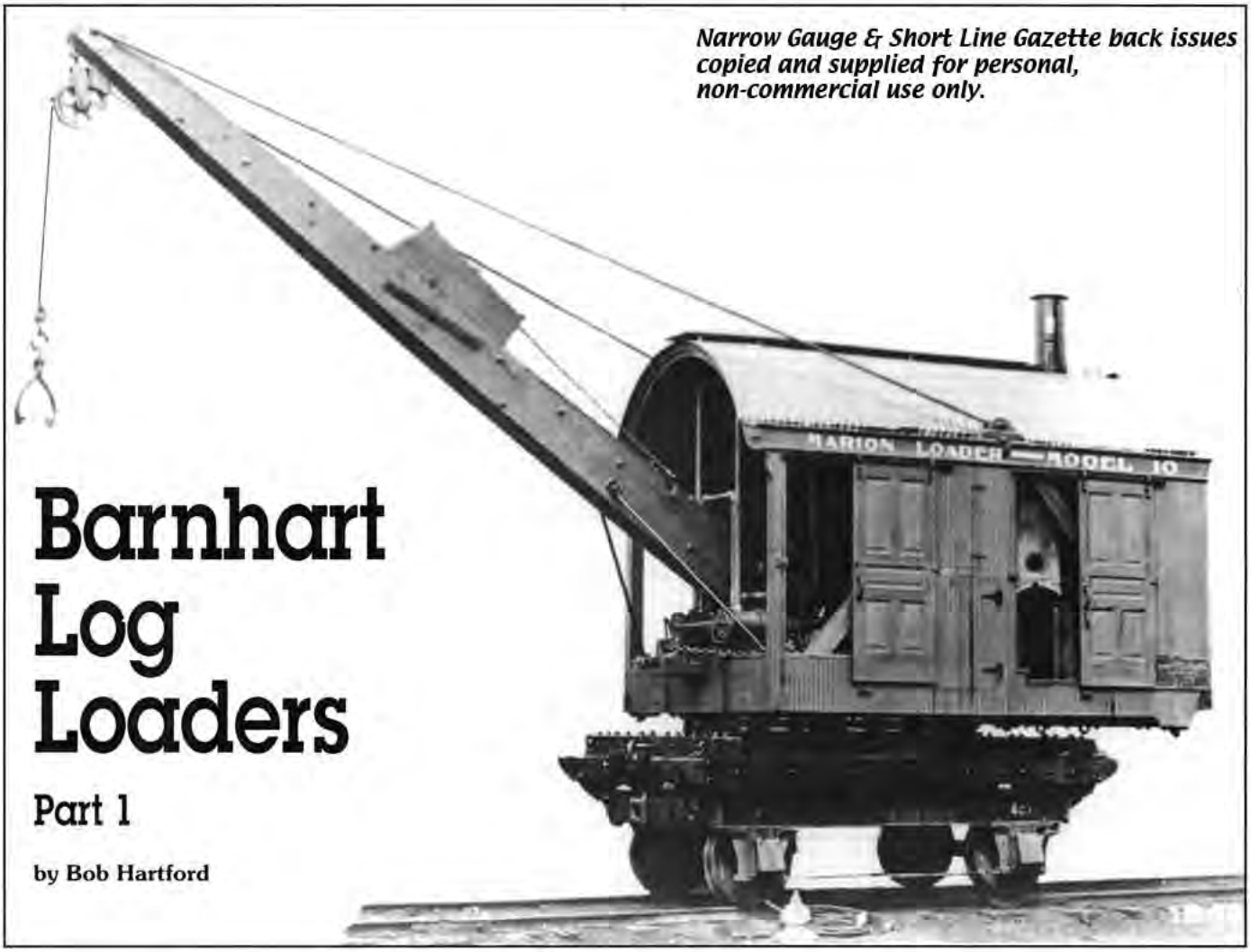
Narrow Gauge & Short Line Gazette back issues copied and supplied for personal, non-commercial use only.



Barnhart Log Loaders

Part 1

by Bob Hartford

My company, Hartford Products, Inc., is now producing a kit for a Barnhart Log Loader in ½ inch scale. **GAZETTE** columnist, Al Armitage, drew the plans for the Hartford Products kit, and helped with the research. Al and I came up with much interesting material – more than I could possibly include in the kit instructions. So Al and I will be sharing this material with **GAZETTE** readers in a series of articles. In this first part, I will give a short description and history. Al will follow in later issues with detailed descriptions, and the plans he drew for the kit.

