40-TON GEARED LOCOMOTIVE USED FOR HEAVY GRADE

The locomotive pictured, Booth & Flinn No. 10, was a Climax (serial No. 1508) built in January, 1921. According to research by Booth & Flinn and the author, after being sold by Booth & Flinn it was owned by a lumber company in Pecohold, West Virginia, and then by the Snap Creek Coal Company, Logan, West Virginia, and was scrapped between 1951 and 1953.  

K. C. Warner, Booth & Flinn Company, Pittsburgh
GEARED IRON HORSES IN PENNSYLVANIA

By Ivan W. Saunders*

The steam locomotives of the common types were seen in nearly all counties of Pennsylvania through the years until comparatively recently. Now the only operating steam locomotives are those owned by museums or tourist attractions. There was another type of steam locomotive, the geared designs, that were not so common and were not seen so often, since for the most part they operated back in the woods. The Susquehanna & Eagles Mere Railroad in Sullivan County, for example, began as a lumber road, but shortly after the turn of the century became a scenic line using these geared locomotives.

Two of the three most popular types of geared locomotives were products of the Keystone State, and, oddly enough, of the same county in the northwestern part of the state. They were manufactured at Erie and Corry. These locomotives were used principally in the lumber industry and mostly in the western half of the state. There is, however, record of two Heislers, built in Erie, used in the Lukens Steel Company's plant at Coatesville, and several others used by the Lehigh Coal & Navigation Company in the anthracite coal fields at or near Hazleton and Summit Hill. The final disposition of the half dozen or so owned by LC&N is unknown, as is frequently the case with the geared locomotives; thus their individual histories are incomplete, and unsatisfactory to the historian.

In the eastern part of the state, geared locomotives appeared in the Grand Canyon of Pennsylvania, a scenic location much advertised. The canyon is a very deep and narrow valley of Pine Creek running northward from near Williamsport and Jersey Shore, mostly in Lycoming County, and it has been the scene of operation of at least three lumber railroads. The town of Cammal, in this deep valley, had two of them. One ran to the westward up out of the valley and must have used switchbacks to get to the

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Goodyear Lumber Company's big Climax locomotive. Once the largest private lumber company in Pennsylvania, with mills in Potter, Elk, and McKean counties, Goodyear later moved to Bogalusa, Louisiana.

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One of the little twenty-five-ton Heisler locomotives built for the Lukens Steel Company at Coatesville.

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top, as most of them did; it was called the Cammal & Black Forest Railroad and was purely a lumber road. The other railroad out of Cammal was one of the oldest named railroads in the country and a source of some amusement to those familiar with it. It ran from Cammal northeasterly towards Oregon Hill, evidently a very small community, and its name was “Oregon & Texas Railroad”! The incorporators of this road must have been humorously inclined. There was another railroad farther north, called the Slate Run Railroad, westward from the community of the same name. There was yet another lumber road up out of the valley still farther north at Tiadaghton, known as the Leetonia Railway, westwards to a location with that name. The Leetonia Railway was the location of frequent runaways. Viewing Tiadaghton from the west rim of the deep canyon makes one wonder how in the world a railroad ever got up out of that valley sixty years ago. The Leetonia is known to have owned geared locomotives, but this is not certain in the case of the others. It seems more than likely, however, since the standard rod type locomotives would not have been able to handle the grades these roads must have had. The railroad that follows the valley all the way is the New York Central’s line from Corning, New York, to the Pennsylvania coal fields.

The most common type of geared locomotive was the Shay, originally designed by a Michigan lumberman, Ephraim Shay, in the late 1870’s, and built by the Lima Locomotive & Machine Company of Lima, Ohio, from about 1879 to 1945. Over 2,750 were constructed in that time span. The Shay is the most easily recognized of the geared locomotives as it has two (in the early models) or three cylinders mounted vertically in front of the cab on the right side only, driving vertically downwards to a crankshaft which is a part of a lengthwise shaft alongside the wheels, to which it is geared by pinions and gears, on the right side of the locomotive only. As all this machinery is on the right side, the weight is balanced by mounting the boiler off center to the right, as the engine is seen from directly in front. From the beginning, these Shays remained the same basic design, only becoming larger through the years. In the 1920’s, thirty-three locomotives of the basic Shay design were built by the Willamette Iron & Steel Works of Portland, Oregon, the Shay patents having run out. Because of the extremely close resemblance, these
Heisler 1919 of the Tionesta Valley Railroad, photographed July 7, 1938, at Sheffield, Pennsylvania.

