THE MEIGS ELEVATED RAILWAY.

The roadbed and rolling stock of the railroad of to-day have reached their high standard through the labors of countless ingenious and persevering inventors, each of whom has added his link to make the chain more perfect; even the smallest detail shows the combined talent of many industrious workers, one taking it up, advancing it a step, and then giving place to another. It therefore seems peculiar to be called upon to describe a new method of railroading designed as a whole by one man—a new railroad from the ballast to the top of the smokestack, from the pilot to the coupler on the last car.

The system herewith illustrated is the invention of Mr. Joe V. Meigs, of Lowell, Mass., and has been tested under conditions far more exacting than would be found in actual practice. The road is not a model, but a full-sized elevated railroad in every respect. This was made necessary by a section in the act of the Massachusetts Legislature authorizing the incorporation of the Meigs Elevated Railway Company, which states that "no location for tracks shall be petitioned for in the city of Boston until at least one mile of the road has been built and operated, nor until the safety and strength of the structure and the rolling stock and motive power shall have been examined and approved by the board of railroad commissioners or by a competent engineer to be appointed by them." To fully demonstrate the possibilities of the road under widely varying circumstances, the company has built tracks of several kinds—wooden way of the cheapest possible kind; wooden way following the contour of the earth; wooden way with level grade secured by varying the heights of the posts; wooden way with very short curves and steep grades; and iron way upon high grades, increasing in height until a level of 14 feet in the clear above the earth was secured. The trial road, beginning at the shops of the company on Bridge St., East Cambridge, has one curve of 50 feet radius, 165 feet long, on a grade of 120 feet, and on level and curves has grades of 240 feet, 300 feet, and 345 feet. So far everything has worked in the most satisfactory manner, the train rounding the exceedingly sharp curves easily, and mounting the steep grades without trouble.

The peculiar features of this road, wherein it differs most essentially from the ordinary railroad, are the way, switch, trucks, passenger cars, engine, drawbar, and brakes.

The posts for an iron way are made up of two channel bars united by two plates, thereby forming a box-like structure whose cross section may be varied as demanded by location. The posts are to be placed upon foundations, the plans of which vary to suit the character of the material that may be encountered.

The way upon which the train runs consists of a single iron girder 4 feet in depth for each span, placed over the center line of the posts. The girder carries an upper track beam and a lower track beam, upon the sides of each of which the rails, four in number, are placed. The two bearing rails, which carry the load of the train, consist of angle irons placed upon the outer upper edge of wooden stringers upon the lower track beam. These stringers are placed in the exterior recesses formed by two channel bars properly secured to the sides of the posts. These rails are fastened to each other, to the stringers, and to the track beam by bolts passing clear through. Two vertically placed rails for the balancing or friction wheels are carried by the upper track beam. The distance from out to out between the lower rails is 22½ inches, this being sufficient to insure the necessary transverse stiffness. This is the gauge of the road. The distance between the upper rails is 17½ inches. It is expected to adopt the common form of rail, beveling the edges of the lower stringers and placing the rail at an angle of about 45 degrees. In our engraving, the rails are in the form of a right angle, and the treads of the wheels are made with a corresponding right angle groove. The usual length of post, 24 feet, would give a clear headway of 14 feet, 4 feet being taken up by the truss and 6 feet forming the foundation

The switch is formed of a single swinging section turning upon a hinge of great strength attached to one of the posts. A movement of four or five feet by the free end of the switch is enough to permit the cars and trucks on one track to clear the end of the other track. The free end travels upon a carriage provided with rollers moving upon a supporting rail. Suitable mechanism is provided for operating the switch and locking it in place.

