

# SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXII.—No. 16.]  
[NEW SERIES.]

NEW YORK, APRIL 17, 1875.

[\$3.20 per Annum,  
Postage prepaid.]

## WIRE ROPE TRACTION STREET RAILWAY.

This system of street railroad, the invention of Mr. A. S. Hallidie, has been adopted by the Clay Street Hill Railroad Company, in the city of San Francisco, Cal., and is said to be adapted to all kinds of metropolitan railroading, especially where the surface of the streets has to be kept free from obstructions, where locomotive steam engines are not permitted, or where the streets are so steep as to preclude the use of horses, locomotives, or steam traction engines.

The system consists of an endless wire rope placed in a tube below the surface of the ground, between the tracks of

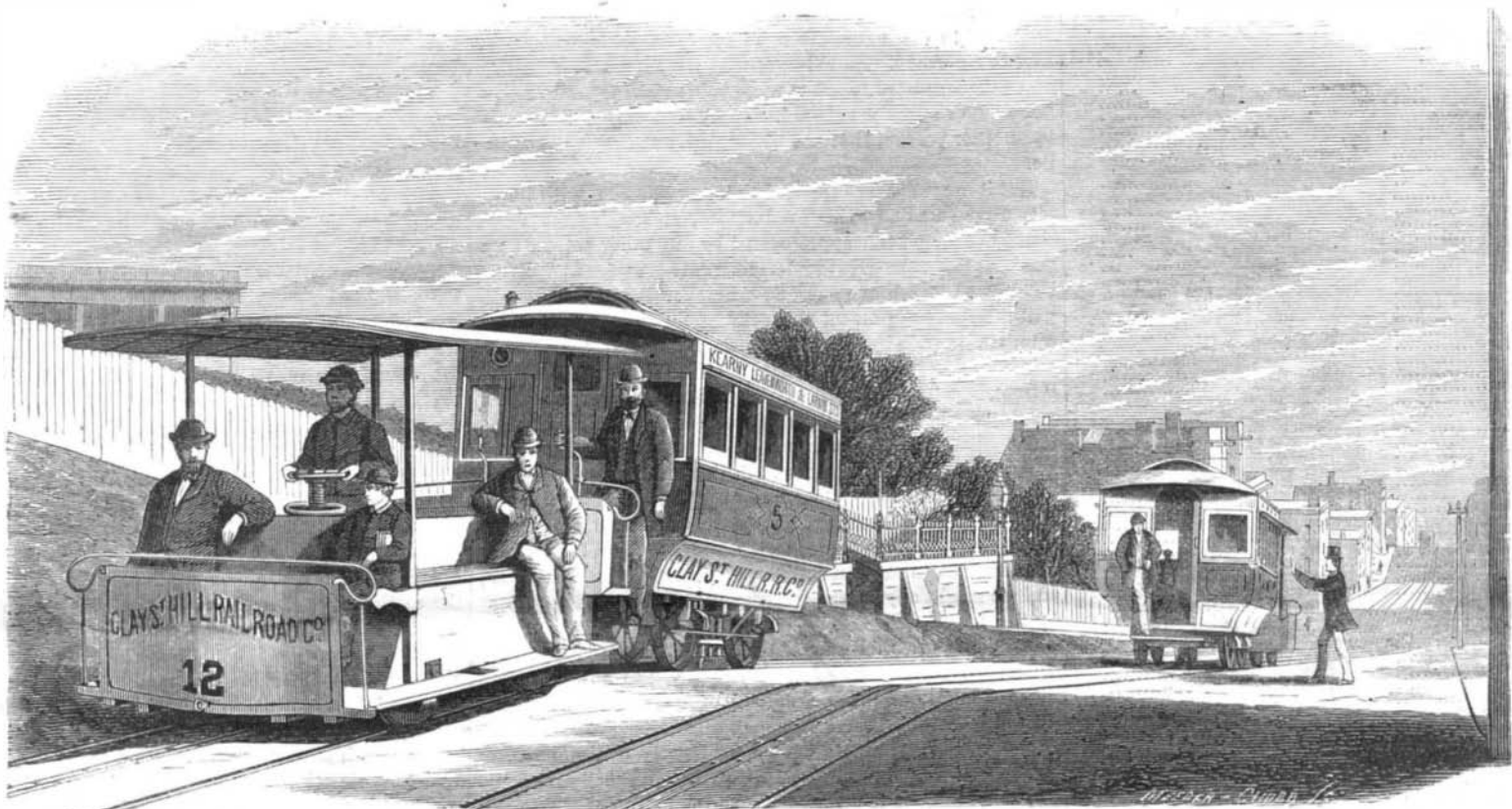
of this slide is a wedge-shaped block, which actuates two jaws, B, horizontally, which open and close according to the direction in which the slide is moved, closing when the slide is moved upwards. These jaws have pieces of soft cast iron placed in them, which are easily removed when worn out, and which are of proper shape and size inside to grip the rope when they are closed over it.