In gathering information for this kit, I worked closely with Delores Buchsen, Administrator of the Pennsylvania Lumber Museum near Galeton, Pennsylvania. Ms. Buchsen gave me access to a prototype Barnhart, provided technical data, and spent many hours unselfishly sharing her extensive knowledge of Barnhart Log Loaders. The museum is restoring one of only two known remaining Barnharts under the direction of Lester Jordan. Lester has contributed his time over a period of seven years towards this project. Besides being of interest to **GAZETTE** readers, I hope this series will help the museum in the restoration project. If you have information – or photos – of Barnharts to share, contact Ms. Buchsen at the Pennsylvania Lumber Museum, P.O. Box K, Galeton, PA 16922.

A Barnhart Log Loader was a steam-operated derrick used to pick up and swing logs onto railroad log cars. It rode on rails fixed to the tops of log cars or flatcars. Every car in a train using a Barnhart had to have rails on it. The Barnhart started either on the second car behind the locomotive or the next to last car, loaded the first (or last) car, then winched itself to the next car across a transfer rail, or "shoefly." (Shoeflies were inverted "U"-shaped sheets of iron placed over the gaps between the rails of adjacent cars.) After all the cars in a train were loaded, the Barnhart ended up either right behind the locomotive or on the last car, where it rode to the mill to help unload the cars.

Barnhart Log Loaders were produced by the Marion Steam Shovel Co. of Marion, Ohio, a company famous for its derricks, ditchers, and steam shovels. Many of these were used in railroad construction and maintenance. The Barnhart originated when a Pennsylvania lumberman, Frank Goodyear, saw one of Marion's steam shovels running on tracks on the floors of gondola cars to unload them. He recognized the potential for using these machines as log loaders. Sometime in the mid-1880s, he had Marion equip a steam shovel with a crane and tongs. Goodyear used it to load logs on the Sinnemahoning Valley Railroad in Pennsylvania. Apparently this machine was successful, and Marion's co-founder and chief engineer, Henry M. Barnhart, developed a heavier, more stable model. It weighed 16 tons, and was named after him.

Title photo: This appears to be a builder's photo of a Marion Model 10 loader, machine #2748. The late Ben Kline thought this photo may show the Barnhart now being restored at the Pennsylvania Lumber Museum. The four-wheel truck is not part of the loader, but was just used for moving the loaders about in the Marion factory. *Photo, collection of the late Benjamin F. G. Kline, Jr.*

"Barnhart's Log Loader." Goodyear himself purchased as many as 25 Barnharts for his lumber companies in New York and Pennsylvania. Goodyear also acted as a distributor, selling Barnharts to other companies.

A Barnhart's 25-foot wood boom was stationary, and its cab pivoted. The boom was held in place by gravity and suspension rods, the toe of the boom resting in a support bolted to the engine bed in the cab. The loader's frame consisted of wood beams sheathed with iron channels. The cab rode on a 6-foot gauge, 16-roller truck. The cab and boom pivoted on this truck via a swinging circle consisting of 20 rollers and a center journal.

Power was provided by a two-cylinder steam engine with a 6½-inch bore and 8-inch stroke. (In its "twilight years," the steam engine in one Barnhart was replaced by a Diesel engine. A photo of this machine appeared on page 88 of the February 1989 **GAZETTE**.) Power for steam-powered Barnharts was transferred from a pinion gear on the drive shaft to a drive gear on a drum shaft, resulting in a 4.1:1 gear reduction. The drum shaft, supported by five bearing blocks or "boxes," had four centrifugal clutches. When engaged, the clutch at the right hand end of the shaft caused the cab and boom to pivot to the right. The clutch on the left end pivoted the cab to the left. The third clutch engaged the drum to the hoisting cable for lifting the log load. The fourth engaged the drum that winched the loader from one car to another. A friction drive at the middle of the boom, powered by a belt from the engine drive shaft, paid out the cable when there was no load on the relatively light tongs.

