

The "Antelope" and "Eagle" were transferred in 1865 to the Philadelphia & Erie division, where they rendered several years' service before going the way of the "Atalanta."

Since boyhood I have heard rather vague statements from some of the older men on different divisions of the road, which when put together imply that a fourth Wilmarth was built for the Pennsylvania Railroad Company, but was lost overboard in its passage from Boston to Philadelphia by vessel and was never recovered. In one instance this story named a Smith & Perkins engine as the derelict, but if correct at all the conditions of those days would rather indicate the Wilmarth engine as the "missing link." The most authentic data at my command is a distinct remembrance that an extra tender used on the Pittsburgh division between 1853 and 1860 was often referred to in my presence during boyhood as having belonged to an engine which was lost at sea.

In this connection mention might be made of another engine owned by the Cumberland Valley, which was named "Jenny Lind," and was an almost exact counterpart of the "Pioneer," but bore a badge plate, naming the C. V. R. R. Co. as builder and the date of 1878. From various "earmarks" I believed this engine to have also been a Wilmarth, rebuilt at the time named on the plate, but the company's officials are positive that this is not the case. The "Jenny Lind" differed only from the "Pioneer" in having a longer rear extension of the frame, with a sort of observation room or car for the use of officials built on it and a four-wheel truck underneath. This engine was only cut up within the last two years.

The confirmation of much of the foregoing data is due to the courtesy of M. N. Forney, J. Snowden Bell, Esq., W. H. Taft and various officials and employees of the Pennsylvania and Cumberland Valley railroads.

The Portland & Seattle Railway.

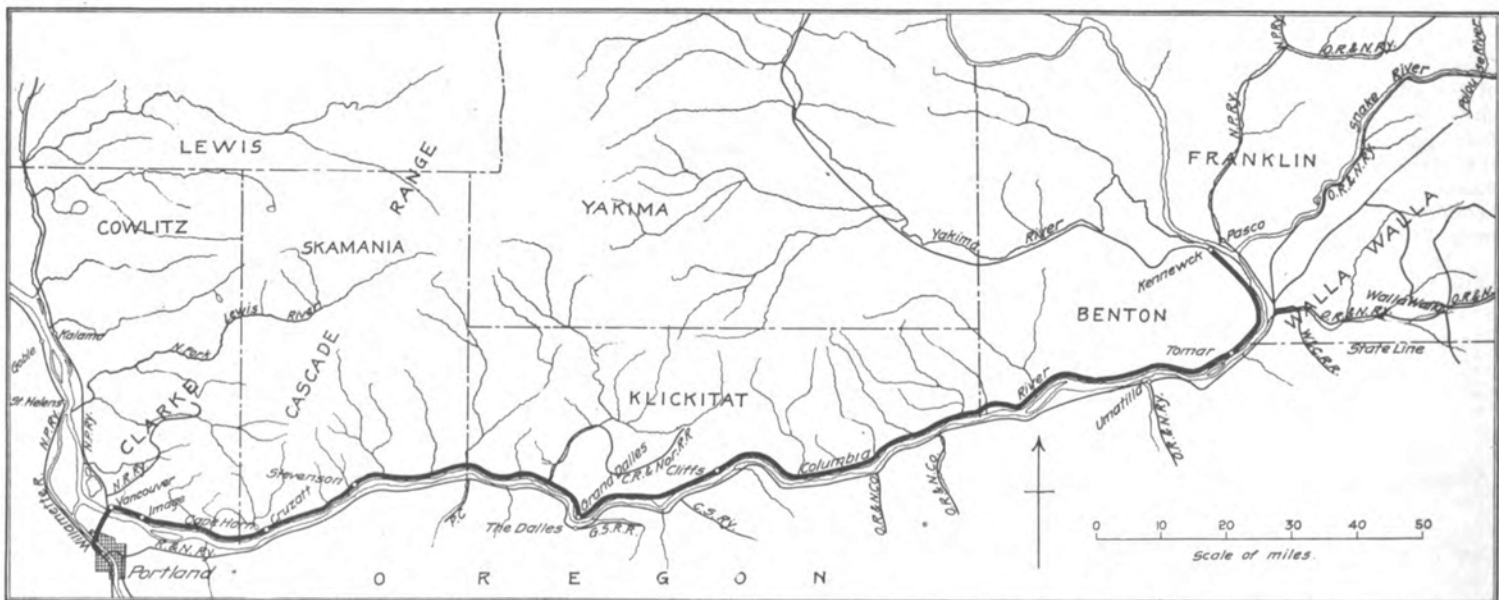
BY H. COLE ESTEP.

