Melbourne's Cable trams

A brief History

Science Museum of Victoria 304-328 Swanston Street Melbourne 3000

The newly restored Cable Tram No. 1 * 1885-1940 was unveiled by the Premier of Victoria, the Hon. R.J. Hamer, E.D., M.P., on Thursday 1 May 1975 at the Russell Street entrance of the Science Museum.

Melbourne's Cable trams

A brief History

Cable Tramways

A cable tramway is a transport system in which wheeled vehicles are drawn over steel tracks by means of a moving cable located beneath the road surface. Power from the cable is transmitted by means of a grip.

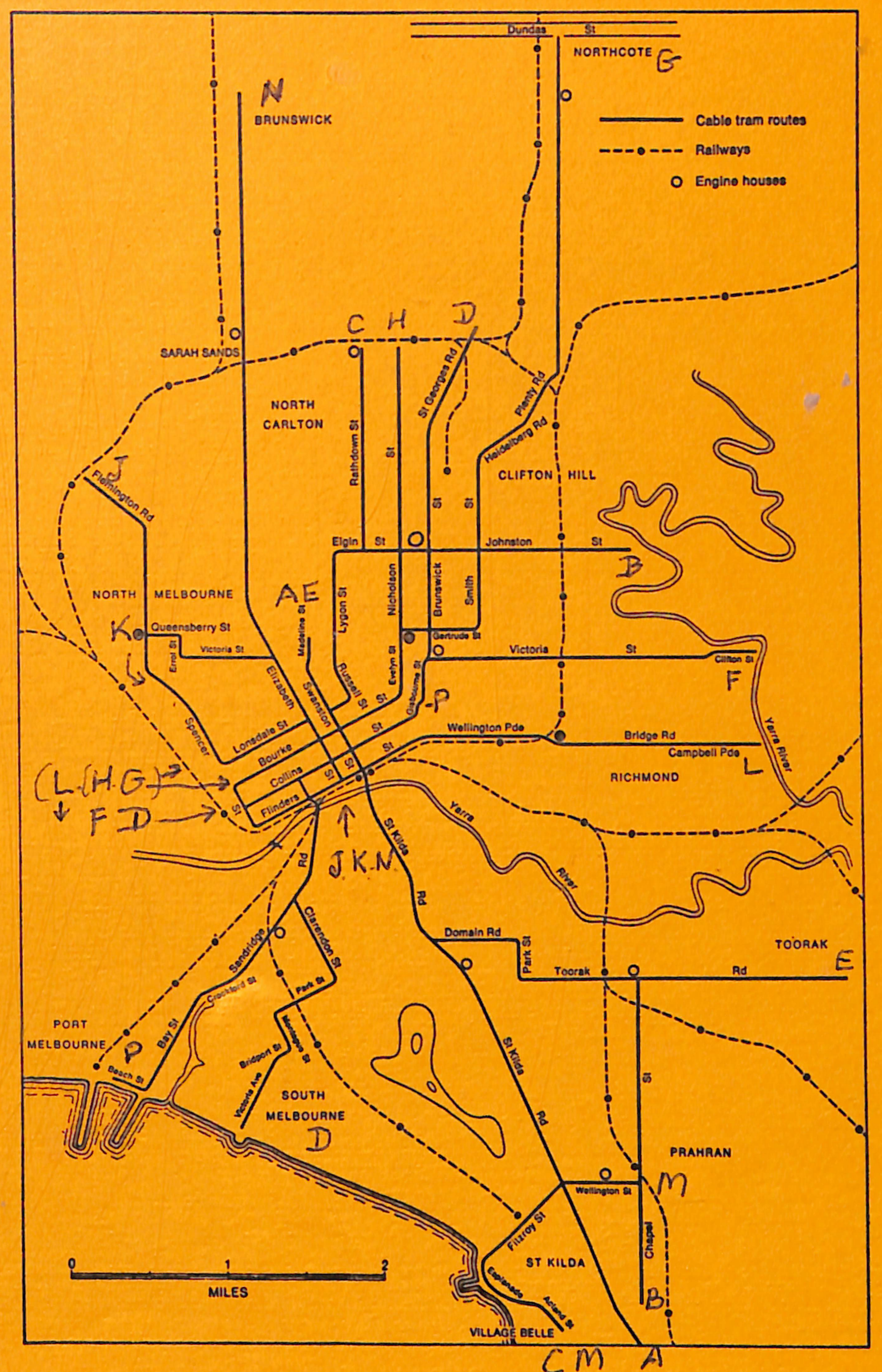
"Cable tram" is the combination of the dummy (the grip car, presumably so named as a contraction of dummy locomotive) and the car (the trailer or saloon car). Some systems elsewhere in the world utilized a single car combining grip and passenger facilities. "Grip" is the mechanism fitted to the dummy which takes hold of the cable to draw the tram along and releases it to stop or coast under the control of the gripman's lever.

