the direction of rotation was changed. The Cooke Locomotive Works rebuilt the plough, embodying these improvements, had been able to proceed. J. S. Leslie personally operated the plough during the trial. The operation of the "rotary"

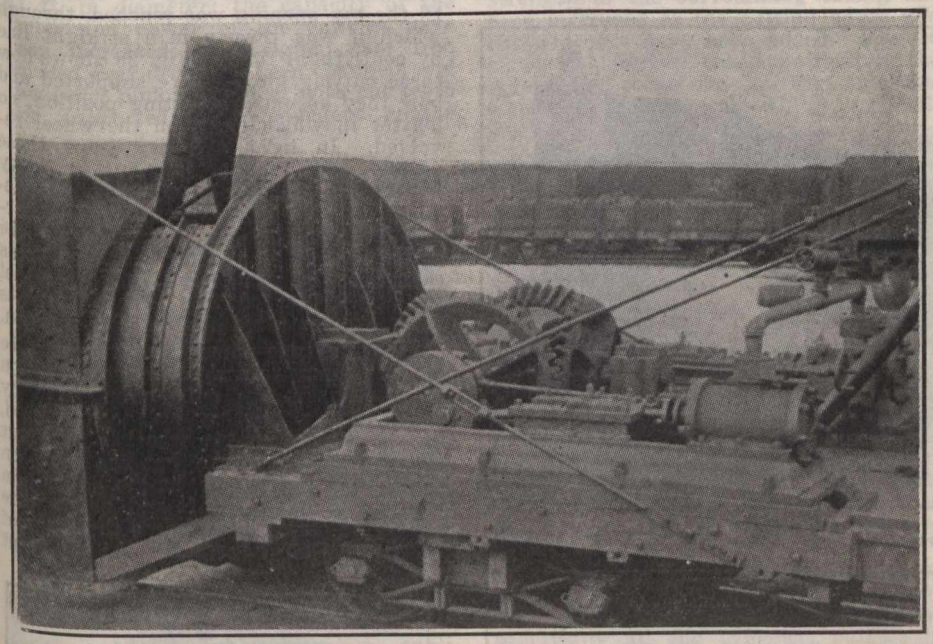

Fig. 22. Leslie Bros.' Model Rotary Snow Plough, tried in C.P.R. Parkdale yards, Toronto, in 1883-84.

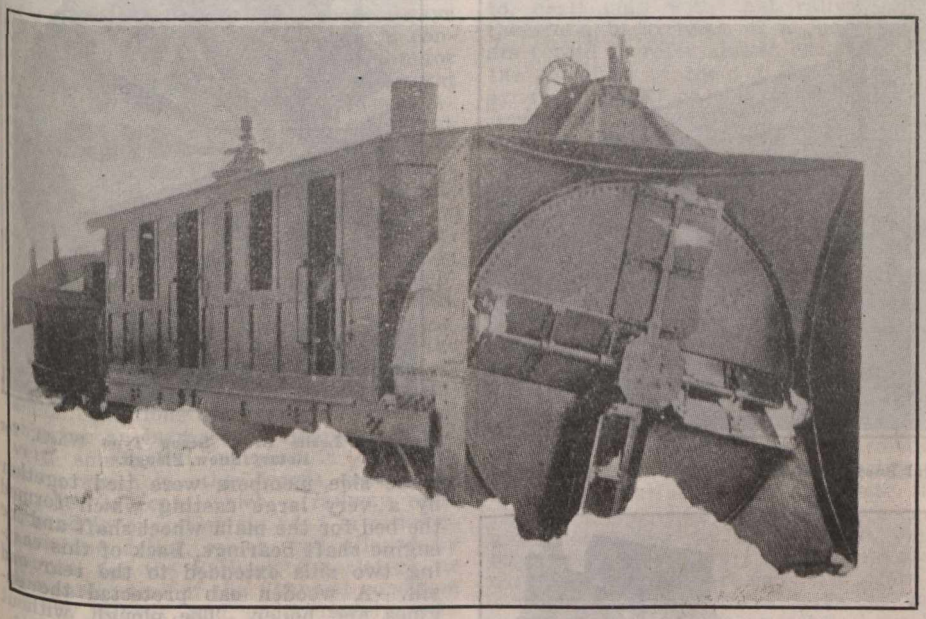

Fig. 23. Leslie Bros.' Rotary Snow Plough, 1886.