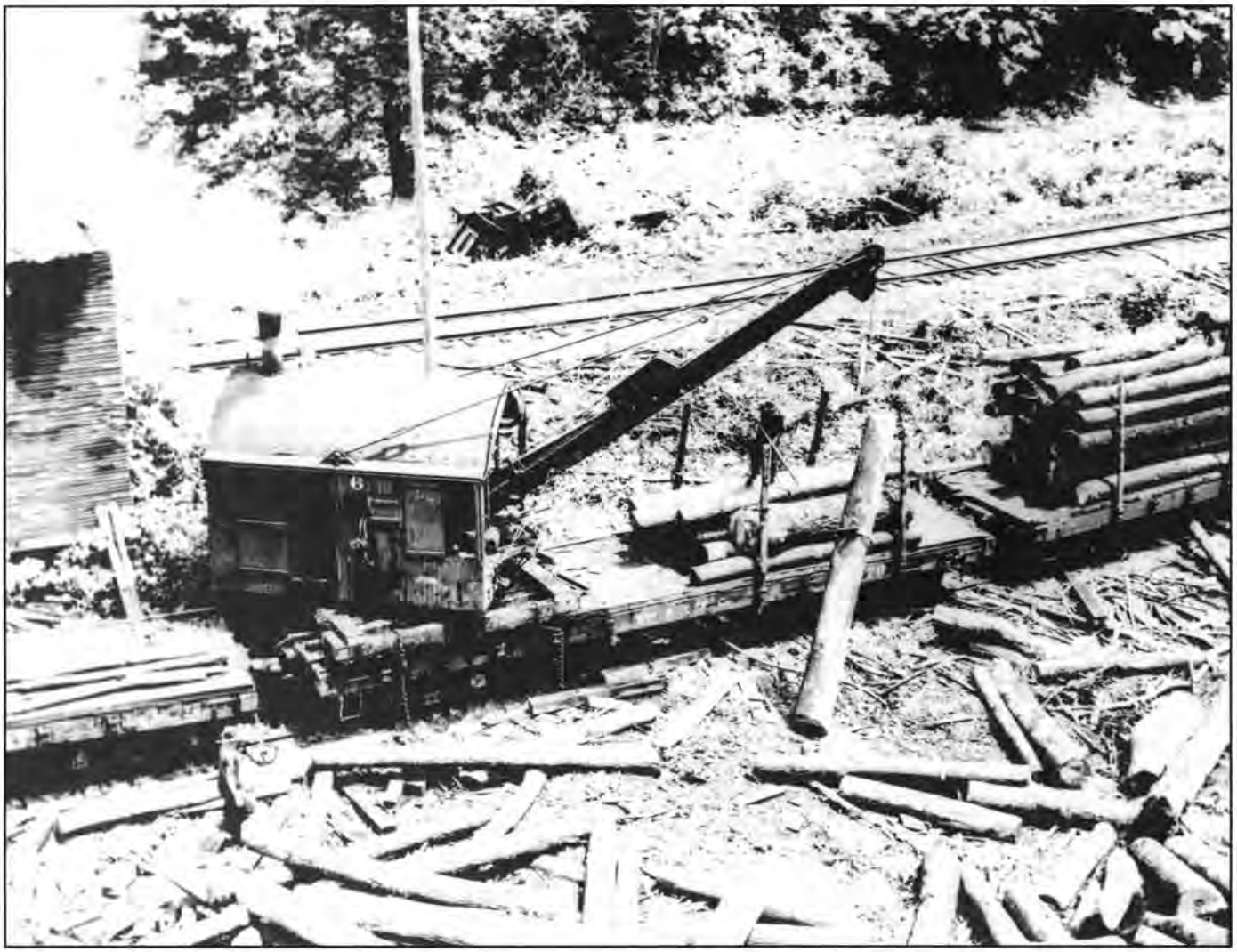
Steam for the engine was supplied by a coal-fired, 36-inch diameter, 90-inch high boiler with a working pressure of 120 psi. Two 210-gallon vertical water tanks were situated on either side of the boiler. The Barnhart loader was capable of exerting a pull at the tongs of between 11,000 and 12,000 pounds, corresponding to a log of about 1,500 board feet.

Barnharts were extremely popular with lumbermen because they were fast and efficient, requiring a crew of only three: an operator and two "tongers." Moreover, the loader could be used as a yarder because it had enough cable to drag logs to the loading site. Barnharts were also pressed into service as derricks to help clear wreckage or derailed equipment – occurrences all too frequent on short line logging roads.

Barnharts were produced over a period of 40 years, starting in the 1880s. Prior to 1906 the name "Barnhart's Log Loader" was used. Then they were renamed "Model 10 Marion Loaders," but there is little evidence to suggest that this was anything more than a name change. Barnharts and Model 10's saw service in many regions of the U.S., except for the Pacific Northwest. For the massive redwood logs of that area, Marion developed the "Model 12" loader. The Model 12 weighed 20 tons and had a steel boom and frame. However, these sturdier, more powerful machines never enjoyed the popularity of the Model 10, and only 20 were ever produced – all between 1906 and 1916. A derelict Model 12 has been photographed rusting away in a field near Elk River, Idaho.