The truck is a development of the conditions controlling the adoption of the permanent way. It consists of a horizontal rectangular wrought iron frame, stiffened by cast iron pieces and provided with stiff pedestals bolted to its under side, in which is a fixed short axle for the wheels. Each truck has four wheels set at an angle of about 45 degrees, the axles being properly inclined. Between the supporting wheels are two horizontal wheels, one on each side of the upper girder, upon vertical axles attached to the frame; these wheels bear upon the rails of the upper truck beam, and are kept in yielding contact with the rails by springs outside the boxes, and serve as balancing wheels to take the side oscillations of the cars. They are formed with flanges that pass under the lower edges of the rails, thus tying the truck to the rails, so that no lifting or jumping can take place, and there is no possibility of the trucks running off the track. The wheels are 42 inches in diameter, have a tread of 3½ inches, and rotate independently of each other. In case any or all of the wheels should break, provision is made to prevent the cars from overturning or leaving the track, by means of a strong shoe, which would slide upon but could not leave the way. On top of the truck frame is a movable iron frame carrying four posts containing heavy spiral springs. These posts interlock with similar spring sockets bolted to the framing of the floor of the car, which is directly above the truck and within 18 inches of the top of the girder. The truck is guided in turning by a center pin, and is securely tied to the car body, as the horizontal flanges of its frame castings overlap the rim of the upper turntable. In passing curves and switches, the trucks turn upon the balancing wheels, placed centrally between the supporting wheels, which are 4 feet apart.

It has been found that, by reason of the independent motion of all the truck wheels, curves are followed so closely that practically the increase of friction of the cars upon curves even as small as 50 feet radius is too slight to be noticed or measured by weighing in a model one-eighth full size. This construction of the trucks also admits of a car 50 feet long turning from a street only 28 feet wide into another of the same width.

The cars possess many novel features, both outside and inside. The circular section and rounded ends admit of the strongest possible construction without an overweight of material. The floor consists of a platform made of 5 inch channel beams, and is 7½ feet wide by 51 feet 2 inches long. The framing of the body is of light T iron ribs, bent in a circle, filled in by panels covered with rich upholstering, which covers all the interior; the exterior is sheathed with paper and copper. The cylindical portion is 10 feet 8½ inches in diameter. While adding to the strength, this form is expected to diminish the wind resistance fully one-third. The interior of the car, as shown in Fig. 1, is light, roomy, and pleasing to the eye. The seats are upholstered like the rest of the car, and comfort and luxury have been carefully studied in every detail. At each window is a specially designed device for securing ventilation without the annoyance caused by dust. There is an entire absence of sharp corners, so that, in case of a serious accident, the liability of the passenger being greatly injured is largely avoided.

The locomotive consists of a platform car supported upon a truck at either end and housed like the passenger car. The floor is 7½ ft. wide by 29¼ ft. in extreme length; the tender is 25⅝ ft. long, has a tank and bin for the water and coal, besides additional room which may be used for other purposes. Upon the floor of the engine are, in effect, two complete stationary engines, each connected with a single driving wheel. The boiler is of the locomotive type, is 60 in. in diameter, 15 ft. in length, and is placed over the engines, its center line being 61 inches above the floor. There are 200 tubes, 2 in. in diameter and 7 ft. long; the grate is 4½ ft. square. The crown sheet is arched in shape, and is inclined downward at the back end to allow of climbing and descending grades equal to 800 feet to the mile without exposing any uncovered part to the fire. The cylinders are 12 by 22 in., and their center lines are placed 18 in. above the floor and 61 in. apart. The piston rods connect with independent crossheads sliding upon steel girders supported at their ends by standards bolted to the floor beams.

The driving wheels are 44·6 in. in diameter, flanged upon their lower edge like the balance wheels of the trucks, and are mounted upon steel axles 6 in. in diameter, which extend through a sliding box containing the journals. The boxes slide in cast iron ways placed at right angle to the line of the engine, and each axle has a crank keyed upon its upper end. The well known slotted yoke connection is used. The slide valves are of the usual locomotive form. The links are placed in a horizontal instead of a vertical position, and are operated by two bell cranks. The throttle valve, link rod, brake, and coupling rods, and the connection between the driving boxes for producing pressure against the rails, are operated by hydraulic power, although hand levers are also provided.

Adhesion of the driving wheels to the rails is obtained by means of a cylinder and piston secured to the sliding boxes. The engineer is on an elevated platform in the front part of the engine, the fireman being at the rear end. The former has an unobstructed view through the windows of the monitor roof, and before him are five hydraulic cocks, which control the throttle, links, sliding boxes of the driving wheels, the brake, and the coupling rods of the entire train, while just above are steam and hydraulic pressure gauges and indicators, whistle and bell ropes, etc. With an engine thus furnished with provisions for griping the rails, steep grades become of minor importance, as the steepest possible can be ascended if the requisite power is provided.