Howard Davis, Pittsburgh

James B. Weed's Slate Run Railroad carrying hemlock bark for a tannery, 1885. The locomotive is a very early Shay.

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engines are known as Willamette Shays. None of the Willamette-built Shays ever operated in Pennsylvania, so far as is known. Lima Shays were used in Pennsylvania in many areas, notably in Cameron, Clinton, Elk, Forest, Lycoming, McKean, Potter, and Tioga counties.

The Climax, next to the Shay in number built, was of a considerably different design. The Climax Manufacturing Company of Corry, Pennsylvania, constructed a total of slightly more than a thousand locomotives, of two different designs, between about 1888 and 1928. The oldest, known as class A, had a big wooden cab covering most of the engine, and the two cylinders were mounted vertically inside the cab, driving directly downwards to a gear arrangement that allowed shifting gears. This “gearshift” allowed two speeds with corresponding power, in low speed about seven to ten m.p.h., and in high top speed about fifteen to twenty m.p.h. The gearshift was part of a centrally located lengthwise shaft under the boiler that was geared to the axles by pinions and gears. Later, the Climax Company developed a class B and later still, a larger version of the B called a C. The B and C classes were practically the same, with the conventional cab and cylinders mounted in the usual place on an engine. The cylinders drove downward at an angle to a jackshaft which was crosswise under the boiler, this jackshaft being connected to the lengthwise shaft. All these classes were known in Pennsylvania, and though the A was somewhat scarce, a coal company had one in service as late as the middle 1930's at High House in Fayette County. Climax built more engines than either Shay or Heisler for use on roads with wooden rails. A description of these wooden railroads might be of interest.

The cheapest and easiest to construct and maintain of the wooden railroads was what was called the “pole road.” In this type, trees were selected of as near a uniform diameter as possible, felled and trimmed, then split lengthwise. These log halves were then laid on more or less cleared land, end to end and flat side down; then fastened in place with stakes driven into the ground through pre-drilled holes in the ends of the log halves and sometimes in the middle, depending on ground contour. Climax locomotives were built with wheels with double flanges and curved between the flanges to fit the rounded log halves. The
other type of wood railroad, known as the "tram road," was far more widely used than the pole road, and used rough dressed lumber, about 6" by 6" by several feet in length and laid on ties. Some tram roads used lumber in a smaller section, but added a 2 x 4 or 2 x 6 piece of hardwood on top to reduce wear and the need for frequent replacement. Neither the pole road nor the tram road could be used where there were grades of any height; these were strictly level ground roads. Many lumber roads were built with the conventional iron or steel rails and ran for years, many of them supplying the only local transportation available. However, a number of lumber roads were built with the intention of logging out the timber; when the timber was gone, so was the railroad.

The Heisler Locomotive Works of Erie started about 1894 and built some 600 of its design of geared locomotive between then and 1941. It was the only one of the three major producers that built a diesel-powered geared engine, but the diesel was not successful because it appeared too late, the early 1940's, when trucks had begun taking over logging, not to mention the diesel-electric locomotives and the war. The Heisler also has the lengthwise shaft under the boiler, but the cylinders are mounted differently, in front of the cab, crosswise and driving the lengthwise shaft direct, this shaft in turn driving on the "outside" axle only of the trucks, crossing over the inner axle, which is driven by side rods. The giant Baldwin Locomotive Works of Philadelphia entered the geared locomotive field too late, and of the only five they designed and built, only one is known to have operated in Pennsylvania, at first at the Baldwin plant and later for a steel company. Baldwin appeared in the geared engine field with their five engines in 1912-1915.