Probably the most spectacular piece of railroad construction in the United States to-day is the new line of the Portland & Seattle from Spokane, Wash., to Portland, Ore., by way of Pasco and the north bank of the Columbia river. The Portland & Seattle is, as is well known, a corporation owned jointly by the Northern Pacific and

tion was made during the summer and fall of that year. The locating engineers and their parties who actually did the work of laying out this line deserve the highest praise for the unflinching courage and silent heroism they manifested in the daily performance of their duties. The Portland & Seattle is built for miles and miles along cliffs on the north bank of the Columbia river, ranging from 100 to 700 ft. in height. Not only are there sheer cliffs, but the erosion has worn them into shapes of inconceivable ruggedness, the famous banks of the Rhine being tame in comparison. Pillars, pinnacles, sharp rocks and deep, narrow, perpendicular walled gorges abound. Only those who have had the experience and know what such work is can appreciate the difficulties encountered in locating a line through such a district. Passengers will ride over the finished track and admire the precipitous scenery, but as the writer stood on the nearly finished grade, which had been literally torn from the cliff by tons of blasting powder, and beheld the ragged face of the mountain, he could not help but think of and admire the splendid courage of the men who, suspended day after day on slender ropes, the sky above, the vicious, swirling river below, had slowly and painfully created a line of railroad over these places. The thought came that it was not dollars, after all, that produced the Portland & Seattle, but engineering skill and courage.

The ultimate purpose is to build a line from Spokane to Portland, a distance of 375 miles, with a branch 75 miles long to Lewiston, Idaho. The work now practically complete is that portion of the main line from Portland to Pasco, 230 miles, and the branch to Lewiston. The Spokane end is not so far advanced. Track laying is in progress between Portland and Pasco at this writing, and all the difficult, subaqueous work on the big bridges near Vancouver has been completed. Fifty miles between Portland and Pasco is being double tracked.

The road from east to west is level or down hill all the way. The maximum grade is 0.2 per cent. compensated for curvature; the maximum curves are 3 deg., spiraled according to the best modern practice. When these facts are considered, some of the difficulties encountered in locating along the tortuous bluffs of the Columbia can be appreciated. From Spokane to Cow creek, in Adams county, Washington, on the main line, and from Lewiston to Washtucna on the Lewiston line, there are no special features.



Map of the Portland & Seattle from Portland, Ore., to Pasco, Wash.

Great Northern railroads. Its name is scarcely accurate, however, as the line does not go within 180 miles of Seattle.

The road is being built ostensibly to get a direct low-grade freight route between eastern Washington and the coast and thus avoid the haul over the Cascade mountains. At present, on the western side, trains must be lifted from sea level to an elevation of 2,800 ft. in a distance of 75 miles. As a matter of fact, however, the Portland & Seattle would not have been built for years had it not been for the invasion of the state of Washington by the Chicago, Milwaukee & St. Paul and the Union Pacific. As soon as it was certain that these lines were building to Puget Sound, the Hill lines set to work on the Portland & Seattle in order to retain for themselves the only remaining water grade from the "Inland Empire" to tidewater. Construction work on the "North Bank" line, as the portion from Pasco to Portland is called, was actually begun simply in order to keep the other roads out; thus a project which, like all other Washington railroad schemes dates back about twenty years, became a reality.