On both sides of the jaws, and attached to them, are two small sheaves, C, which are held by means of rubber cushions sufficiently in advance of the jaws to keep the rope off from them, and, at the same time, to lead it fairly between them,

trip when attached to the car, which has already been turned on the turntable.

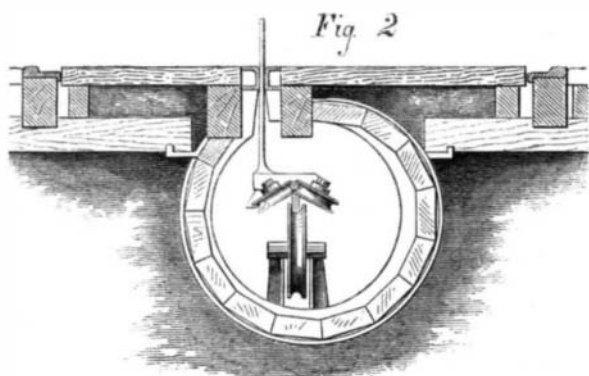
The road has a gage of 3 feet 6 inches. An ordinary 20 pound T rail is used, which is set flush with the street and presents a neat, smooth appearance. The rope runs at the rate of about four miles per hour, and the ascent is made, including stoppages, in about 11 minutes, the distance being 3,300 feet. The motive power is supplied by a steam engine of 30 horse power.

The road has run regularly since its completion in September, 1873, and during the period of one year and four



HALLIDIE'S WIRE ROPE TRACTION STREET RAILWAY

a railroad, and kept in position by means of sheaves, upon and beneath which the rope is kept in constant motion during the hours the cars are running, by a stationary engine. The power is transmitted from the motor to the rope by means of grip pulleys, and from the rope to the cars on the street by means of a gripping attachment attached to the car, which passes through a narrow slot in the upper side of the tube.



From the illustration, Fig. 1, which is prepared from a photograph of a portion of the route in San Francisco, it will be seen that the ground is exceedingly irregular. The average grade is 580 feet, and the steepest 850 feet, to the mile. The entire length of the endless rope operated, which is of steel wire, three inches in circumference, is 6,800 feet, and the line is supported in the iron tubes, every 39 feet, on 11 inch sheaves. Other sheaves hold up the rope in turning angles, etc. By referring to Fig. 2, which shows a cross section of the tube, will be seen the opening or slot, seven eighths of an inch wide, in the upper side of the tube, which enables the foot of the gripping attachment to pass by and under the upper sheaves and over the lower sheaves. This attachment is shown in Figs. 3 and 4.

