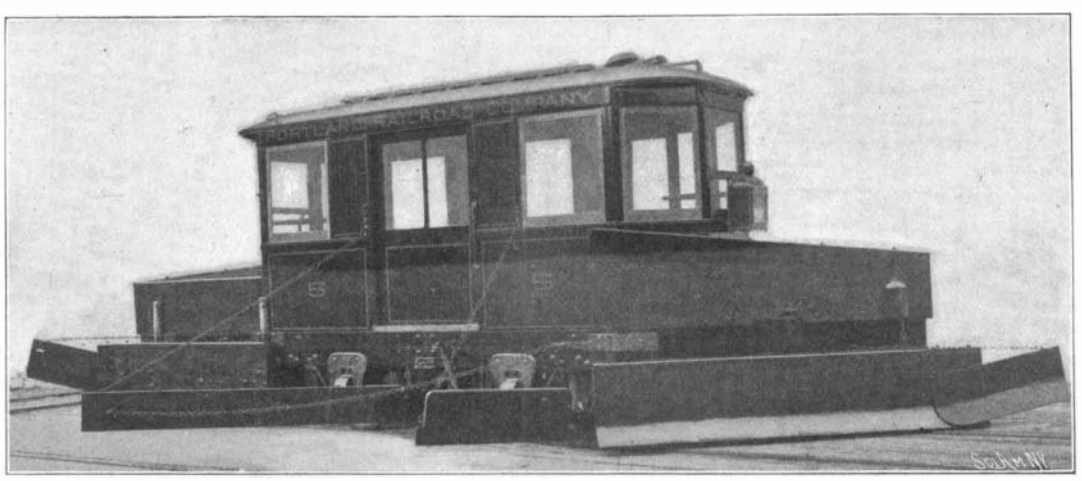
The operation of the rotary plow in a snow drift might be compared to the manipulation of a gigantic auger, and the snow removed from the track in front of the plow—the "borings," it might be termed—is driven out by the fan just as chips are expelled from a planing mill. A rotary plow will make its way through drifts at speeds varying from two to twelve miles an hour according to the solidity of the barriers encountered; but inasmuch as the snow removed by the plow is hurled a distance of from fifty to one hundred feet, a reasonably wide path is cleared. If a drift is encountered of such depth that the rotary plow is entirely buried in the mass, it is necessary to reduce the size of the embankment by hand-shoveling until a level is reached which will permit of the funnel from the fan clearing the snow and providing an outlet for the snow removed by the plow.

An important factor in surmounting winter obstacles to transportation is found in the snow sheds, which are employed to a greater or less extent on almost all western railroads. These sheds are necessarily of the staunchest timber construction, and some idea of the expenditure involved may be gained from the fact that one transcontinental line has on its road a total of thirty-two miles of snow sheds, costing, on an average, $64 a foot, or upward of $11,000,000 in all. In addition this railroad has during some seasons made outlays which have aggregated as high as $1,000,000 a year for the repair and maintenance of the sheds. Another costly means of affording protection from snow blockades is found in the construction on mountain sides of timber "glances," or huge fences of logs designed to divert snow slides from the railroad tracks. Dynamite cartridges are used to break up the miniature glaciers which occasionally form on railroad tracks in the mountainous districts of the West.

Very interesting, by way of contrast, are the methods of combating snow followed by the railroads of Great Britain. In season each of the principal English railroads places upon its payroll an immense force of "foggers," men who in foggy or snowy weather place detonators on the rails, in order to acquaint the engineers with the positions of the semaphores or spectacle glasses, the signal lamps being, as a rule, quite invisible under such circumstances. How heavy an expense is involved by this system be imagined from the fact that the Midland Railroad of England pays as wages to its "foggers" over $50,000 a year, and the one million detonators exploded between September and February of each year cost the company about $15,000 additional. The London and North-Western Road frequently uses as many as 12,000 detonators in twenty-four hours. All of the Scotch lines and the North-Eastern Railway of England own regular snow plows, but most of the other British lines utilize improvised affairs pushed