"Cable" or rope is the stranded wire which runs on guide pulleys in an underground tunnel from the engine house to the end of a route and back.

The first patent for a cable and grip system was taken out in England by W.J. Curtis in 1838 but the basic principles used in all systems were contained in patents taken out in 1858 by E.S. Gardner of Philadelphia U.S.A.

The first city to build a cable tram system was San Francisco U.S.A. where the first tram ran on 1 August, 1873.

Map of Melbourne's Cable Tram System in 1901. →



Melbourne's Cable Tramways

Melbourne's cable tram system was inaugurated when this tram, No. 1, made the first passenger trip from Spencer Street Station to Richmond on 11 November, 1885. (Photograph top right). The system which became one of the largest and most complex in the world closed on 26 October, 1940 when the last tram ran in Bourke Street. (Photograph bottom right).

At its peak the system traversed 17 routes covering 100 km (62 miles). Because some routes in part shared the same streets there were only 71 km (44 miles) of streets furnished with double track.
In 1923 there were in service 592 dummy cars, 597 trailer cars and power was obtained from 12 engine houses driving 26 cables. The engine houses were normally sited about midway along a route.

In 1883 an Act of the Victorian Parliament gave power to construct tramways and the Melbourne Tramways Trust which consisted of representatives of the various municipalities concerned was set up. This Trust built the cable lines and the engine houses and leased the system to the Melbourne Tramway and Omnibus Company to operate and maintain for a period of 30 years.

Two men stand out for their contribution in making the system a success. George S. Duncan the engineer of the Trust who designed and supervised the construction, and Francis B. Clapp, Chairman of the M.T.&O. who supplied the business acumen.

In 1916, after the M.T. & O.'s lease expired, the Melbourne Tramway Board was formed to take over the assets of both the Trust and the M.T.&O., as well as the operation and maintenance of the system.

In 1918 The Melbourne and Metropolitan Tramways Board was set up as the permanent authority responsible for tramways in the metropolitan area and it took over the functions of the Melbourne Tramway Board.

Trailer 579

Power for the Cables

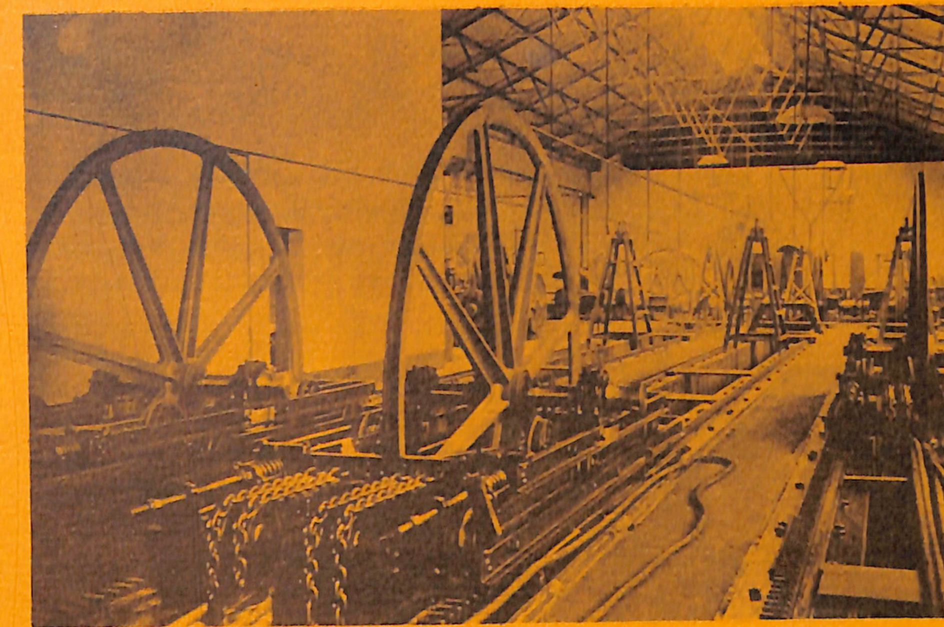
The cable tram engine houses were operated by coal-fired boilers feeding steam at 552 kPa (80 psi) to pairs of horizontal engines with cylinders 610 mm (24 inch) diameter and stroke of 1219 mm (48 inch). The engine shafts were driven at 80 rev/min but this was reduced to 27 rev/min for the main shaft on which the drive wheels were mounted.