In popular usage, the Model 10's continued to be called "Barnharts" and I will follow this practice. According to Marion's

This Barnhart Log Loader, riding on a short log car, is shown working for the Alamogordo Lumber Co. in the Coconino National Forest of New Mexico. Alamogordo purchased at least three Barnharts from Marion. Notice the rails used to move the loader from car to car as it loaded logs. This Barnhart still has its factory-provided corrugated roof. *Photo, collection of the National Forest Library.*



This Barnhart is loading one end of a flatcar on the West Virginia Pulp & Paper Company. Notice the rails laid on the flatcar decks to allow the loader to move from car to car. This loader has a sheet metal roof instead of the corrugated roof supplied at the factory. *Photo, author's collection.*

1893 catalog, Barnharts were also offered as derricks to be used "...for light wrecking of any kind, or for use in stone quarries ..." Records indicate that by 1927, 218 of these machines were produced. About two-thirds were the original Barnhart's while the rest were Model 10's.

Owners altered, repaired and "improved" their Barnharts, producing noticeable changes in their appearance, as did normal wear, damage, and weather. The wood parts of Barnharts were painted brown at the factory, and the metal parts, black. Photos suggest that Barnharts were rarely, if ever, repainted, and eventually their typical colors became "weathered gray" and rust.

One of the most obvious owner modifications was to the protective housing over the levers actuating the friction drive on the boom. Some photos even show that this housing was removed. Another typical owner modification was to replace the corrugated tin roof with tongue-and-groove boards covered with tar paper. Factory blueprints show a ladder at the rear of the cab and a roof walk, but both are generally absent in photos of working Barnharts.

Apparently the factory-mounted "U"-bolts and rings for the propelling chain on the truck proved to be too weak, and Marion replaced this design with spring-loaded drawbars housed in brackets bolted to the end cross stringers of the truck. The Barnhart at the Pennsylvania Lumber Museum has this drawbar arrangement. One "cosmetic" change was to modify the shape of the ends of the main truck beams from a rounded to a flat slope profile. Sometimes the tips were cut off (or worn off) flush with the iron channels. It is impossible to provide exact data on any particular "Barnhart." Blueprints used by the Pennsylvania Lumber Museum in its restoration project cover more than 20 years.

Each machine had a number on its builder's plate. These numbers ranged from #5 on the first Barnhart, to #5839 on the two hundred and eighteenth. Obviously Barnharts were not numbered consecutively, machine numbers being assigned to other kinds of equipment Marion was building at the time. According to company records, the last Barnhart, #5839, was shipped to the F. H. Hopkins Co., Ltd. (Singer Mfg. Co.) on January 27, 1927.

Title photo: The doors, windows, and roof of this Barnhart Log Loader have all been modified from factory condition. *Photo, collection of Bob Hartford.*

This dilapidated Model 10 Barnhart Log Loader is mounted on a skeleton log car. *Photo, collection of Bob Hartford.*

Barnhart Log Loaders

Part 2: The Cab and Carriage

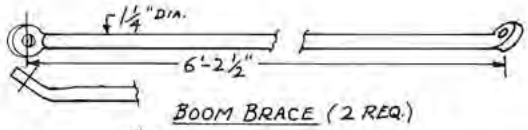
by Al Armitage

In Part 1 in the last issue, Bob Hartford described the history and operation of Barnhart Log Loaders. In this, and two following articles I will point out some odd features of these machines on the plans I drew

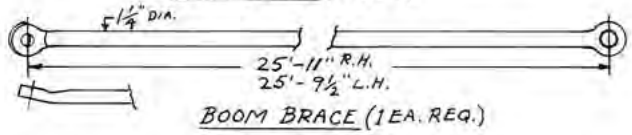
(Continued on p. 52)

A BARNHART LOG LOADER — THE CAB

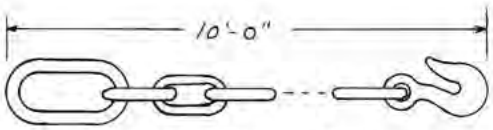
DRAWN BY AL ARMITAGE
SCALE: 3/8 INCH=1 FOOT (except for small parts and details)



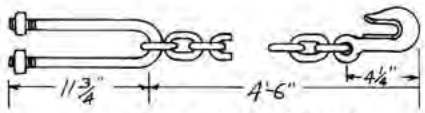
BOOM BRACE (2 REQ.)