Fig. 3 shows a perspective view of the attachment from above, and Fig. 4 represents the wheel by which it is operated. A vertical slide, A, works in a standard, and is moved up and down by a screw and hand wheel. This screw is shown on the dummy, Fig. 1. The small upper screw, going down through the large screw, operates it. At the lower end

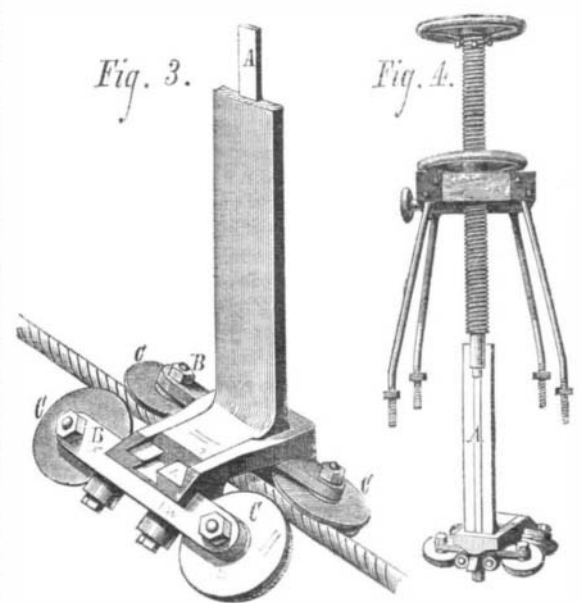
allowing it to travel freely between without touching them. When it is required to grip the rope, the slide is drawn up by means of the small screw before described, and the wedge at the lower end closes the jaws over the rope, at the same time forcing back the small guide sheaves on to the rubber cushions.

The standard containing the slide, etc., is inclosed in a cast iron bracket, and raised and lowered bodily through an opening in the tube from above the surface of the street to the rope in the tube by means of a worm and nut or rack and pinion. The dummy is coupled to the passenger cars, at the bottom of the incline, and uncoupled at the top, and vice versa, horses then being coupled to the car for the level road. In order to stop the car, the jaws of the gripping attachment are opened slightly; when they release the rope, the guide sheaves take it, and the car stops. All the essential working and wearing parts of the gripping attachment are made of steel.

The turntable at the foot of the incline is double. The available space at this point was very limited; and in view of this, some ingenuity had to be employed. When the traction car reaches the foot of the incline, it is uncoupled from the car, and run on a turntable, the slot in the turntable allowing the shank of the grip to pass down freely. The table is then turned around one quarter of its circumference, and the track and slots are then brought in the same line: The traction car is then run on a second table, which is turned back, and the traction car is run on the up track. The car is then transferred in the same manner and coupled to the traction car, ready for the ascent. This course is necessary, as there are double tracks; and the traveling wire rope runs down beneath one pair and up under the other. As the gripping attachment passes down under the street through the slot, it is necessary to have a slot in each turntable, to allow the traction car to be turned.

The method adopted at the upper end of the road is more simple. A turnout is made for the car, and it runs down to a common single turntable. The dummy is turned as follows: A circular table connects both tracks, with a slot described around a center. A small iron triangle connects the dummy at two points with the center of the slot and tube. By pushing on the dummy, the center of this triangle being held in position by appropriate means, the dummy turns around in a very small circle, and is ready for the return

months its actual running expenses per day, including wear and tear, and interest on cost at 15 per cent per annum, are estimated at \$123.



Companies or persons desiring to negotiate for the use of the foregoing system, or construction of similar lines, can communicate with the patentee, A. S. Hallidie, President of the Mechanics' Institute, 113 Pine street, San Francisco, Cal.

## New Process of Engraving on Copper.

The hydrographic office at Paris has begun a process of engraving on copper which promises, by its rapidity and the moderation of its price, to be very widely useful. It consists in substance, first, in covering a plate of copper with a thin shell of adhering silver, upon which is spread a thin layer of colored varnish; second, in drawing thereon, with a dry point, the lines of topography, and lettering, precisely as one engraves with a diamond upon stone; third, in corroding the traced parts by means of the perchloride of iron.