

A National Historic
Mechanical Engineering
Landmark

Lombard Steam
Log Hauler

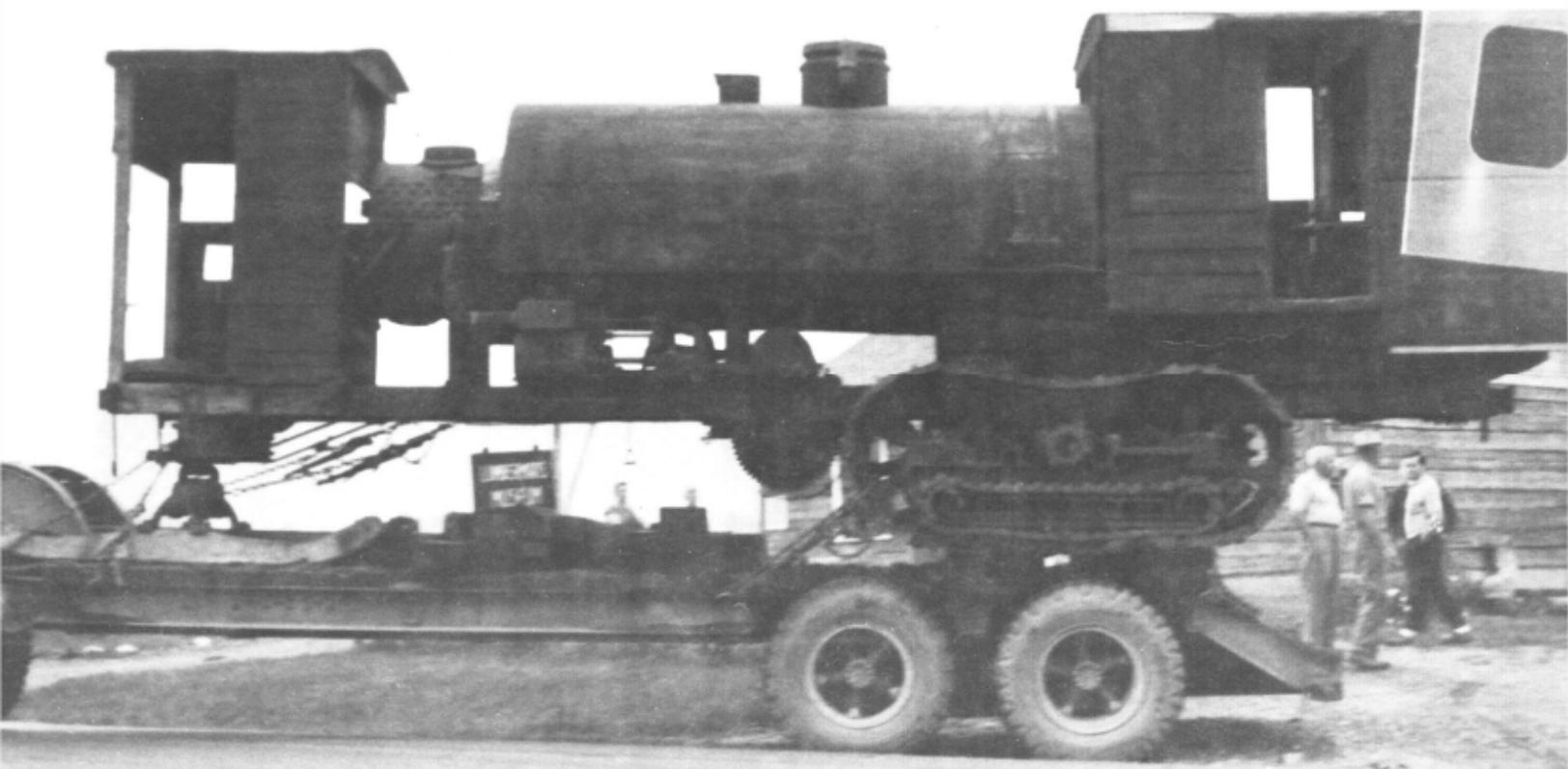
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Patten, Maine

The American Society of
Mechanical Engineers



Lombard Steam Log Hauler



The Log Haulers

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Lumbering in Maine, which began along the coast with cutting pine for masts for the Kings Navy, was limited to the suitable timber growing near enough to the water to permit its transportation by oxen to water on which it could be floated to the ship. As new mills developed and lumbering moved up the rivers the cut was still limited to lumber that could be hauled to water on which it could be floated to the mills.