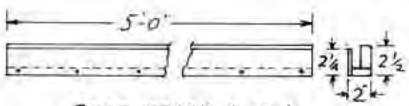
BOOM BRACE (1 EA. REQ.)



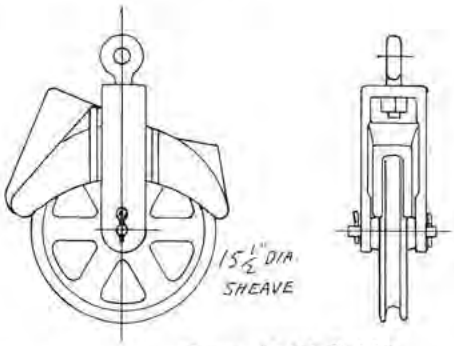
HOG CHAIN (2 REQ.)



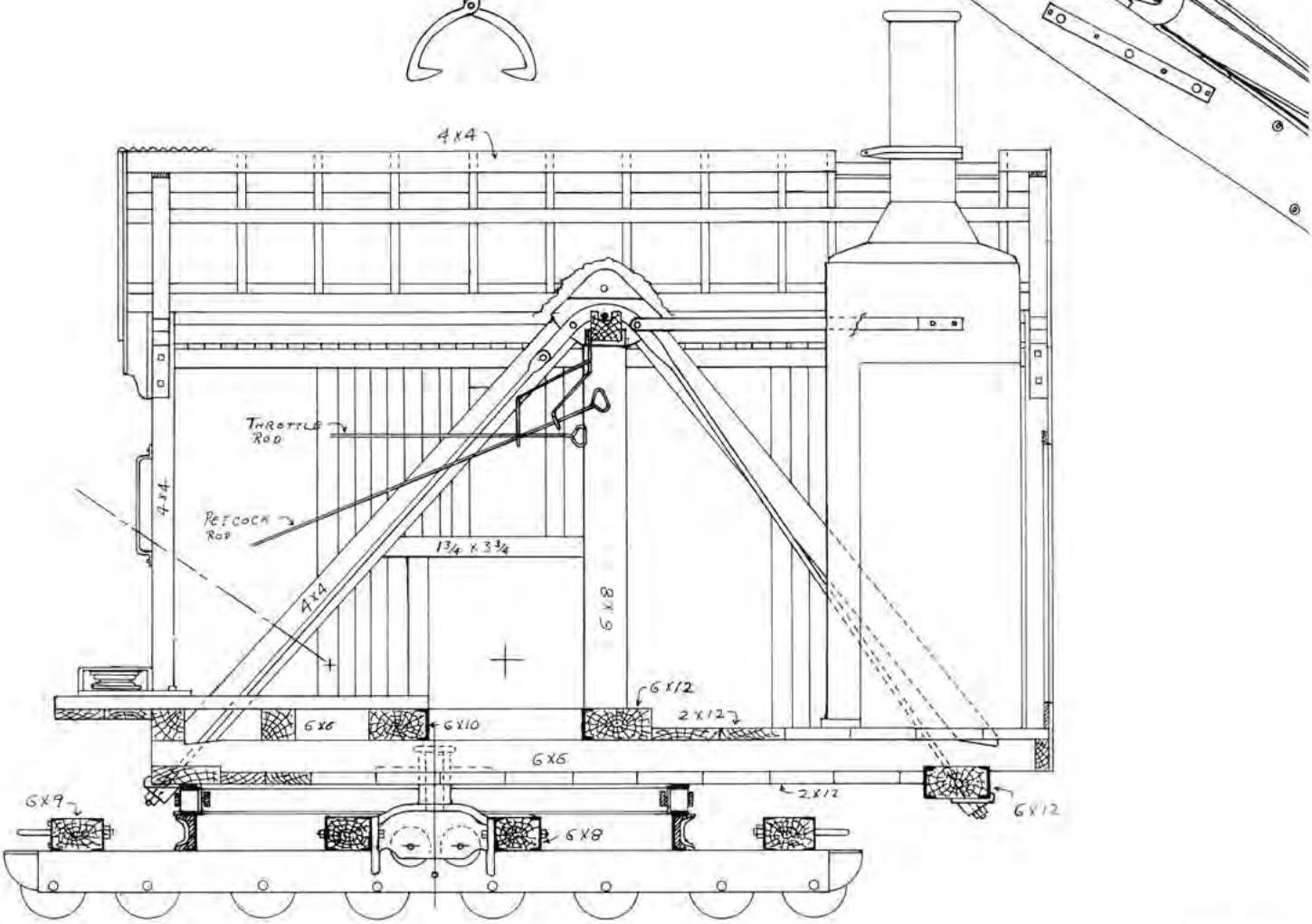
ANCHOR CHAIN (4 REQ.)