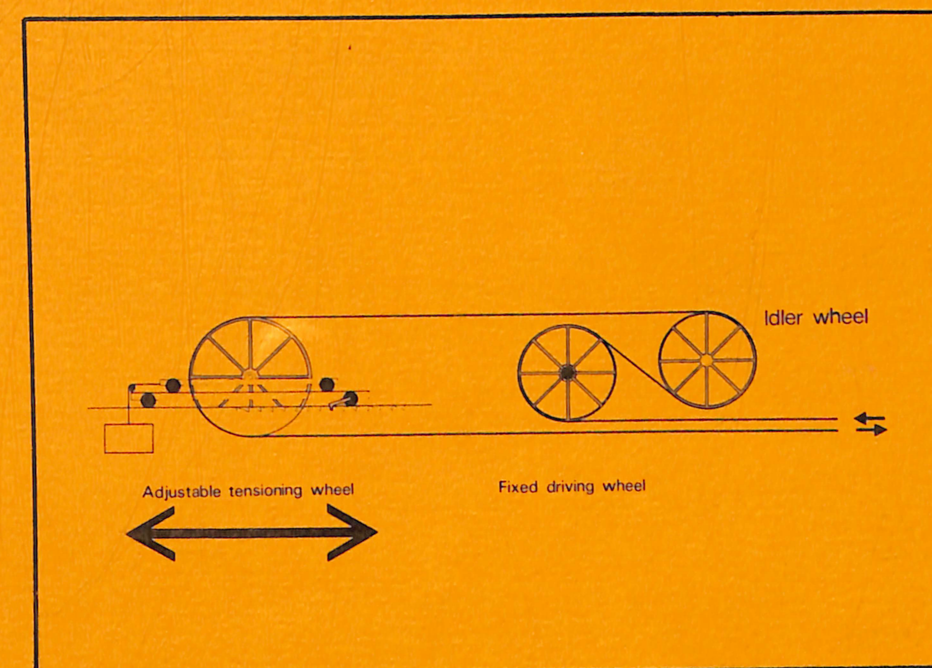
The driving wheels were 3.7 M (12 feet) in diameter with rim grooves lined with hardwood. The cable passed around a drive wheel and an idler wheel in a figure of eight fashion and then around a tensioning wheel. This combination produced sufficient friction to haul the cable and its attached trams.

The tensioning device was essential to allow for stretching of the new cable when first installed and for lengthening and slackening of the cable with temperature changes, and with the constant gripping and releasing of the cable by the trams.

The tension wheel was mounted on an upper carriage which moved to and fro against a counterweight as the tension varied. This carriage was itself mounted on a lower carriage (Photograph on right) which could be manually moved as a new cable stretched. By these two means the same tension was kept on the cable at all times. (Diagram on right)

A cable tram system has far less fluctuation in power requirements than electric and other systems of traction, even in peak loading periods. This is due to the probability of roughly half the trams on the route going down-hill, feeding back power to the cable to assist trams going up-hill.





Melbourne's Cable Trams

Tram No. 1 is one of the original twenty built in New York by John Stephenson & Company for the inauguration of the Richmond line. The dummy is 4.8 m (15 feet 10 inches) long and weighs 2.9 tonnes. The car is 6.7 m (22 feet) long and weighs 2.5 tonnes. The colour scheme is that used on the Richmond route until 1924. Prior to that year the trams on each route were sign-written and coloured for one route only and were not used on other routes. (List on right.) The adoption in 1920/24 of the uniform brown and cream colour scheme with adjustable destination signs allowed trams to be interchanged for any route.

Cable Tram No. 1 made the first trial runs on the Richmond line on 23 October, 1885, began the first passenger service on 11 November, 1885 and was taken out of service in 1940.

Lighting of the trams was originally by four oil lamps — one in front of the dummy, one in the clerestory roof above the gripman's head and one at each end of the interior of the car. The two car lights were fitted into the bulkheads and illuminated the respective platforms. By means of special glass these lamps showed the route colours at night. Oil lighting was replaced by battery-powered electric lighting in 1918.

