From one lever in the interlocking machine there is a pipe connection run to a slide in the selector box; in this box there are a number of arms, one for each signal to be operated, which are connected directly to the signals. These arms are raised or lowered by connections running from the pipe lines to the switches which are to be signaled; the reversing of the switches automatically changing the arms in the box. When a route is set up, all of the arms are held up except the one attached to the particular signal for that route, which is down; and when the signal lever is pulled the slide engages the arm that is down and pulls the signal clear; there is a back wire to each signal which is attached around a wheel to the box, and pulls the signal back to danger. There is no limit to which this can be carried, but it requires careful attention in adjustment or it will cause delay, and more than two way selectors are not advisable.

SLOTTED SIGNALS.

It sometimes happens that two interlocking towers are located so close together that some of the signals are made common to both towers; that is, the clearing of certain signals is made dependent upon the joint action of both sets of operators. This is accomplished through what is known as the mechanical slot (Fig. 15). (There is also an "electric slot" that accomplishes the same purpose.) The mechanical slot is an iron frame which is arranged to slide through a casting fastened to the post below the signal arm. From the top of the frame there is a rod connected to the signal. Running into the bottom of the frame are two arms, the ends of which are beveled toward the center, each of the arms being attached to a separate balance lever. The front and back signal wires are attached to these balance levers, and one set of wires runs to each tower. Resting on the top of the two arms in the frame is an iron disk, which is free to roll from the top of one arm onto the other. This disk is directly under the top of the frame. If one of the arms is pushed up into the frame, it rolls this disk over the top of the other arm and slides past it, but when the second arm is pushed up it cannot roll the disk away, so that it pushes the frame up with it, and this pushes

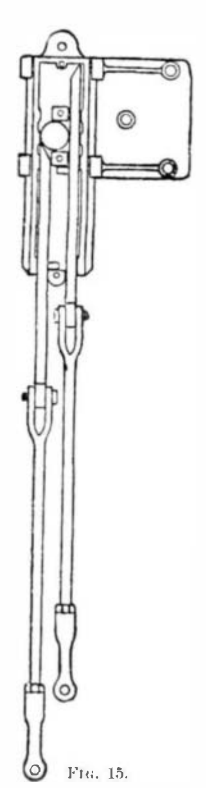


FIG. 15.

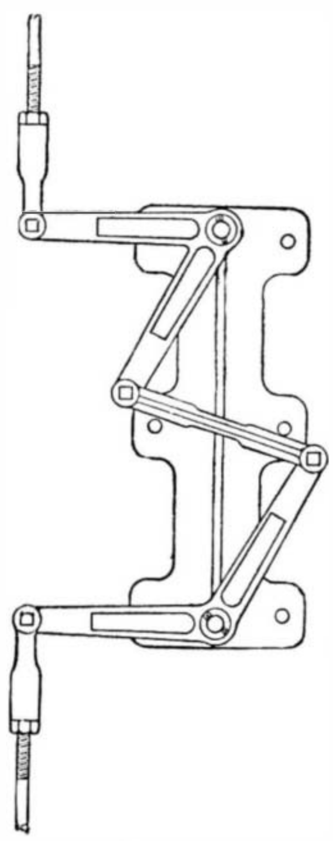


FIG. 16.

the signal clear. Either arm may be first withdrawn, and the first one will throw the signal back to danger.

COMPENSATORS.

One of the first things for the engineer to take into his calculations when using iron or steel for erecting purposes is nature's law of expansion and contraction. A piece of metal will expand or contract in direct ratio to its length for each degree of change in temperature; this must be taken care of in the pipe and wire lines. Pipe lines will expand about 84-100 of an inch in each one hundred feet for each one hundred degrees (F.) increase of temperature. This expansion is taken care of by placing a compensator in each pipe line half way between the tower and switch or signal. This can be done by placing a straight bar, pivoted in the center, on a suitable foundation, and connecting half of the pipe line that runs to the tower to one end, and the other half of the pipe line that runs to the switch or signal to the other end; as each half will expand or contract equally, the bar will move on its center, and as the end of the pipe line is a fixed point at the machine lever, the switch or signal end must also be a fixed point. This form of compensator has a very serious objection, as it throws the connections out of line. To overcome this objection the lazy jack compensator was invented, which accomplishes the same purpose as the straight bar but does not throw the pipe out of line. The lazy jack compensator consists of two bell cranks (Fig. 16), one having an angle of 60 degrees and one an angle of 120 degrees, placed on a suitable bed plate, the two cranks being connected together by a link. The free end of one crank is connected to the line which runs to the tower, and the free end of the other crank is connected to the line which runs to the switch. As the stroke from the lever to the switch is transmitted through the compensators, the motion is reversed; that is, a pull by the lever gives a thrust at the switch, and vice versa. The compensation of pipe lines gives no trouble, but of all the wire compensators so far introduced not one has given satisfaction.