DOOR TRACK (4 REQ.)

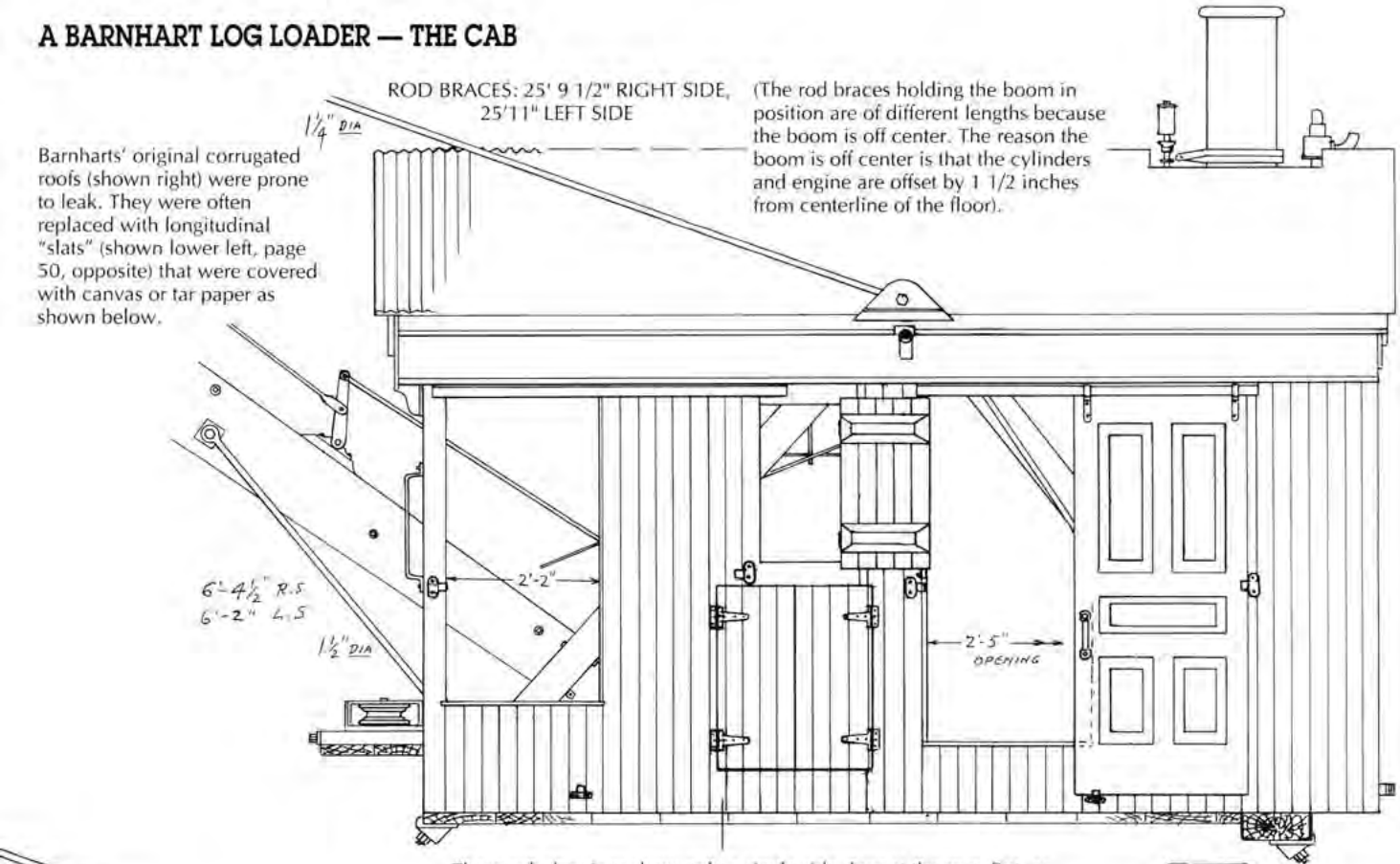


BOOM HEAD BLOCK
(1 REQ.)



