RAILROAD CONSTRUCTION IN OLD AND MODERN TIMES.

An exceedingly interesting exhibit at the World's Columbian Exhibition was contributed by the George-Mary Mining Co., of Osnabruck, Germany. This interesting collection represents different specimens of road and railroad construction, from the most primitive form of early times to the highest perfection of the modern steel rail. The articles, most of which were real samples, and some of which were in part or wholly reproductions, were taken from the Museum of Permanent Way, which is one of the institutions of Osnabruck. This museum owes its foundation to the fact that the company named above has for many years been identified with the railroad interests of the world, and had the requisite enterprise and enlightenment to organize this most interesting collection.

In point of time the earliest age of transit is represented by the plankroad (Fig. 1), the "Pontes Longi," or "long bridges," described by the Roman historian Tacitus. This exhibit is an actual piece of a road laid about the fifth year of the Christian era, by Domitius. It was 10½ miles long, over a marsh called Dievenmoor, near Osnabruck. It is now covered with six feet of peat and moss. It was excavated in 1892. It is to some extent the predecessor of our modern plank roads. It will be noticed how the planks are split out radially from the trunk. It is said that after exhumation it had to be dried in the dark to prevent it from falling to fragments.

This structure, laid on longitudinal sleepers, and not intended so much for wheeled vehicles as for horse and infantry, is followed (Fig. 2) by a primitive wooden railroad or tramway. Here we have wooden rails simply spiked down on wooden sleepers. Later improvements consisted in "gaining" the rails into the sleepers, so as to prevent spreading, and in facing the tops of the rails with a strip of hard wood easily replaceable or with a plate of iron. To a coal mine proprietor named Beaumont, of Northumberland, the construction with sleepers is attributed, in the year 1630. The example shown is from the Apostle mine, Transylvania. Simple plank laid without sleepers antedate this construction.

In England the spiking down of the plate of iron upon the wooden rails was termed "plating" the rail. Here we find the origin of the word "platelayer," still used in England to denote men who lay rails on the sleepers.

The next cut (Fig. 3) is an early example of iron railroad work, constructed by B. J. Curr, in Wales, in 1800. The rail is of angle iron section, with fish-bellied flange, and is supported at its joints on rough stones about two square feet in area and about eight inches thick. The rails were a yard long. The spikes were driven into wooden dowels set into holes drilled in the stone. This primitive road ran from Merthyr-Tydvil to Aberdare Junction. In 1804 Richard Trevithick experimented with an unsuccessful locomotive engine on this road.

The form of cast iron rail shown in Fig. 4 is of more modern section. It dates back to 1789, its constructor bearing the name of Jessop. The ends of the bottom flange were enlarged to give a better support. Each rail was between three and four feet long. This exhibit was a model, no original being obtainable.

Still keeping to stone sleepers, we see in Fig. 5 a very curious rail laid by George Stephenson for the Stockton-Darlington line in 1825. This is a forged and rolled rail, attributed, as regards its construction, to a metallurgist named Berkinshaw. It was laid on cut stone sleepers with cast iron chairs. The rail was fish-bellied between the sleepers, and had a slight foot-flange of fish-belly type. This railroad employed other kinds of rails also. It was the first line worked by locomotives. Stephenson here fastened the chairs directly by wooden treenails driven into holes drilled in the stone. The rails were fifteen feet long. A species of spike passing transversely through the web secured the rail to the chairs. This construction furnishes one of the earliest examples of the chair in railroad construction.

Next we are introduced (Fig. 6) to the transverse tie or sleeper of wood, which not only supported the rails, but also held them laterally so as to prevent spreading. We also see an early example of the fish plate. Between the wooden ties stone sleepers are seen, their use being abandoned with reluctance. The rail was spiked down by dog-headed spikes, dowels being employed for the stone sleepers. A line of this construction was laid on the Bavarian state railroad as late as 1866.

The United States supplies the example shown in the cut (Fig. 7) from the Georgia Central Railroad, referred to 1851. A series of transverse sleepers carry longitudinal sleepers which are sometimes gained into the transverse ones and sometimes rest on their upper surface. The rail of wrought iron was of rebated section, so that the head of the spike was below the tread. The sleepers of the upper and lower sets were fastened to each other by treenails. The peculiar hooked or bent plate used at the joints is indicated in the cut. Sometimes the end of the rail sprung up and pierced the floor of the car. This accident was termed a "snake-head." This system at one time was in extensive use in America.