The pine was hauled almost entirely by ox team. Six, sometimes eight oxen, made a team. A small operation was one team cutting perhaps 600,000 feet BM in a season. Larger operators had two or three teams, and the size of crew and the cut were increased correspondingly.

The tree was "topped off" to make all of the marketable timber into one log and this long log with the bark removed from one end, was dragged on a "go devil" or bob sled to the landing where it was sawed into short lengths.

The horses of this period were not equal to this task while the oxen, the ordinary beasts of burden of the time,

were available and moreover could get through a winter on wild hay cut on the meadows in the woods while horses required good hay and grain.

The oxen in many cases hauled pine long distances and the logs were driven out of streams so small that it now seems hardly possible that they ever floated a pine log. When it was considered that the available pine was exhausted there still remained many small areas with a good stand of "pumpkin" pine.

One town in northern Maine was known as the dry town because in all its 36 square miles there is no stream large enough to float a log.

When the lumbermen turned to spruce and horses displaced the oxen, the situation was changed only temporarily. A logging road for horses must be entirely down grade or at least generally level. A four turn road was considered about the limit for profitable lumbering. Furthermore, the necessity of driving these logs to market limited the activities of the lumbermen to those varieties that would float, that is, spruce, fir, cedar and pine.

It was impractical to mix in a drive even pine which floats nearly submerged with the smaller spruce which floats with a fourth of the log out of water. When a lumberman could not resist the temptation and put a fine big pine with his spruce, the log made so much trouble that it was usually pushed into a poke log and

abandoned. Some attempts were made to drive poplar pulpwood but it became waterlogged so quickly that it usually sank in the pond in which it was landed.

As a result of these limitations, there were at the turn of the century uncounted thousands of acres of fine maple, white and yellow birch, beech, and ash, which, with the equipment available, could not be gotten to any market.

Thus the time was ripe for the development of a mechanical means of hauling logs and the opportunity was not overlooked by the mechanics who had built and repaired the lumbering equipment of the period.

In the 90's when the internal combustion engine was being perfected and the horseless carriage was becoming commonplace, lumbermen returning from visits to Bangor brought reports of the progress James and Ira Peavey were making with their log hauler.

Vehicles powered by gasoline engines were running successfully, but these ran on wheels on the ground. But the log hauler must run on snow and a wheel with its very limited surface in contact with the surface of its roadbed would certainly slip if the surface were snow and ice.

Peavey's solution of this difficulty was to apply the power through two large screws. This worked on ice and a full scale model actually hauled logs on a good hard road, but the screw churned up the snow so much that it lost traction and in loose snow it was pretty nearly helpless. Peavey's log

Early type of Lombard Steam Log Hauler with upright boiler and engine.



"He has known the crash of the falling spruce...has trod the ruts to the camps long ago...boasted the scale of the heavy loads that cricked o'er the frozen snow..." The Old Lumberman, Harold P. Andrews.



hauler never got beyond the experimental stage.

In this same decade a carpenter millwright and general handyman, Johnson Woodbury, who was something of an inventor in his own right, and all his life had been familiar with lumbering and its problems had his mind at work on the log hauler. Almost any line of reasoning that he followed brought him to the necessity of some form of track that would give the wheels the traction that snow could not provide. Railroads would do this but were obviously not the solution of the problem. When he moved a house, beams were laid on the ground for a short distance and the building moved along on rollers running on these tracks. As it progressed, the beams in the rear were moved forward so that there was always a track in front of the moving building. By repeating this process often enough, the building could be moved a considerable distance, but obviously this method was impractical for hauling logs.

But Woodbury had in his barn a "horsepower," a treadmill commonly used to provide power for a thrashing machine or a drag saw for sawing wood. The essential part of the treadmill was an endless chain of wooden lags running over two pairs of trucks to which the lags were geared. Set at an angle the weight of the horses walking on the lags tends to force the lags down hill, turning the wheels and

generating power which is transmitted through a drive wheel on the shaft of the upper pair of trucks. Woodbury envisaged this assembly reversed, the track on the ground, the power applied to the trucks and the lags moved by the revolving wheels. The weight of engine providing the power supported by the trucks would hold the lower half of the lags firmly to the road bed, whatever its nature, thus providing a track on which the trucks rolled forward. The rear truck picked up the lag it had just passed over, while the forward truck laid down a lag to extend the track. He demonstrated that this would work by rolling the tread of his horsepower up an incline by turning the fly wheel.