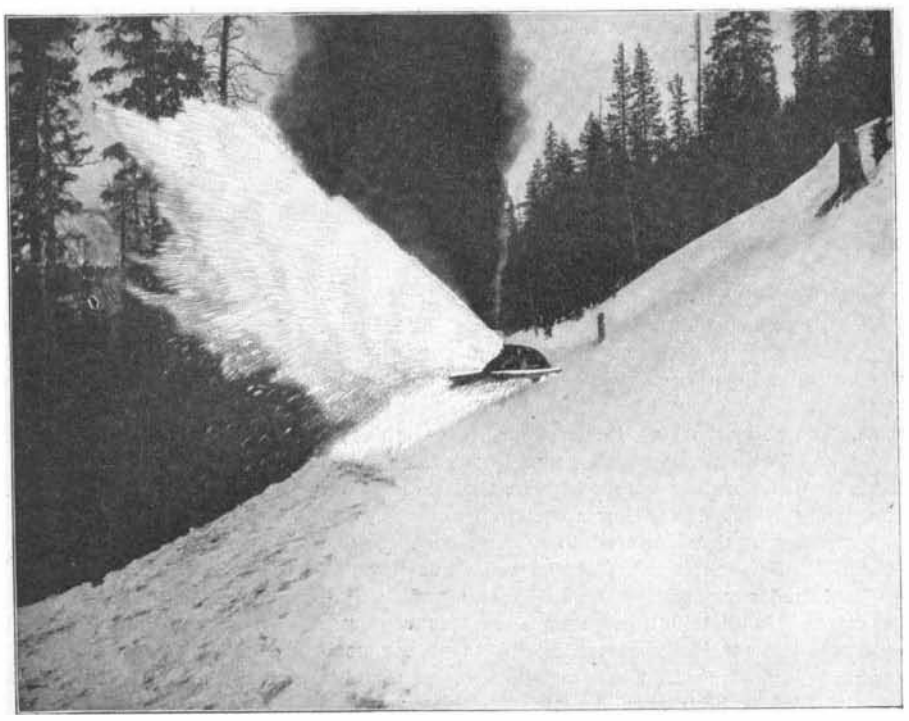


A SAULT STE. MARIE ICE-BREAKER.



A TYPICAL SNOW PLOW USED ON THE ELECTRIC ROADS OF THE EXTREME NORTHWEST.

A ROTARY PLOW IN TWENTY FEET OF SNOW.



THE COLORADO AND SOUTHERN RAILROAD'S ROTARY PLOW AT WORK EAST OF ALPINE TUNNEL.

by two or three locomotives. The regular snow plows are all of the pattern designed for "bucking," the rotary plow being unknown in England. The heaviest English plows do not exceed thirty tons.

A problem kindred to that of snow fighting, namely, battling with ice, is presented each winter to those American railroads in the vicinity of the Great Lakes, the track systems of which are divided by some portion of the inland waterways. For instance, whole trains of freight and passenger cars are ferried across the Detroit River at Detroit, and across the Straits of Mackinac in northern Michigan, while an even longer link is found on Lake Erie, where "car ferries" operate the year round between Conneaut, Ohio, and a port on the Canadian shore opposite. Solid fields of ice are frequently encountered by these vessels, and they are compelled to plow their way through the frozen fields.

The plan employed for breaking up the ice in the pathway of one of these powerful steamers, especially constructed for the purpose, is a modification of the idea exemplified in the rotary snow plows. Propellers are fitted at the front of the vessel as well as at the rear, and the rapid revolution of these screws results in a violent agitation of the water, which, exerting an upward pressure on the expanse of ice, rends it asunder. This same fundamental plan has been adopted in the case of the famous Russian ice-breaking steamer "Ermak," designed to keep open during the winter some of the more northerly ports of Russia, and in the case of the car ferries which form connecting links in the Trans-Siberian Railway, just as do the similar vessels operated by American railroads having termini on the Great Lakes. The largest of these Russian ice-breaking car ferries will accommodate but twenty-five loaded cars, while the American ferries of the largest size will each accommodate about thirty-four cars.