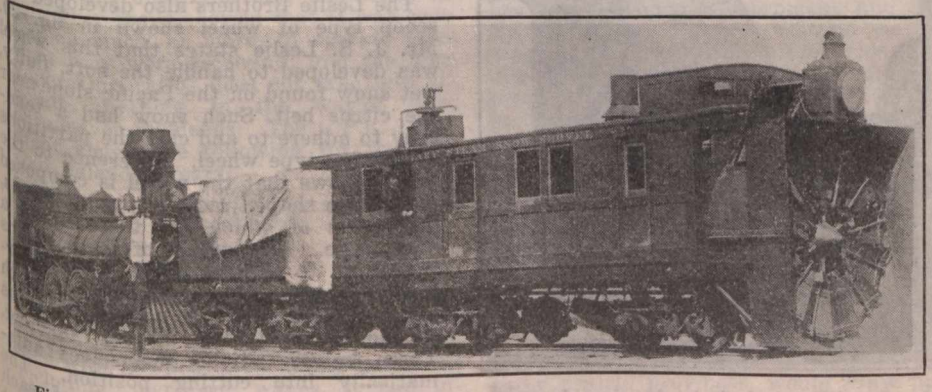

Fig. 24. Improved Leslie Bros.' Rotary Snow Plough, as rebuilt by Cooke Locomotive Works.

fig. 24, and during the winter of 1886-87, it was put into service on the Union Pacific Rd., doing particularly good work in opening up one 70-mile branch which had been blocked for some time and through which no ploughs of other types was so successful that the railway company not only purchased it, but three others in addition.

In Canada, in 1888, the C.P.R., through the Polson Iron Works Co., of Toronto, built eight of these ploughs in its Montreal shops, applying a fan wheel which had been still further improved by the Leslie Brothers. This wheel is shown in fig. 25. Fig. 26 shows a plough with the perfected Leslie wheel. The ice cutter and flanger can be seen very well in this illustration.

In 1889, Orange Jull devised a centrifugal excavator which was first put in service on the Union Pacific Rd. during the winter of the same year. Fig. 27 shows a plough of this type. This excavator was intended to remove snow by means of a cone shaped screw conveyor. The screw was built up of plate and supported on a shaft. It was not only set diagonally across the track, but inclined so that the nose pointed down toward the right hand rail. The shaft was supported by two bearings, the front one being located in the bottom right hand corner of the hood; the back one in the left hand corner. The screw was made up of four spiral blades of ½ in. steel plate. The action of the excavator was similar to that of an auger, the snow being carried back and up through an opening in the top of the hood. The screw was revolved at from 250 to 300

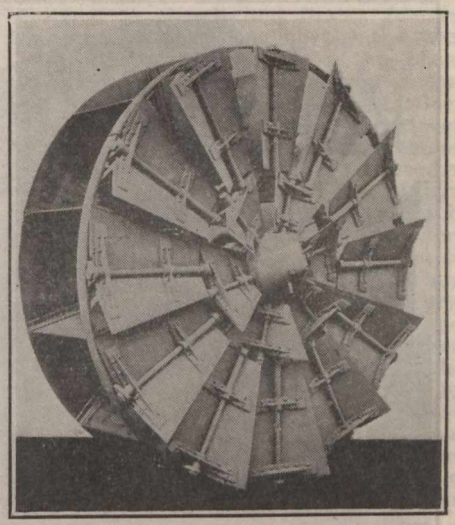

Fig. 25. Improved Fan Type Wheel, for Rotary Snow Plough.

revolutions per minute. The Jull plough was unsuccessful. The screw conveyor filled up solid with snow and ice; the spiral cutter was easily damaged by rocks and ice; the screw also had a tendency to raise the front of the plough, resulting in derailment.

During 1889, another snow plough, called the Cyclone, was brought out and put into service on the Central Pacific Rd., now a part of the Southern Pacific System. This plough, like the Jull excavator, had a revolving auger, with a fan wheel placed behind it to remove the snow. The fan wheel and auger were mounted on the same shaft, and driven by two powerful engines. This plough was also unsuccessful.

Although there has been considerable development, the general arrangement of the modern rotary is very similar to that of the improved Leslie ploughs. As development progressed, the ploughs became heavier and were made more powerful. The size of the cutting wheels has increased to such an extent that on the heaviest and most modern ploughs the knives will cut through small trees and successfully open up snow slides containing a very large proportion of dirt, rock and gravel.

The first rotary ploughs with the improved Leslie wheel were equipped with