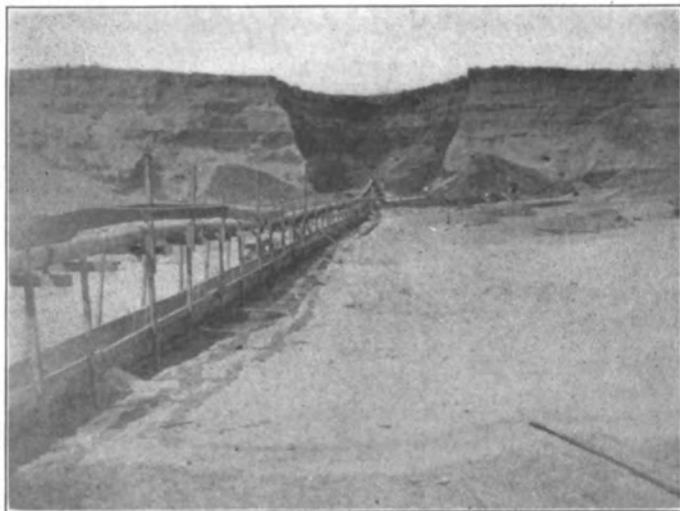
Preliminary surveys were commenced early in 1905. The loca-

The road through these sections is simply an ordinary first-class line through a broken country. There are six points of special interest on the work, located as follows: Near Cow creek and Washtucna, in Adams and Franklin counties; Pasco and Kennewick; Cliffs and Grand Dalles, in Klickitat county; Cape Horn in Skamania county, and the line from Image, in Clarke county, Washington, to Portland. These will be taken up in the order named.

At the junction of Cow creek and the Palouse river, in Adams county, the Portland & Seattle encounters the most expensive stretch of railroad construction, except that in Devils' canyon, ever known in Washington. The valley is crooked and entered frequently by steep, narrow gulches; the road is built across a succession of "hog backs" and gulches. Eighty-foot cuts are followed by 90-ft. fills in alternation; short tunnels are frequent; high steel trestles are necessary in many places. At one point, near the ranch of James Kennedy, one of the largest of the "hog backs" was pierced by several long, narrow tunnels, which were loaded with many hundred pounds of powder, and then the whole hill was

blown off at one shot. The blast was a decided success and vividly demonstrated the economy of removing large masses of rock by this method.

Approaching Washtucna the line crosses a flat part of the coulee (many peculiar valleys in the region having no direct outlet are called coulees) on a fill approximately 6,000 ft. long and averaging 50 to 60 ft. in height. Here the line crosses the Palouse branch of the Oregon Railroad & Navigation. A concrete arch has been built to permit the latter to pass under the fill. The line



Hydraulic Excavation of a Deep Cut near St. John's.

passes the town of Washtucna on the side of Quality hill, several hundred feet above the village, and proceeding southwestward down the coulee, practically parallels the O. R. & N., the grade being in general about 8 ft. above the older line. Passing Kahlotus, in Franklin county, the line cuts off one corner of Lake Kahlotus on a huge fill, and proceeds, with easier construction, down to Pasco. It was first proposed to cross the lake on a trestle, but the more permanent and satisfactory rock fill was finally adopted.

At Pasco occurs the first crossing of the Columbia river. The Northern Pacific has recently rebuilt its bridge at this point, and the new structure will be used jointly by the two roads. From Kennewick, on the west side of the river, the North Bank line



Erecting First Span of Columbia River Bridge.

proper commences. The construction is fairly easy along the upper Columbia. Fences similar to the snow fences on eastern lines have been erected at dangerous points to keep off drifts of the fine sand abounding in the vicinity. For 20 miles west of Pasco, to Tomar, the line is double tracked. It is single track the rest of the way to Cape Horn, because a double track along the cliffs of the north bank would entail an expense at present altogether out of proportion to its usefulness.