There were a few other designs of geared locomotives, but none of them approached the success or numbers built of the Shay, Climax, or Heisler, and these odd designs, except Baldwin's, appeared before the turn of the century. Some of them were used in Pennsylvania, but these odd engines have, no doubt, long ago gone to the scrap heap. Information on most of them is sketchy, and in some cases the history of the company owning them is shrouded in mystery. Most of the geared designs were sold and resold all over the state and in and out of the state as well; very
Climax “box car” dinky owned by Markleton Lumber Company, Markleton, Somerset County. Photograph taken about 1905.
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Thirty-five-ton Climax of the Williamsport and North Branch Railroad, from Climax catalogue of 1905.
few geared engines were one-owner engines throughout their active lives.

Several lumber (and other) companies owned more than one type of geared locomotive, which usually had a hard life, and frequently a short one. Most such companies had only the barest rudiments of repair facilities, and more than one conducted such repairs as were made in the open with no shelter for man or engine. Maintenance work, strongly stressed by the builders, was in many cases much neglected. Even such highly important maintenance as boiler washing-out was not done thoroughly or so often as it should have been. Many lumber and other companies owned only one engine; any maintenance work had to be done after the day's work, and for this reason was frequently neglected. Many of the engineers who ran these locomotives came from a standard railroad and had never before seen a geared locomotive. While most of them were competent enough as regards the boiler, cylinders, and to some extent, the valve gear, the gearing generally baffled them.

The builders maintained a force of men who escorted new locomotives to their owners, but who also handled trouble-shooting assignments. The builders published booklets and/or catalogues containing not only drawings of the locomotives with the parts listed, but with a code of figures and/or words intended to be used for certain phrases in telegrams. These code words and figures are listed in a 1908 repairs list booklet for Heislers which is before me as I write. "Matilda Agnes Lover February 6th Team Kiss," according to the 1908 Heisler booklet means: "1126, hurry shipment of our order of February 6th, pinion, part # 90 for front truck." The figure 1126 refers to the Heisler serial number. Practically all the locomotive builders did this same thing, frequently going to such lengths as inventing words for their codes to cover everything they could think of. (The Lionel Corporation, makers of toy trains, followed the same practice.)

Many of the builders used a section of their catalogues for various tables covering construction and other mathematics, even conversions from and to foreign languages and "American," as the H. K. Porter catalogue has it. The Porter catalogue was unusually thorough and was used by many geared engine owners as well as Porter engine owners. The tables and conversions were
Climax locomotive of the Blair Silica Brick Company, probably used in Sproul, Pennsylvania.

Walter Caster, R. D. 2, Corry, Pa.

Central Pennsylvania Lumber Company at Leetonia, with their Shay locomotive.

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frequently an absolute necessity to many of the lumber road owners, as, while their knowledge of the lumber business might be excellent, they were usually somewhat foggy as to railroad construction, operation, and maintenance.

The geared locomotives were favored in the lumber industry because the gearing made them extremely powerful for their size and weight, more than a standard rod engine of the same size; and they could and did operate on up to 10% grades, that is, a rise of 10 feet in every 100 feet of forward movement from a common point. And with a paying load at that! While most of the geared locomotives were used in the lumber industry, for which they were originally designed, they also found favor in the coal and limestone producing industries, for some reason, in Pennsylvania and Ohio especially. The majority of the locomotives built by all three producers went to the Pacific Coastal areas.

A three-cylinder Shay in operation but not in sight gives the listener the feeling that the engine is moving at somewhere around eighty m.p.h. A glance at the usual type of hit-or-miss construction of the railroads on which these engines ran is then likely to induce the listener to place one foot in front of the other with considerable rapidity, to the nearest mountaintop, so as not to be in the way of flying debris. However, after waiting several minutes, fanning and congratulating one's self on a narrow escape, when the engine has not appeared the listener begins to get the feeling that there's something wrong with his hearing. This is not so; when the engine does appear it is moving at a modest ten or so m.p.h. The reason for the sensation of high speed is that the three cylinders produce sixteen exhausts (puffs or "choo-choos") per turn of the wheels, whereas the standard rod engine has only four exhausts.

Note on sources. The material for this article has been drawn from Poor's Manual of Railroads, 1871-1920; partial records of the Lima Locomotive Works, Lima, Ohio, and the Heisler Locomotive Works, Erie, Pennsylvania; and from various Bulletins of the Railway and Locomotive Historical Society, Inc. The records of the Lima Works are in reasonably good order: those of the builders of the Climax and the Heisler are not and are far from complete.