Apart from the 20 trams made in New York all other trams on the Melbourne system were built in the Melbourne Tramway and Omnibus Company's workshops in Nicholson Street, Fitzroy.

Brunswick Victoria Bridge Prahran—Johnston Street Northcote	red
Richmond Nicholson Street	blue
North Melbourne South Melbourne St Kilda Beach—North Carlton	green
Port Melbourne (amber light) Brighton Road (amber light)	white
Toorak (white light) North Fitzroy (white light) Windsor—Esplanade (red light)	yellow
West Melbourne (white light)	brown

1 – 1½
MAY 22 1886 — Milsons Pt — St Leonards Pt
8 Grip – 4 Trailers
July 17 1893 ? — LANE COVE Rd
13 G – 23 T 2 M
1 – 8¾
18 King St Ocean St 2¾ M
23 G – 22 T
Air Brakes
33 G – 40 T

The Cable

The average cable used in the Melbourne system was slightly more than 25 mm (1 inch) in diameter. It consisted of six steel strands, each strand having seven wires, wrapped around a hemp core. Its tensile strength was 1390 MPa (90 tons per square inch).

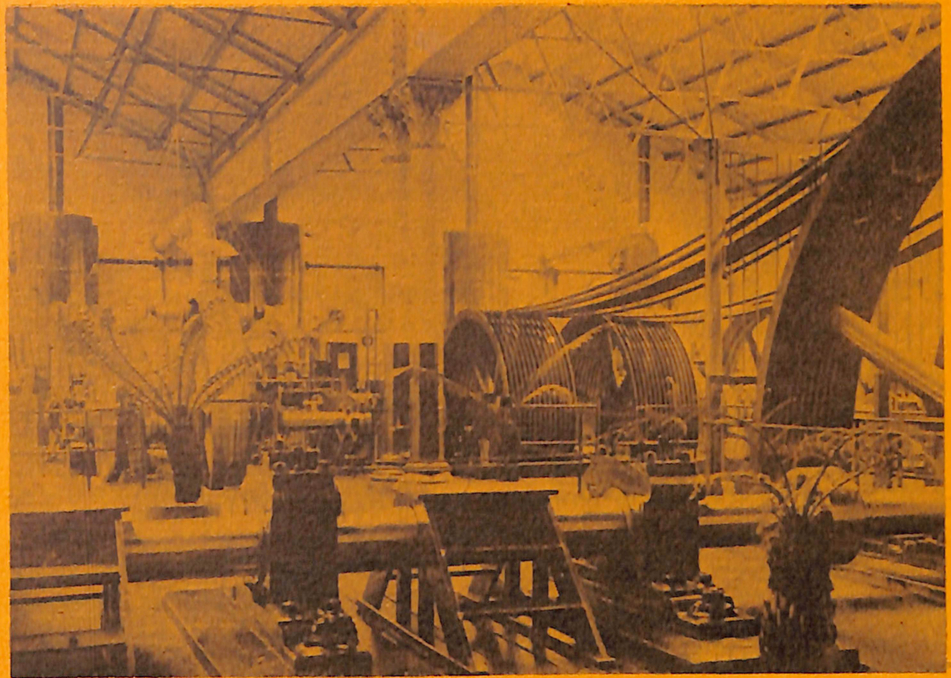
Each cable was installed as a single length, the longest in use being 9625 m (31 620 feet). The photograph (bottom right) shows a cable being transported from the wharf to the engine house. Splicing was confined to joining the two ends and the splice covered 24 m (80 feet).

The cable ran over 229 mm (9 inch) diameter vertical pulleys located in special yokes that were spaced every 10 m (33 feet) along the route. Intermediate yokes at 1.1 m (3½ feet) spacing were to hold the slot rail in place and did not have cable pulleys. The speed of the cable, and hence of the trams, was originally 13 km/h (8 m.p.h.), but this was increased several times and in 1910 was finally set at 21 km/h (13 m.p.h.).

The life of a cable was less than a year in normal use. The main wear occurred from the frequent engagement of the grip jaws and from wear on pulleys needed to bend cables around curves and corners.