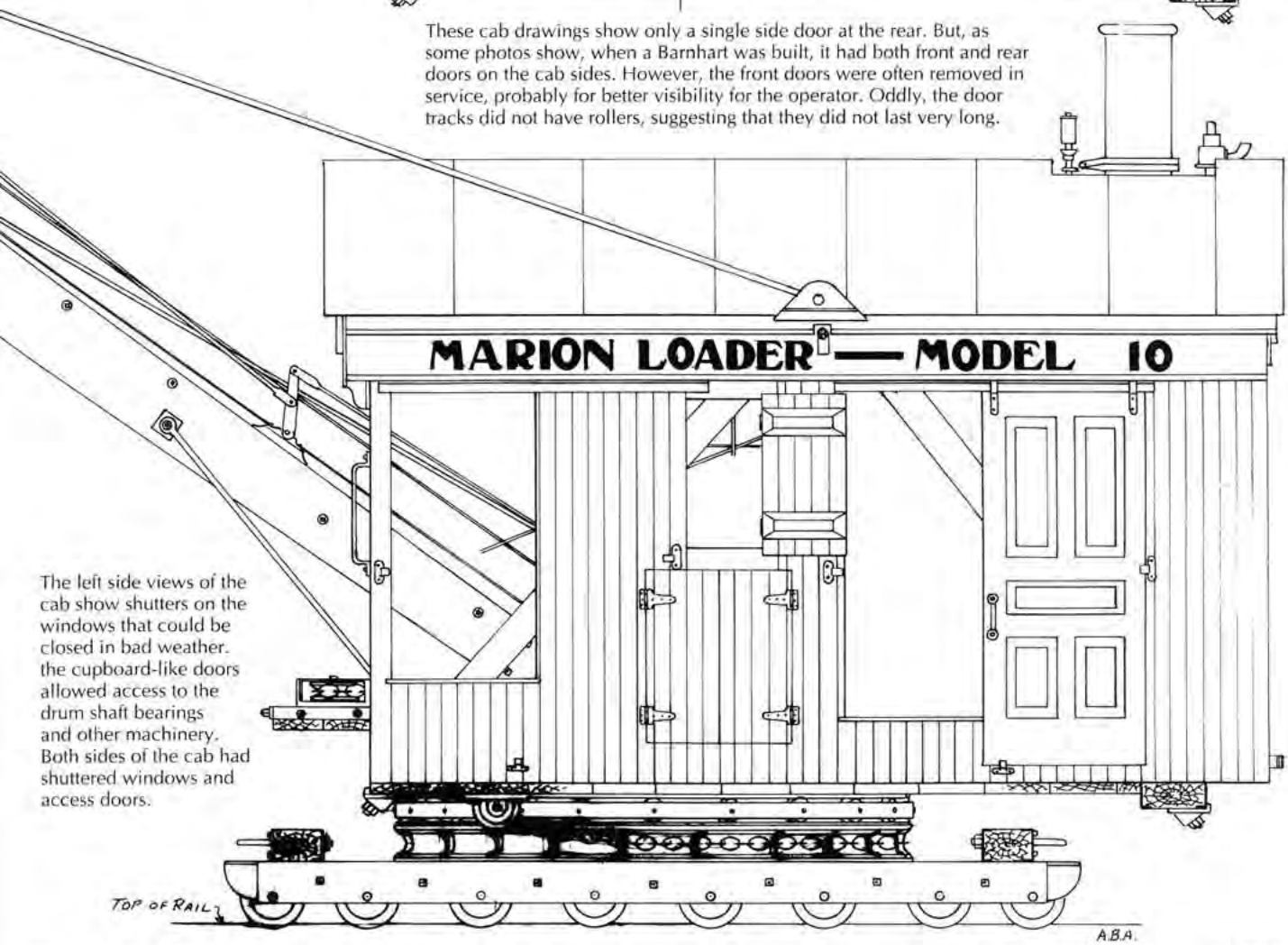
A BARNHART LOG LOADER — THE CAB

Barnharts' original corrugated roofs (shown right) were prone to leak. They were often replaced with longitudinal "slats" (shown lower left, page 50, opposite) that were covered with canvas or tar paper as shown below.



(The rod braces holding the boom in position are of different lengths because the boom is off center. The reason the boom is off center is that the cylinders and engine are offset by 1 1/2 inches from centerline of the floor).

These cab drawings show only a single side door at the rear. But, as some photos show, when a Barnhart was built, it had both front and rear doors on the cab sides. However, the front doors were often removed in service, probably for better visibility for the operator. Oddly, the door tracks did not have rollers, suggesting that they did not last very long.