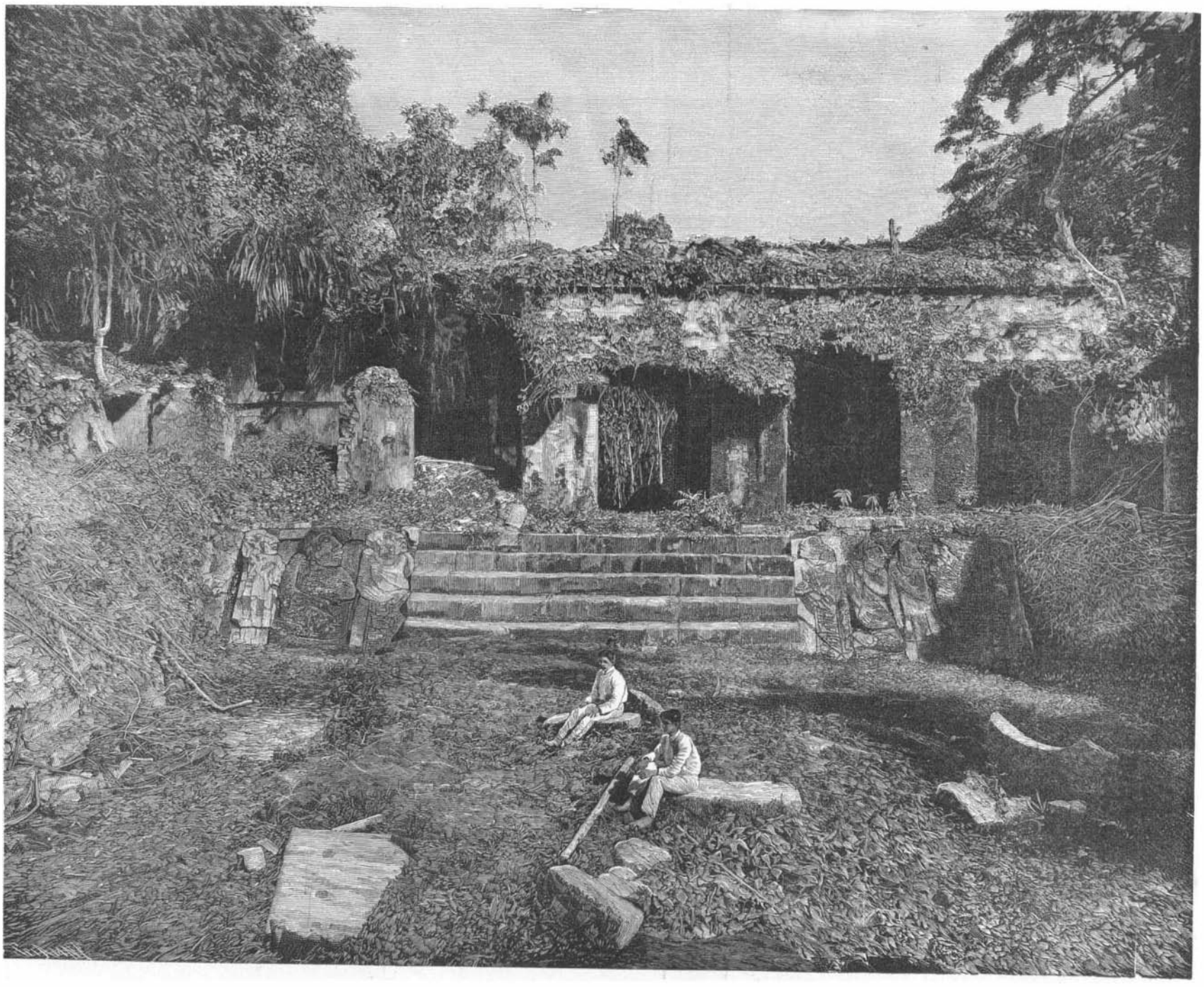
A perhaps more commonplace but not less important phase of the removal of obstacles to transportation is found in the clearing of the streets of a city after a heavy fall of snow. The methods followed in New York city, where any interruption to traffic would be especially disastrous to the commercial interests of the entire country, are especially interesting. As many as 10,000 men have been engaged at one time in removing the snow from the streets of the metropolis. An average snow storm costs the city at least $75,000. When the fall approximates, say, 400,000 cubic yards, as many as 3,600 extra shovelers are employed, and fully 3,000 carts and trucks are brought into service for the removal of the snow. In all large cities the street railway companies are required to remove the snow from the tracks, and usually from the pavement for a certain distance on each side of the track. As a rule, the street railway lines make use of wedge-shaped scraper-like plows, supplemented in many cases by large power sweepers.

A CARVING FROM THE RUINS OF PALENKE.

## THE ANCIENT RUINS OF PALENKE.

BY ENOS BROWN.

A traveler who recently visited the famous ruins at Palenke, State of Chiapas, Mexico, laments the changes which time and the elements are gradually making in their appearance and condition. Nothing has ever been done by the Federal Government to preserve these impressive monuments of the highly cultured race who constructed them and of whose history and origin but little is known. The climate of the region in which the ruins are situated is the direct opposite of that of Egypt, inasmuch as the rainfall at Palenke has been known to amount to 200 inches a year. The air is humid and encourages decay and at the same time stimulates the rapid growth of the vines and creeping plants, which are disintegrating the walls and pavements and will eventually level them to the ground. So dense is the foliage surrounding the ruins, that light from the sun is almost totally obscured. The photographer who was employed by the Mexican government to take pictures of the ruins could accomplish his object in some instances only by means of a flash light. The ruins of Palenke are about 200 miles from the port of Frontera and are reached by steamer up the Tabasco River to San Juan Bautista and thence by trail. The group all lie within a radius of 2,000 feet, and consist of nine distinct structures, of which the "palace" is the largest and most central. The ruined buildings consist of temples, pyramids, aqueducts, and edifices whose purpose is not yet ascertained. The temple is the largest of all, and upon it the ancient builders lavished all their art. It includes a court and balconies, as well as great corridors in which tablets in bass-relief are fastened into the walls. Sculptures representing battle scenes and events of the nation's life are carefully depicted. From them the physical characteristics and domestic habits may be correctly ascertained. The dimensions of the "palace" are great. Its length is 238 feet, and breadth 180 feet, and it is elevated on a mound 310 feet long, 260 feet wide, and 40 feet high. The material used was stone, many blocks of prodigious size being used, and all joined together with mortar. As great architectural ability was displayed by the builders of the edifices at Palenke as was shown by the architects who erected those of the Nile. How it was possible for a primitive people to fashion, convey, and sculpture such



THE RUINED TEMPLE OF PALENKE.