Fig. 8 shows a rail construction used on the Great Western Railway of England under K. J. Brunel, about 1850. Here the longitudinal sleepers carry the rail. As late as 1889 there were about 1,000 miles of longitudinal sleeper construction still in use. The cross sleepers merely held the rails from spreading, a strap being used to hold the two sets of sleepers together. The peculiar section of rail with the chair securing alignment of the joints is to be noted.

In Fig. 9 we see an example of the double-headed rail from the Bombay, Baroda, and Central India Railroad, referred to the year 1852. The constructing engineer was W. Bridges Adams. The distinguishing peculiarity of this system was the use of double longitudinal sleepers, running along with the rail, and between which the rail was held by bolts passing through the web of the rail and the wood on each side. The bolts had no heads, were slotted at each end, and wedge-shaped keys were driven into the slots. Transverse sleepers were used to prevent spreading.

In Fig. 10 we have an example of German practice of the year 1838, from the Leipsic-Dresden line, in Saxony. Here we have the familiar flat base or single-head rail section held in a chair at the joints, and elsewhere resting directly on the transverse sleepers. The section differs from the modern rail in being less deep. Its foot also is wider in proportion to its other dimensions than is that of the modern rail. This is the earliest example we show of what may be termed distinctively modern practice. In the exhibit the rails and chairs were original, the other parts were supplied.

Fig. 11 is another German example, dating back to 1842, from the Breslau-Oppeln line, in Prussia. It was laid on cross ties, a very unusual arrangement with this type of rail. In the exhibit the wooden ties were not original, but had to be supplied.

In Fig. 12 we meet with a new feature, the use of cast iron sleepers. It is from the Alexandria-Cairo line in Egypt, laid by H. Greaves in 1854. The sleepers are segments of spheres or pot-shaped, made of cast iron, cast about the chair so as to make one piece with it. Double-headed rails held at the joints by fish plates, and transverse-keyed spacing bars are used. The spacing bars were distributed one on each side of the rail joint and two intermediate between the joints, giving a total of four for each rail. Seven sleepers were provided for each rail.

The iron works of the exhibiting company, the Georgmarienhutte, Hasbergen, near Osnabruck, Prussia, give us an example of modern practice (1890), shown in Fig. 13. It is an arrangement for avoiding butt joints. The rails are rolled of peculiar section, the web being at one side of the center, a distance equal to its own thickness. From the ends of the rails the foot and head are cut off as shown in the cut, leaving the thickness of the web unchanged. By laying the rails with webs to right and left alternately the scarf joint shown is secured with double thickness of web under it. The rail is of steel and it is laid on soft steel sleepers, and is held by hooked chairs and clips. Deep, angular fish plates are used at the joints.

In Fig. 14 is a sample of rail construction used on the Berlin-Stettin road in 1882. Here we have a soft steel longitudinal sleeper, with rail clamped to its top. At the joints a fish plate was used which clamped both rail and sleeper.

In Fig. 15 we have a saddle or self-supporting rail, laid on the Great Western road in England in 1855. The joints were secured by riveted fish plates. This is interesting as being the first road laid without sleepers.

Fig. 16 exhibits one of the last examples of Continental design (Germany) for countries where wood is abundant. The rail shown in Fig. 13 is used for this, but is canted inward to resist overturning strains.

In Fig. 17 we see the principle of Fig. 13 applied to a broad-footed rail, to be laid without sleepers. This is one of the heaviest rails in the world, weighing 127 pounds to the yard.

Fig. 18 shows a similar construction which has already had ten years' use on German lines. Twenty dollars per year is allowed as the maintenance expense. Here a compound rail is employed instead of the single one of ordinary construction.

Figs. 19 and 20 show, finally, rail systems for use in city streets. Here we see the usual single rail system departed from. Although they present examples of practice foreign to American ideas, they have been extensively used in Germany and elsewhere. The sections are self-explanatory.