At intersections one cable had to pass below the one from the opposite direction and it was essential for the gripman on one route to release the cable until the tram had coasted over the intersection when the cable was automatically fed back into the grip. At such points special devices were built below ground to smash the grip should the gripman be late in releasing the cable. The cost of repairing the grip was small in relation to the risk of damaging the cable.

Cables normally ran for 20 out of each 24 hours and were constantly inspected for damage such as frayed wires. These were repaired in the engine house in the stopped period.



Engine house, Prahran.

The Grip Mechanism

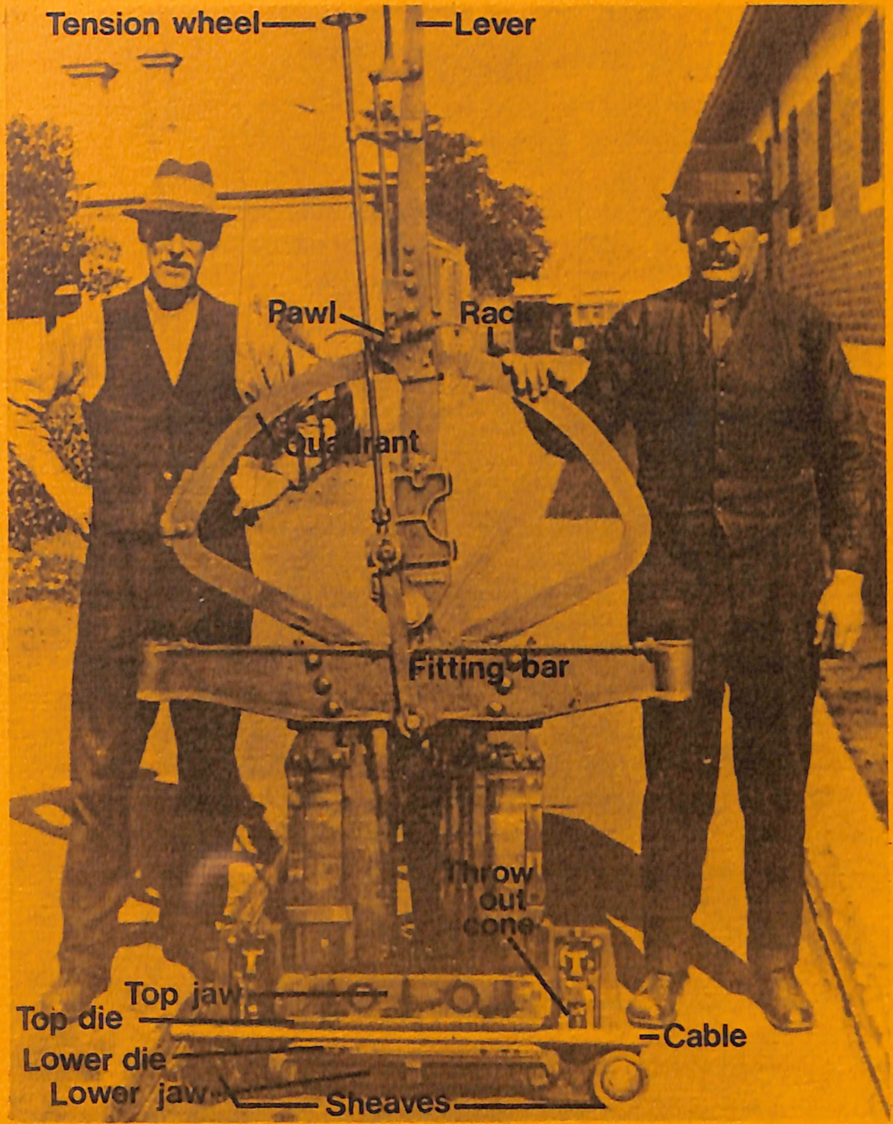
The grip is a device fitted to strong studs in the dummy and used to grip the moving cable and drive the tram.

The cable tunnel and slot through which the grip ran were exactly centred between the rails but the cable was 41 mm (1-5/8 inches) off centre. The grip was slightly L-shaped and was thus able to engage the cable from the side with its jaws in position to close vertically on the cable. The jaws were lined with dies of soft iron 483 mm (19 inches) long.

The lower jaw was part of the grip frame and was fixed in position. The upper jaw was raised or lowered by forward or back movement of the grip lever in the dummy. This lever moved over a 457 mm (18 inch) quadrant rack and was fitted with a pawl to lock it in position. Wear in the dies was compensated for by moving the top jaw down by means of a screw thread operated by a small wheel on the grip in the dummy.