(To be continued.)

## BRIGHTON AND ROTTINGDEAN TRAMWAY.

THE following is a brief description of this line, which is now causing a considerable amount of discussion on the Brighton Town Council.

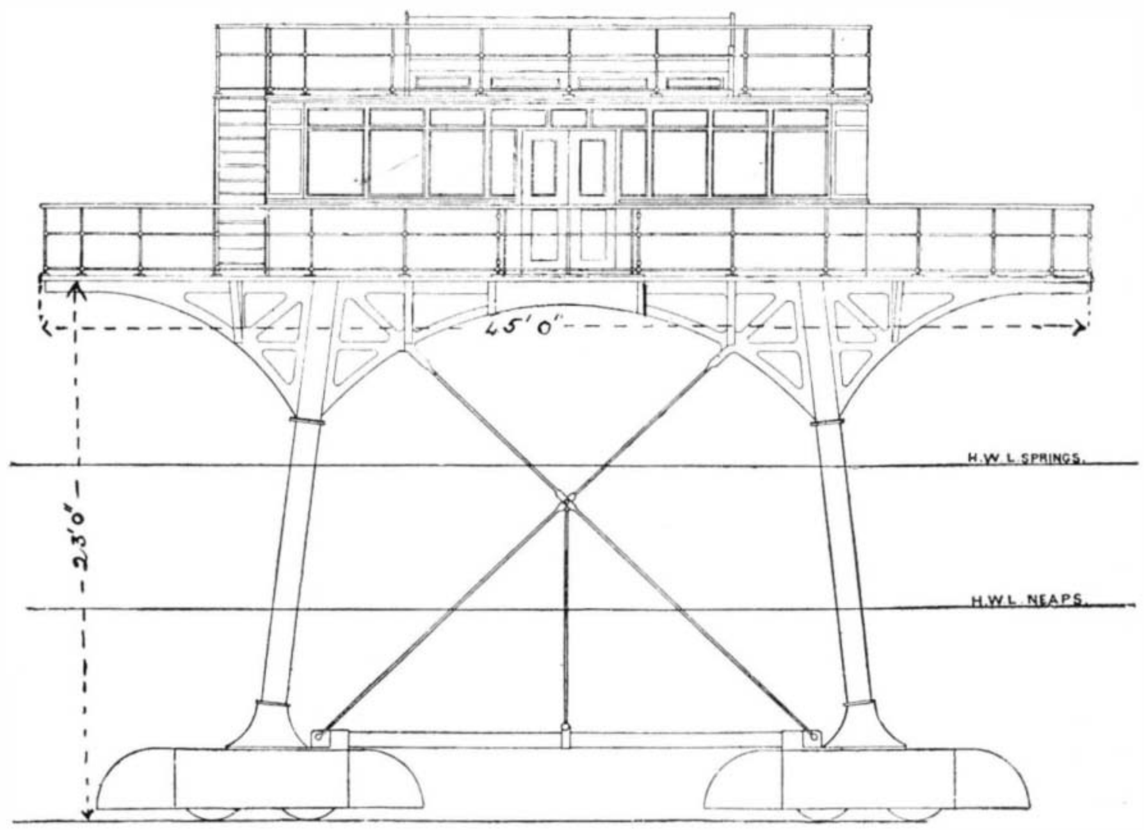
The line commences at the eastern end of the electric railway, Brighton, and extends a distance of three miles to the village of Rottingdean, a favorite summer resort.

Here a small iron pier has been erected for the cars to run alongside; the pier is available for steamer traffic and promenading. At the Brighton end of the line an iron jetty has been erected, and a building containing commodious waiting rooms and offices has been erected on it. The rails are laid on concrete blocks (made in situ) spaced about 3 ft. apart, mortised into the sound rock, the height of the blocks varying with the irregularities of the shore. A shifting sand of very moderate depth covers the rock in places; the rails, however, have been laid sufficiently high to prevent any trouble from accumulations on the rails. The steepest gradient is 1 in 300 and the radius of curves 40 chains.