Woodbury did not have the facilities or the funds to develop his plans for a tractor that would run on snow, but at a town meeting in which the voters were considering the construction of an oversized roller to pack the snow to make a hard road bed, he asked the town to wait until the next year when there would be available a machine which would run on snow and would push or pull a snowplow. The town built the roller, which proved impractical and was soon abandoned. Later developments proved that Woodbury's snow plow would have been successful.

There is a story which relates a meeting of Woodbury and Alvin Lombard in the railroad station at Millinocket when they were leaving town after working as millwrights in the new mills of the Great Northern Paper Company. It is said that in the course

of their friendly conversation, Woodbury told Lombard about his plans for a log hauler. Woodbury went back to his farm in Patten, where his dream of a steam log hauler became only a local tradition.

Alvin Lombard, back in his shop in Waterville, was a mechanic of more than average ability who already had a number of inventions to his credit. Among these were a machine for barking pulpwood, and a governor for water driven turbines, which had come into general use.

The story, often told, of his start on the log hauler relates that, going home from work one evening on the street car he fell in with an official of one of the big lumber companies. In the course of the conversation about lumbering problems, this gentleman said that he was tired of wearing out horses hauling logs and suggested that Lombard put his mind to work constructing a machine that would replace the horses. Lombard acted very promptly on this suggestion, going at once to his shop and applying himself to the problem with such diligence that in 24 hours he emerged with the answer all set forth in a drawing and a working model. Lombard arranged with Waterville Iron Works to build the first Lombard log hauler and his application for a patent was filed Nov. 9, 1900. Patent No. 674,737 for a logging engine was issued May 4, 1901.

The description, claims and drawings of this patent are restricted to the



A Peavey Log Hauler, Traction was obtained by revolving screws.



traction and method of support. It discloses a method of obtaining traction in which the engine is supported on two pairs of geared wheels over which runs a track made up of lags bolted together in a manner to make the track flexible and geared to mesh with the wheels. The weight of the engine holds the lags on the ground (or snow) firmly in place. The power is applied to the forward pair of trucks which, as they turn, move a lag forward and place it on the ground to extend the track forward. The rear wheels, as they move forward, pick the last lag off the ground and move it forward. By this arrangement the engine rolls on a track held firmly on the ground or loose snow by its own weight with sections of the track laid down in front of the drivewheels as it moves forward. This, in brief, was the basic invention which made possible all the tractors, bulldozers, earth movers, and the military tanks.

At the time Lombard began developing his log hauler, two California companies, Benjamin Holt of Stockton and the Best Company of Oakland, were making farm tractors. Holt bought out the Best Company. In the following year Best's son organized a new company to make tractors. There was prolonged litigation between the two companies, but eventually they were combined as the Caterpillar Traction Company and the business moved to Peoria, Illinois where they began the manufacture of

tractors equipped with the track covered by the Lombard patent. These were wheel tractors made to run on the ground, but when later the Holt tractor ran on a track, the impression was created that this type of tractor originated on the Pacific coast and that Holt was the real inventor of the track.

In response to our inquiry for information on the relations of the Lombard Company and the Holts, Mr. Louis Lombard very kindly sent us various papers relating to the history of the Lombard log hauler. Among these was a copy of a memorandum found in the files of the Alvin O. Lombard Traction Co. In this memorandum Mr. Lombard states that the first Holt tractor was built in 1907 but that he does not think it was put on the market until a later date. In regard to the payment by Holt for Lombard's patent rights the memorandum states: "On February 21, 1910, Alvin and Samuel Lombard made a trip to California to see Benjamin Holt and advised him that he was infringing the Lombard patent and it was at that time that Holt acknowledged that he was infringing and agreed to pay a royalty to Lombard if Lombard would send him a contract agreement after his return home. This Lombard did send but the agreement was never signed by Holt nor was any royalty ever paid Lombard by him or by his company."