Cliffs, half way down the river, will be a division point and

will have a roundhouse, coaling station, switch yard and other usual facilities. About 23 miles below Cliffs is Grand Dalles, opposite Dalles, Ore. The elevation of Dalles is 103, of Pasco, 389, and the distance between them is 130 miles, the average grade being 2.2 ft. per mile.

Below Grand Dalles the difficult solid rock construction commences. Nearly all the grade from this point to within 30 miles of Vancouver had to be blasted out of solid rock cliffs varying in height from 100 to 700 ft. There are 17 tunnels on the line from Pasco to Vancouver. The most notable of these is the Cape Horn tunnel, 24 miles east of Vancouver. It is half a mile long, single track, and bored through solid rock. From Cape Horn (Cruzatt station on the P. & S.) to Vancouver the construction is somewhat easier and this portion is double tracked.

Approaching Vancouver the line leaves the bluffs and curves down across the flats, crossing the east portion of the military reservation on a double-track fill averaging 16 ft. in height. The west end of the reservation, as well as the business portion of the town of Vancouver, is traversed by a double-track pile trestle. The fact that heavy concrete abutment walls are built at all road and street crossings under this trestle indicates that it is the intention to fill it as soon as the work can be conveniently done. At Vancouver there is to be a switch yard and junction with the Van-



Cape Horn on the Columbia River Before Work on the Portland & Seattle Was Begun.

couver branch of the Northern Pacific. This branch, 30 miles long, extending from Kalama, on the main line, to Vancouver, will become a part of the main line of the Northern Pacific as soon as the big bridges and heavy work on the Portland & Seattle between Vancouver and Portland are completed. Northern Pacific trains will be run to Vancouver and thence to Portland on the P. & S., using the magnificent new bridge over the Columbia. The historic old car ferry between Kalama and Goble will be abandoned and the line between Goble and Portland will be used almost exclusively by the Astoria & Columbia River Railroad. The Northern Pacific is now engaged in revising and straightening the Vancouver branch. When this relocation is finished the line will be first-class in every respect, this work being virtually a part of the construction of the Portland & Seattle.

Probably the most interesting section of the Portland & Seattle from an engineering standpoint is the eight miles between Vancouver and Portland. This short stretch includes three large steel bridges, three double-track draw spans, a steel trestle 1,968 ft. long, and one of the largest earth cuts on the road. The road is double-tracked from Vancouver to Portland.

The difficult work on the great Columbia river bridge is completed at this writing. The piers are practically finished. The

bridge, omitting inches, is 2,806 ft. long, divided into ten spans as follows from east to west (i. e., from Vancouver toward Portland): First span, 189 ft.; draw span, 467 ft.; third span, 375 ft.; fourth span, 269½ ft.; fifth, sixth, seventh and eighth spans, each 269 ft.; ninth span, 268 ft.; tenth span, 162 ft. The bridge is double track, its inside dimensions being: width, 27 ft. 6 in.; height, 22 ft. 6 in. A swinging draw is used, which when open, leaves two channels each 200 ft. wide. The piers are set on pile foundations. Those near the center of the stream are 115 ft. high, and at this writing project about 20 ft. above water. The piers are built with concrete cores and granite facings. The steel work is being furnished by the American Bridge Company. The bridge will be the largest and finest in this section of the country.

Following the Columbia river bridge is a steel trestle consisting of 24 82-ft. spans, 1,968 ft. in all, over the swampy end of the island opposite Vancouver. The trestle is followed by another steel truss bridge 1,465 ft. long over Oregon slough, divided into eight spans as follows from east to west (omitting inches): First span, 161 ft.; second, third, fourth, fifth, sixth and seventh spans, each 162 ft., and draw span, 332 ft. A swinging draw is used here also, leaving two 150-ft. clear channels when open.

