sections at every standard; that is, a separate length of rope is used for every span of the line, special means being provided for clamping up and tightening each rope, and also for making a smooth track for the carrier wheels from one rope to the other.

There are three particular advantages in this special sectional system of ropeway. In the first place, where absolute freedom from breakdown or stoppage is necessary, in the event of breakage of a carrying rope, instead of the whole length of rope coming to the ground, and with it, of course, all the carriers on it, only the short length of rope on the span at fault would be involved, the rest of the line remaining intact. Then, if a few spare lengths of rope be kept in stock it is only a matter of an hour or so to put in a new span of rope and start the line afresh. Then again, if any specially long spans are involved, and a correspondingly heavier rope be required for this span, only the length of the heavier rope need be used on this one span, the rest being of the normal type.

Improvements in Double-Rope System. — In the author's opinion, one of the greatest improvements that have been effected in the double-rope system is in the form of construction of the fixed rope, or rail rope, as it is sometimes called. This is the locked-coil type of rope. In each of the two types of locked-coil rope now made, the outer wires are so locked together in the stranding as to prevent a wire coming away loose from the rope, even if broken, and at the same time these interlocked wires form a smooth, hard, outer surface to the rope, effectually keeping out the weather from the inner wires, and, what is of greater importance, providing for the easy running of the carrier wheels, with very little vibration, and with a co-efficient of rolling friction very little more than with a similar sized running wheel on a main line steel rail. Then, owing to the absence of any hemp or other soft core in this type of rope, there is exceedingly little stretch in the rope itself when put to work. The reduction of vibration in this type of rope just referred to is of greater importance than appears at first sight.

Curiously enough, the principal cause of failure on these standing ropes is not due to wear on the top of the rope by the passing of the carrier wheels, as one would suppose, but is owing to the breakage of the wires at what is known as the point of arrested vibration. It is obvious that in the middle of a long span of rope there is considerable vibration due to the carriers, and also in some measure to the action of the wind. It is also equally clear that where the rope rests on the supporting saddles there can be no vibration, the rope being solid with the saddle. Consequently, there must be some point between the centre of the rope and the saddle where this vibration commences, and where the wires begin to move relatively to each other. This point is a few feet away from the supporting saddles, the actual distance depending on the construction of the rope itself, the length of the span, and the tightness to which the rope is drawn: and lastly, the amount or amplitude of vibration itself. It will, therefore, be seen that the less the vibration is, the less will be the disturbance at this point and the better for the rope.

It is also apparent that for this and other reasons a long and easy bearing for the rope is necessary at the saddles, with plenty of side support to reduce the flattening tendency on the rope when the load is passing over, and with gradual and easy tapering off of the bearing at each end of the saddle, so as to distribute the position of the point of arrested vibration under carrying conditions of load and tension of the rope.

The haulage rope is spliced endless on the spot. It is driven by gearing at one end, and the usual tension arrangement is provided at the other end, generally the return end, though if the carriers are to be automatically returned from the outwards to the return rope at this point, it is necessary to provide the tension gear at the driving or loading end, for obvious reasons. This driving gear generally consists of a grooved pulley of the same diameter as the gauge of the line, say, 8 or 9 ft. This pulley is keyed on to a vertical shaft, provided at its outer end either with fast-and-loose belt pulleys or with a friction clutch to connect up by suitable gearing with the steam engine or motor driving the line.

The grooved pulley may have one or more grooves around which the hauling rope makes as many half-turns as there are grooves, or if heavy duty is required a fleeting or surging pulley is employed, having a "C" shaped section on the tread around which the rope makes 2½ turns, or even more if necessary to give sufficient adhesion between the rope and the pulley.

There are good reasons for the adoption of either form of driving-wheel, and each form has its own adherents, but if the multiple-groove wheel be used, instead of employing the tension wheel to take the rope from one groove to another, as is generally done, it is better to use a fixed wheel for the purpose, and to run the outgoing loop of rope after leaving the tension wheel around a separate wheel, generally of the same diameter as the double-grooved driving wheel, but running loose on the same shaft. This arrangement saves the "slip" that must otherwise occur in the second groove of the driving-wheel whenever the tension wheel moves, under the varying conditions of load or temperature, and provides for much smoother running of the hauling rope.

Negotiating Angles.—Both vertical and horizontal angles can readily be automatically negotiated on the double-rope system, wherever required, provided a suitable form of gripper be adopted for the purpose. Where ropeways pass over traffic of any kind it is generally advisable to provide some form of protective bridge, in case some of the material carried should fall over the side of an overloaded carrier on to the traffic beneath.

There is yet another form of double ropeway which is now making some progress, though its name involves a contradiction in terms. In this case a single line of fixed carrying rope is used, along which a single carrier travels backwards and forwards, being actuated by an endless hauling rope, the travel of which is reversed as required, this reversal being done by hand or automatically. This type of ropeway forms an exceedingly simple and economic arrangement for automatically disposing of cinders, clinkers, pit dirt or other material, where the quantity is too small to permit the installation of a regular type of ropeway.

In the earlier forms, the carrier was simply stopped at the outer end of its travel, after tipping its contents, by an arrangement of the hauling rope, which moved over an electric switch, after the rope had run out a predetermined distance. The man in charge had to move the switch over again to bring the empty carrier back again. As tipping proceeded, arrangements were made to lengthen the run-out of the hauling rope before moving over the switch.

The next advance on this arrangement was to reverse the carrier automatically after tipping, so that the man in charge would not have to wait for the incoming