There was also included a copy of a patent issued to Holt in 1912. This covers a method of suspension and stabilization of the tracks and does not touch the fundamental principle of

traction through trucks running on a moveable track covered by the Lombard patent. There is no evidence that Holt's company had any patents on the track, but the new company copyrighted the name Caterpillar as applied to this type of traction.

As a matter of fact there is in the Patent Office files Patent No. 23,853 issued May 3, 1859, to Warren P. Miller of Marysville, Calif., for a locomotive machine for propelling plows. The specifications and drawings of this patent are a quite accurate description of the traction system described in Lombard's patent and his claim states briefly: "What I claim as my invention and desire to secure by letters patent is: the combination of the endless chain or track with the leading and driving wheels cc and the supporting tracks ee wholly constructed and operated substantially as and for the purpose set forth in said specifications."

Miller did not design his tractor to run on snow but he states that it should be especially suited to soft and sandy soil where wheels would make ruts. Miller's patent was issued and had expired long before Lombard, Woodbury or Holt had even thought of tractors and was forgotten even in the Patent Office. If Miller ever tried to develop his invention he was probably classed as another of the crackpots who were trying to build flying machines.

Whoever had the idea first, it was

A woodburning "Lombard" (c. 1900-1910) built in Waterville, Maine. It was put into operating condition February 7, 1980 for a two-mile run—its performance was deemed "superb".



On an icy road "Lombards" could pull a long string of sleds loaded with logs.



Lombard whose skill, ingenuity and perseverance built the idea into a machine that worked. In 1900 the Alvin O. Lombard Traction Company began in the Waterville Iron Works the construction of the Lombard steam log hauler, and on Thanksgiving Day of that year, the first machine made its trial run. The trial was successful but the machine developed a weakness that was to give serious trouble before it was overcome. On snow everything ran smoothly but when it hit frozen ground the cast iron lags of the tracks began to break. This weakness was finally overcome by making the lags of the hardest and toughest steel obtainable.

The first log hauler had an upright boiler and two upright engines. Lombard attempted to avoid the use of a differential to compensate for differences in speed of the tracks in making turns by using an engine working independently for each track. This worked so far as compensating differences in speed went, but when the two engines got in step, the vibration became so great that this plan was abandoned and the conventional differential was used. The forward end was carried on a bob sled with a king pin to permit free movement of the runners. The first one was steered by a pair of horses, but this primitive method was soon replaced by a steering wheel with pinion on the staff which meshed into a 16-inch gear wheel. This, in turn, had a pinion on its shaft which operated a quadrant attached to the bunk of the bob sled. This double reduction made steering

comparatively easy but required a complete turn of the wheel to get much movement of the runners.

The upright boiler and engine were soon replaced by a horizontal boiler and engine, and in its final form, the steam log hauler was a railroad yard engine, known as a saddle back. The small truck was replaced by a bob sled and the driver by two tracks. The water tank was draped over the boiler, giving this type of engine its name of saddle back. This arrangement of boiler and water tank putting the greater weight of the machine on the tracks, gave maximum traction and was especially suited to the log hauler. There was a cab in front for the steersman, giving some protection from the weather, and one at the rear for the engineer and for the fuel.

In 1903 the first log hauler was sold to a Maine lumber firm and soon a number were hauling logs on snow roads and they rapidly came into general use in Maine and New Hampshire. One was shipped to Montana, and a Wisconsin firm was licensed to build tractors under the Lombard patent. The activities of the Lombard Traction Co. were not limited to log haulers, but tractors were built for special purposes such as a special body for hauling heavy blocks of stone from quarries. One was built for carrying mail and passengers over remote snow-covered roads.

There was one attempt to build a log hauler powered by electric mo-

tors. This involved the construction of a dam, the installation of a generating plant and of three miles of double trolley lines. This machine actually hauled logs three miles but on the first fall of wet snow, so many short circuits developed that the machine was put out of commission and the project was abandoned.

It was soon found that where conditions made it possible to supply coal that coal was a more economical fuel than wood. Coolidge (History of the Maine Woods, p. 144) quotes the record of one operation in which a log hauler burning wood in hauling 3½ million feet BM of logs used 350 cords of wood. The preparation of this quantity of wood in advance to give it time to dry would be quite a sizable operation in itself. In the war period when it was difficult to get coal some of the steam log haulers burned wood, but for the most part they were operated on coal.