The line enters northeast Portland, crosses some of the low land on a high fill, and traverses the suburb of St. Johns through a cut approximately 1¾ miles long and 90 ft. deep at the west end. The cut is in earth, sand and loose gravel, and will require the excavation of 1,000,000 cu. yds. to complete it. It is being worked from both ends; from the east end by steam shovel in standard American fashion, while the west end is being sluiced down into the river by hydraulic methods. The water is pumped to the head works through a 10-in. riveted sheet-iron pipe, the stream is played on the earth and the mixture of water and earth is carried back to the river in a sheet-iron lined flume. It is said that 1,600 cu. yds. per day is excavated in this way.

The slopes of the cut are being trimmed by a donkey engine and scraper. The engine is placed on one side of the cut with a cable leading across to the other, to the end of which an ordinary drag scraper is attached. The scraper is started properly and is then dragged down the slope by the engine. It is hauled back by a

ing genius and is by all means the most expensive and best built line in the west. The general contractors are Siems & Shields, St. Paul, Minn. The engineering officers of the Portland & Seattle Railway are: N. D. Miller, Chief Engineer; J. E. Turner, Assistant Chief Engineer; B. L. Crosby, Bridge Engineer.

Railroad Museum of the German Government.

The German Government has recently established a railroad museum in Berlin of which Germany may justly be proud. It was formally opened by the Emperor some months ago, but only one section was ready that time. All sections of the building are now open to the public. It is housed in the abandoned terminal of the Berlin-Hamburg line, which is situated in the northwestern section of Berlin. The exterior of the building has been left unchanged,



Government Railroad Museum in Berlin.

but inside many changes were made, chiefly in the cellar, where a large power plant was installed to generate steam for heating, electricity for lighting and operating motors, and compressed air to work several models for demonstrating purposes. The exhibition space covers 52,000 sq. ft. and comprises a long main hall with arched glass roof, and a number of smaller rooms in both wings. A few exhibits were so large, however, that they had to be placed outside in the adjoining courtyard.

The museum comprises three large sections: A, railroads; B, marine engineering; C, architectural and construction work. By far the largest space is occupied by the railroad department, which is divided into eight groups. The exhibits represent chiefly modern apparatus, the historical part being limited. Explanatory notes are often given, supplemented by many photographs, drawings and other literature. Many of the models of apparatus can be operated to illustrate their working.

In the first group are rails of all kinds, switches, crossings, sleepers, both old and new. Samples of ballast and material for the maintenance of a road, also the tools used are shown. Of particular interest are sections of wornout rails and sleepers which show the tremendous stresses to which they are subjected on busy lines. The influence of shocks exerted by the rolling stock on the roadbed, etc., is illustrated by samples prepared in a special testing plant. A diagram of the sizes of rails used since 1842 shows clearly the considerable increase in height, length and weight. A complete exhibit of crossing gates used on country roads with the necessary bells, lamps and gate-keeper's houses is also included.

In the next group are models of structures designed for various railroad purposes, such as stations, carsheds, water towers, coaling plants, bridges, tunnels, turntables and the like. The chief exhibit is a fine relief model of the Altona depot which is a good example of a modern German terminal. The first large iron bridge is represented by a model of the Vistula bridge near Dirschau, completed in 1857. Drawings and photographs of old and modern bridges and tunnels give a good idea of this branch of engineering. A model of the ventilating plant of the Kaiser Wilhelm tunnel included in this section can be operated by a small fan.



Interior of Main Hall; German Railroad Museum.

team, which at the same time drags another scraper down the opposite slope.

The Willamette river is spanned by a 1,700 ft. truss bridge with swinging draw span similar in general to the Columbia river bridge. After crossing the river the line ends at what is called the Portland outside yard, a switch yard built on a plot of ground 150 acres in extent.

The whole road is a splendid monument to American engineer-