The line consists of four rails (54 lb. per yard) laid as two tracks of 2 ft. 8½ in. in gage, spaced 18 ft. between outer rails, thus giving an effective gage of 18 ft. This is rendered necessary to give the required stability to the cars. The rails are secured by steel clips and bolts, the latter being embedded in concrete; oak blocks, through which the bolts pass, being placed between the rails and the concrete blocks. Tie rods are also used every 10 ft. on the straight and every 5 ft. on the curves; heavy angle fishplates are used for the rail joints; the rails are in 30 ft. lengths.

The depth of water over the rails at high tide is about 15 ft. Although the most violent gales experienced for many years occurred during the winter of 1894-95, no damage whatever was done to the permanent way; so the fact that it possesses ample strength to resist the force of the sea has been demonstrated in a satisfactory manner, and no accumulation of seaweed, etc., has taken place at any time. The line is now practically completed, but the work, being tidal, has been greatly delayed by bad weather.

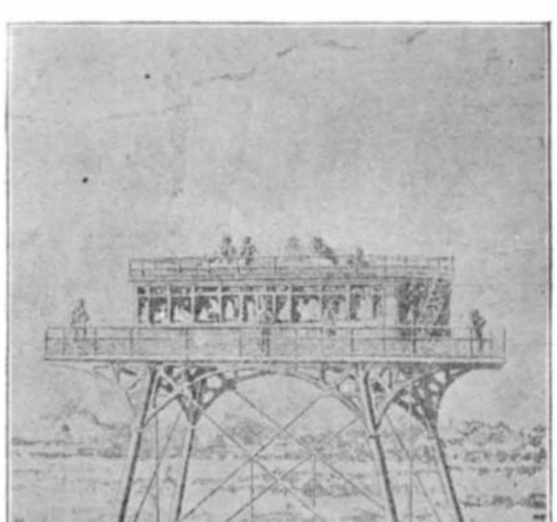
The car, which has been built by the Gloucester Railway Carriage Company, is a structure carried on 16 wheels, 33 in. in diameter. The main deck for the passengers is at a height of 24 ft. above the level of the rails. The four main legs are tubes of drawn steel, 11 in. in diameter. At the bottom of each leg is placed a bogie truck having four wheels, the outside of the bogie being shaped like an inverted double ended boat, to facilitate its passage through the water, and also to remove any obstructions from the rails. The four bogies are firmly held together by steel tubular struts. The wheel base, about 28 ft. long, and the effective gage, 18 ft., give great stability to the car. The tops of the main legs are firmly built into lattice girder work carrying the deck, and the whole structure is firmly secured by cross ties. It is of great strength, although offering but a small surface to the force of the waves. The main deck appurtenances and erections are carried out exactly as if for a steam yacht. The deck measures 50 ft. by 22 ft., the railings round the deck being of iron with a wooden top rail and wire netting. The center space of the deck is occupied by the saloon, a structure 12 ft. wide by 25 ft. long. The roof of the saloon is railed round and forms a promenade deck, seats being placed over the glass dome and over the center of the saloon. On this upper deck will be placed the controlling apparatus for driving and stopping the car. As the journey, in short, will be undertaken more for the sea air than for quickly making the trip, it is proposed to keep the speed between six and eight miles an hour.



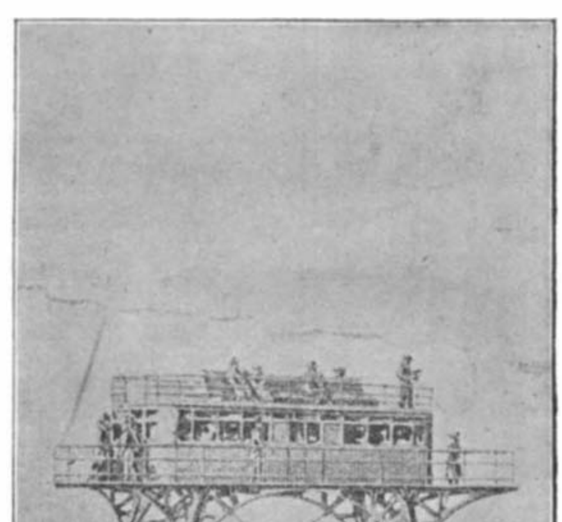

SEASHORE CAR.

The driving machinery will consist of two 30 h.p. electric motors placed vertically over two of the main legs, one on each side of the car, the shafting being carried down inside and communicating with toothed gearing which actuates the wheels. The brakes are worked by rods passing down the remaining two legs.

The current, at 500 volts, will be conveyed to the car by means of a trolley pole overhead.—Electrical Engineer, London.



AT LOW TIDE.



AT HIGH TIDE.