One turn of the cock controlling the couplings divides the train into segments of separate cars, each of which has a brake which acts automatically upon detachment from the train. This partially destroys the momentum of the whole, and a collision could only take place by a succession of comparatively light blows from the engine and slowing sections of the train, instead of by a single blow with the momentum of the whole train.

The brakes are operated upon the balancing wheels of the trucks, but they may also be fitted upon the supporting wheels. The action of the brakes is well illustrated by rails between the rolls of a rolling mill, except that the action is reversed. It is apparent that no slipping of the wheels can take place, no matter what pressure may be brought to bear upon them.

In the illustration, Fig. 2 is a plan view of a train on a sharp curve, Fig. 3 is an end view of the track and engine, Fig. 4 is a section through tender and track, and Fig. 5 is a section through the car.

From the foregoing it will be seen that this system is as applicable for surface as for elevated railroads. It may be more cheaply built than the ordinary road, as the construction of the rolling stock allows the contour of the ground to be more closely followed. As an elevated road in cities, the permanent structure presents far less obstruction to light and air than the usual form. The center of gravity of the cars and engine is brought as low as possible, thereby lessening the effect of leverage caused by wind pressure. The smooth, even surface of the exterior of the entire train serves to decrease the resistance to the wind, and permits a high rate of speed.

The Salt Mines of Nevada.

If the salt formations of Nevada were in railroad communication, there would be no market in this country for the foreign article. In Lincoln county, on the Rio Virgin, there is a deposit of pure rock salt which is exposed for a length of two miles, a width of half a mile, and is of unknown depth. In places, canons are cut through it to a depth of 60 feet. It is of ancient formation, being covered in some places by basaltic rock and volcanic tufa. The deposit has been traced on the surface for a distance of nine miles. It is so solid that it must be blasted like rock, and so pure and transparent that print can be read through blocks of it a foot thick. At Sand Springs, Churchill county, there is a deposit of rock salt 14 feet in depth, free from any particle of foreign substance, which can be quarried at the rate of five tons a day to the man. The great Humboldt salt field is about fifteen miles long by six wide.

When the summer heats have evaporated the surface water, salt to the depth of several inches may be scraped up, and underneath is a stratum of pure rock salt of unknown depth. Soda, borax, and other valuable minerals also exist in large quantities near these localities, and branch railroads will sooner or later bring them into market. A considerable business in gathering borax is already established on the line of the Carson & Colorado Railroad. If Nevada will cut down her working expenses and develop her natural resources, she will be above the necessity of seeking land grants from her neighbors or from the general government.—*San Francisco Bulletin.*

The Effect of Heat on Metal.

Everybody, observes one of our contemporaries, who has used the Brooklyn Bridge, must have noticed the overlapping slides at the middle of each span that allow the structure to grow short or long as the weather is cold or hot, and the marks thereon that indicate a distance of several feet between the extremes of contraction and expansion. Yet few suspect that the bridge contracts or expands sideways from the heat of the sun, though the degree is so small as to be almost imperceptible, and not nearly so great as if the bridge ran north and south. The same phenomenon has been noticed of late in structures of stone and iron. The Washington Monument leans to the east in the morning and to the west in the afternoon. A plummet line suspended in the interior of the dome of the Capitol at Washington was found by actual measurement to swing over a space of 4¼ inches, making a total dip from the perpendicular of 8½ inches. This movement involves the entire dome. Some years ago a learned monk in Rome suspended a plummet in this way from the top of the dome in St. Peter's, and was astonished to find this mysterious movement. He attributed it to a third and undiscovered motion of the earth, but it was afterward explained as the effect of the action of the sun on the metal of the dome.

REFERRING to our navy, a daily paper reports the Atlantic Squadron as being under sealed orders to proceed to the scene of the recent fishery troubles. It is further facetiously remarked that the fishermen will protect the navy while upon the excursion.