It was sometimes necessary to "throw" the cable out of the grip at crossings, curves, engine houses etc. and for this purpose two cones were fitted. When the grip lever was pulled hard back a special mechanism sprang these cones sideways knocking the cable out of the jaws. The cones then returned to their normal position allowing the cable to re-enter the jaws when required.

At the start of running for the day, the cable was placed in the jaws by means of the "drum pulley". This special device was operated by lifting a handle located in a recess near the slot at shunting points. If the cable was accidentally lost during running, it could be returned to the jaws by using a special tool fitted with a hook. The cable ran freely over two sheaves at the bottom of the grip, until the jaws were closed.



Ticket Bell Punch

This device was the invention of J.H. Small, of Buffalo, U.S.A., and was first patented in 1871 as an "Improved Punching, Registering, and Alarm Apparatus for Preventing Fraud by Railway and other Ticket Collectors".

The body of the punch comprises a divided chamber for the registering, and a bell and striking mechanism; a receptacle for the ticket clippings; and a letter combination lock , to prevent access by the conductor. It also has a slot or jaw into which the ticket is inserted for punching. The punching lever or handle is hinged to the body at the opening to the jaw.

The bell is rung each time the punch is actuated, and its failure to sound indicates that the conductor has neglected to operate the punch. The registering mechanism indicates the number of times the punch has been operated whether a ticket is perforated or not. The registering movement is completed before the sounding of the bell, and before the termination of the punching movement. The punching tool remains in the ticket after the ticket has been punched, and prevents its removal until the return movement of the punching lever puts the registering and bell mechanism into position to operate again, in order that a second ticket cannot be punched without registration and sounding of the bell. A stop in the jaw of the punch prevents the punching lever from being operated until the stop is released by the insertion of a ticket.

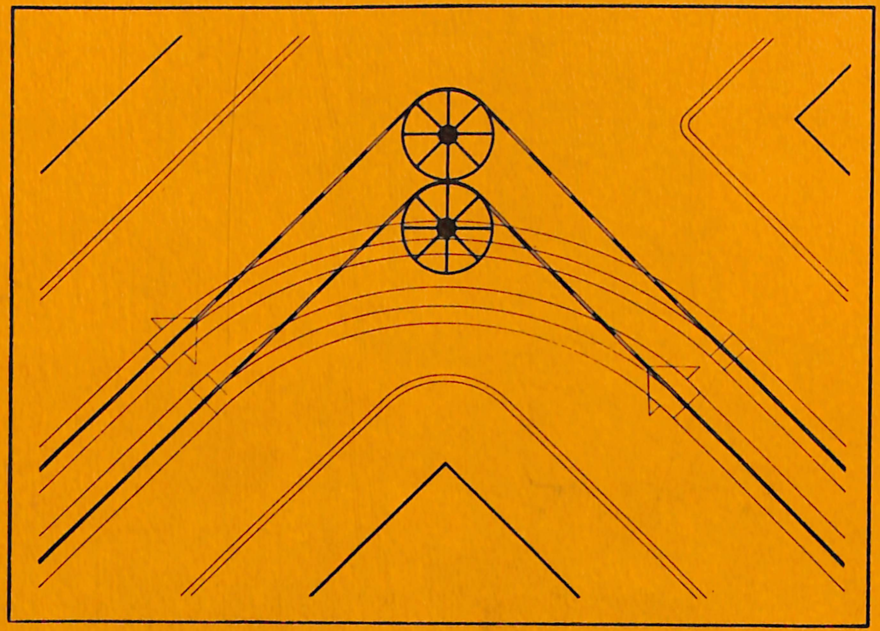
The punch was unlocked in the office when handed in by the conductor, and he was charged with the number and kinds of fares which the register and clippings indicated.

Cable Tram Gripman.

Mind the curve

When first installed the cable was made to follow curves by means of pulleys and rollers and the grip was able to hold the cable and pull the tram round the curve. The flexing of the cable at these points caused it to deteriorate rapidly.

To prolong cable life these sharp bends were eliminated by leading the cable away from the slot to pass around a single large pulley. (Diagram below). Approaching a corner the cable was thrown and the tram coasted under its own momentum. At such times the trams developed a bounding motion and unwary passengers risked being thrown off. Approaching these points the gripman gave the passengers a warning call — "MIND THE CURVE!"



Acknowledgements

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