This exhibit, but a few of whose salient features we have had room to present, was one of the most interesting at Chicago. Most of these exhibits were described at length in Haarman's great monograph on railroad construction. To Haarman's invention are due in whole or part the constructions shown in Figs. 13, 14, 17, 18 and 19.

THE theodolite was first constructed in the seventeenth century, by an unknown inventor.

Correspondence.

The Chinese in Oregon.

To the Editor of the Scientific American:

The article published in your paper headed "Common Sense on Chinese and Other Immigration" should be widely circulated for the benefit of the moon-struck country that passed the senseless and brutal Geary act.

It can be clearly shown that Chinese immigration has been a direct benefit to this coast, and that both California and Oregon would be years behind in their development had it not been for this labor, available when none other was to be had. Nor has white labor been degraded by it. The Chinese laborer, forming the lowest stratum of social organization, has always been the servant. Many illustrations suggest themselves, but one or two will do. In the personal knowledge of the writer, twenty years ago fresh vegetables could not be bought in our cities and towns in Oregon at any reasonable price; now they are abundant and cheap. The Chinaman made his little gardens in neglected corners, and for years, and even now, supplies our working population. When the city council of Portland, a short time ago, attempted to license and tax this occupation out of existence, the effort failed utterly before the indignant remonstrances of our citizens. The Chinese pack the salmon in our canneries; no other labor has been commercially available for this purpose, and the industry would have failed without it. The salmon canneries give employment to thousands of white laborers, as fishermen, boat tenders, engineers, etc., etc. Stop the canneries, and this market for white labor fails, the demand for canning material fails, and the flow of the millions of foreign capital that are paid for its products fails also. Nor do the Chinamen take more money out of the country than they bring in.

In mining the Chinamen work claims that no white man would touch. They take out of the soil, for instance, three dollars per day to the man. Their expenses per man for food supplies, powder, boots, hydraulic apparatus, etc., carefully computed, cannot be less than $2.50 per day, so that if all this profit went back to China, our country would still be the gainer in the proportion of $2.50 to $0.50 in fresh gold put directly into its circulation. The Chinese clear land that otherwise would remain uncultivated for from $10 to $30 per acre; this cleared land gives employment to farm hands, and annually brings in from foreign parts the money that is paid for the wheat raised upon it, while the margin of profit to the Chinese laborer available to send to China is almost too small to be seriously considered. And finally for the political bugbear of the terrible Mongolian invasion that threatens to sweep American civilization into the Atlantic. Forty years' experience upon the coast has demonstrated the fact that white labor has only to fear its own competition. Ten years ago, when our white population was much less than it now is and our Chinese population much larger, wages were much higher and work was easier to get than it has been for several years past.

There is no doubt that the sentiment upon this coast is against the Chinese, as it would naturally be against any weak race under similar circumstances, but it is a good deal political talk. If the President, for instance, under the Geary act, had ordered the arrest of our Chinese salmon packers last summer, he would have heard a voice from this coast that would have surprised him, and the astonishing spectacle would have been presented to our Eastern friends of mobs of fishermen and other laborers upon the Pacific coast clamoring against the deportation of the Chinese.

A laboring friend of mine who hailed from somewhere near Ireland, and who rented some old buildings in Portland, which he could not rent to any one else, to Chinamen for an extravagant figure, once confided to me that while he carried a transparency in a political procession stating that the Chinese must go, it did not apply to his Chinamen, and, in fact, was not meant any more seriously than political declarations generally are.

If we only had good general immigration laws, the Chinese question might be safely left to care for itself.

THOS. N. STRONG.

Portland, Oregon, Nov. 21, 1893.

Car Fenders Required in Baltimore.

The city authorities of Baltimore have passed an ordinance which requires that all city passenger railway companies, which are now using the streets of Baltimore for the carrying of passengers, or which may hereafter be granted this privilege, shall place in front of every car operated singly, and upon the first car of any train of cars, a proper guard or fender, to prevent (as far as such guard or fender may make such prevention possible) accidents to persons or animals. The fender is to be applied within three months. Five dollars a day fine for each car not so provided. An effective fender is an invention greatly needed on every street car in this country. Here is an opportunity for inventors.