In its final form the Lombard was satisfactory, but in the early models structural defects developed and its operational breakdowns caused serious trouble. The strain and wear on the tracks was especially heavy and when it became necessary to replace a track on a hauler stalled in the deep snow with the thermometer registering zero or lower the maintenance crew faced a major problem with all the odds against them. But they always managed and the haulers were strengthened by making the parts heavier and of tougher steel.

The first Lombard gasoline engine machine was built in 1909 by Lom-



A typical log hauler crew consisted of an engineer, fireman, conductor, and the steerer. The conductor, riding close to the rear, communicated with the cab by a bell rope which ran along the sled stakes.



bard for H. H. Linn and purchased by him for running a tent dog show, which he conducted on the road at that time. This is the same Linn who later built gasoline tractors which were used in New York State for hauling logs. By 1917 Lombard seems to have been making gasoline powered engines exclusively.

The gasoline log hauler differed from the steam driven machine only in the substitution of the steam boiler and engine by a gasoline engine. These did not have the power of the steam driven engines and were not efficient for long hauls. On a road where the steam driven engine would haul 12 sleds, the gasoline engines were limited to five sleds. However, the gasoline machines were very useful for yarding and spotting loaded sleds for the steam haulers on the long hauls and were used quite extensively for shorter hauls. They were operated by one man from a cab in the middle, doing the steering and running the engine.

In 1934 Lombard built a log hauler equipped with a diesel engine, increasing the power and reducing the cost of operations. But by that time the development of the truck for hauling lumber had made the log hauler obsolete and the first diesel was the last log hauler made by the Lombard company.

The operating crew of the steam log hauler included the steersman who sat in the little cab in front behind

the big wheel and kept the engine in the road. He had a roof over his head and the end of the boiler at his back, but in front there was no windshield and he took whatever the weather batted up. On the hills, which were sometimes long with sharp curves, they had no control of the speed except to reverse the engine and the steersman was very busy spinning his wheel to keep the runners pointed in the same direction as the road. An engineer in the limited space in the rear cab shoveled coal into the furnace, ran the engine and watched the steam and water gauges. A conductor was in charge of the train, combining in one person the duties of the conductor and the brakeman of the conventional freight train.

An operation using four or five log haulers found it necessary to have a dispatcher with a board on which the positions of the various trains could be plugged in and telephone connections with the terminals and the "turn out."

Lumber was hauled on bob sleds with bunks 9 feet long. A load for each pair of these sleds was about 6,000 board feet. To secure maximum efficiency special sleds were designed. These were built by the Lombard company or they sold the metal parts to those who preferred to build their own sleds. The log hauler sleds were identical in design with the horse drawn bob sleds but larger and of very much heavier construction. The nine-foot-long bunks made the sleds a little wider than the tractor. This made the sled track outside the track

made by the tractor. No chains were used to hold the load. Each bunk of the two sleds making a unit had a rocker swinging on a king pin at the center of the bunk, and at each end of the rocker was a massive stake hinged at the end of the rocker so that when it was dropped down it served as a skid on which the logs rolled down to the landing.

The number of loads in a train varied with the road. The steam engines probably averaged about 8 cars to a train, but on good roads in good condition trains of 10 or 12 cars were hauled.

The roads made for the log haulers were wider than those made for the horse drawn sleds, and stumps, rocks, and other obstructions were removed so that a few inches of snow would pack down to make a smooth surface. The tracks packing down the snow made their own road and some of the Lombards had a scraper fixed behind the runners which could be adjusted to smooth the road and throw the snow to one side. A special snow plow was designed which cut tracks for the sleds, and at night the water carts, big wooden tanks on bob sleds, went over the roads spraying the tracks with water to make them icy. Patrol men went over the roads constantly, repairing minor defects and keeping them in good condition. The log haulers required snow to make a road and while too much

On large operations coal was the usual fuel...but many haulers on the smaller jobs burned wood. Though coal was easier and spared the risk of ramming out a boiler plug while stuffing the fire box, wood burning among the pines made a log hauler truly independent.



A "Lombard" could haul 300 tons of wood at a speed of 4-5 m.p.h.



snow was a handicap, not enough snow was a calamity.

The length of the road varied greatly. In some cases it was five or six miles from the yards to the water. In some cases where they went from the stump to a mill, there would be 10 or even 20 miles. Lumber like spool bars or birch bolts for spool bars was hauled long distances over roads with quite heavy grades, both up and down.

The Holt tractor came into quite general use, especially in yarding logs from the stump and in moving loaded sleds to the main road in making up loads for the log hauler. It was used in some cases for hauling trains on the main road. The early Holt tractor had one feature which made it especially adapted to rough ground. The tracks had a hinge in the middle which permitted it to fit itself to inequalities in the road, thus giving it additional traction.

While the log hauler had greatly extended the distance that logs could be profitably hauled, it was itself limited in much the same way as were the horses. For obvious reasons the log hauler could not be operated on public roads and they could haul lumber direct to the mill or the railroad only where a private road could be constructed.

In some cases it was possible to eliminate driving the smaller streams by hauling to deeper water, but for the most part driving the timber to the mills was still necessary.

While the log hauler was taking over almost entirely the transport part

of the lumber industry, the trucks were being developed, made bigger, stronger, with improved tires and more powerful engines, and were being used first for bringing supplies into the woods and finally for hauling logs. At first they were used to tow bob sleds, but they were soon made to carry a large load of lumber on the truck or trailer.

When the ground was frozen hard before the snow came, satisfactory roads could be made by using motorized snow plows to keep the snow covered roads smooth and hard. These roads were satisfactory but available only in the winter months, and sometimes when an open winter covered the swamps with snow before they were frozen, they were not usable at all.

An important factor in the transition from log hauler to truck was the bulldozer, a tractor with a blade or scraper which could be adjusted to any level and angle. Even the smaller bulldozers could push their way through a dense woods, uprooting trees and pushing them aside to leave a well graded road behind. The more powerful machines which were developed pushed through everything, leveling hills and brushing aside great boulders.

With trucks equipped for hauling gravel and power shovels in the gravel pits a well graded dry truck

road could be made rapidly and at comparatively low cost. Over these roads heavily loaded trucks moved at a good speed taking long logs or pulpwood from the stump out of the woods and over public roads to the mills. This system eliminated much of the river driving and materially reduced the time required to get timber from the stump to the mill. In the ordinary course of events under the river driving system, timber cut in the autumn and winter months would get to the mills in the next July or perhaps August. In an extreme case, when logs were taken out of the Aroostook River and hauled overland to the Penobscot, two years were required to get the timber to market. Now it is quite possible to deliver timber cut in that region in the morning to the mill on the day it was cut.

With this competition the log haulers soon faded out of the picture and the Lombard business folded up. The company had made 83 log haulers in all, most of which were used in Maine and New Hampshire. Three were shipped to Russia.

Log haulers that were in town when their work was done were nearly all cut up and sold for junk. Most of them were abandoned in the woods wherever they happened to be and there they still stand, forgotten and inaccessible.

One of the very few of the steam engines that were preserved has been restored to its original running condition and is on exhibition in the Patten, Maine, Lumberman's Museum.



There were no brakes on a log hauler or on its train of sleds...nearly every road had its downgrade that made steerers pray that should they live this once more then they would find some other way to make a living."— Yankee Magazine, March 1965.



ACKNOWLEDGEMENTS

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The text of the commemorative brochure is a reprint of the article, "The Log Haulers," by Lore A. Rogers and Caleb W. Scribner, former curators of the Lumberman's Museum. The article first appeared in the August, 1967 issue of *The Northern Logger*.

NATIONAL HISTORIC MECHANICAL ENGINEERING LANDMARK LOMBARD STEAM LOG HAULER

c. 1910

THIS STEAM CRAWLER-TRACTOR EMANCIPATED HORSES FROM THE KILLING WORK OF HAULING TRAINS OF SLEDS OVER ICED ROADS IN THE WINTER WOODS OF THE UNITED STATES AND CANADA.

DESIGNED, PATENTED (1901), AND BUILT BY ALVIN C. LOMBARD (1856-1937) OF WATERVILLE, MAINE, EIGHTY-THREE "LOMBARDS" WERE THE FIRST PRACTICAL EXAMPLES OF THE OFTEN-TRIED LAG OR CRAWLER TREAD THAT WOULD BECOME THE MARK OF THE INTERNAL COMBUSTION ENGINE-DRIVEN AGRICULTURAL AND CONSTRUCTION EQUIPMENT AND MILITARY TANKS IN CURRENT USE.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS—1982