The left side views of the cab show shutters on the windows that could be closed in bad weather. the cupboard-like doors allowed access to the drum shaft bearings and other machinery. Both sides of the cab had shuttered windows and access doors.

DRAWN BY AL ARMITAGE

SCALE: 3/8 INCH=1 FOOT

(Continued from p. 49)

for Bob's company, Hartford Products Inc. Hartford Products is now marketing a ½ inch scale Barnhart kit based on these plans. The plans are also being used in the restoration of a prototype Barnhart Log Loader at the Pennsylvania Lumber Museum under the direction of Lester Jordan.

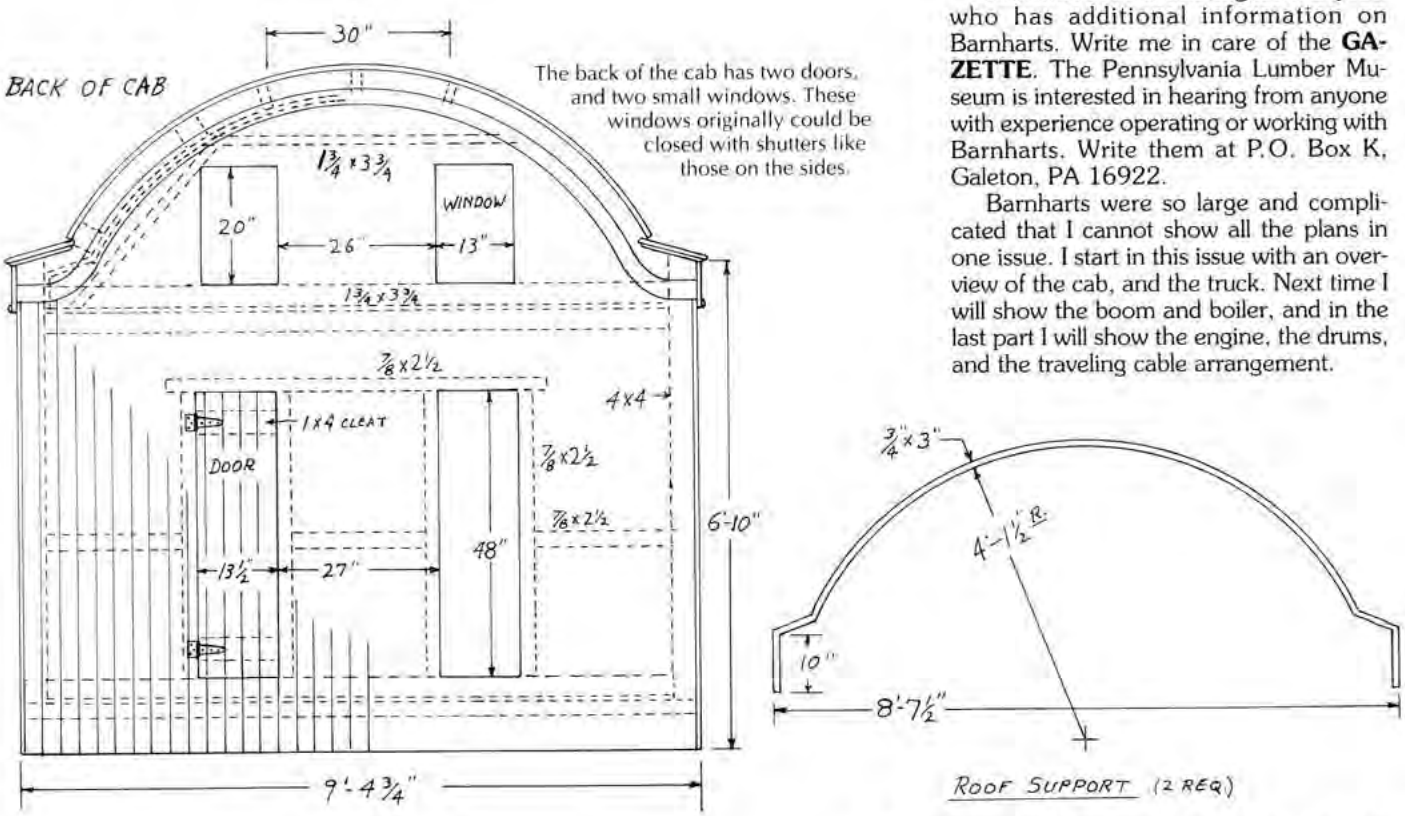
I worked from a bundle of prototype drawings and a few photos supplied by Bob. The drawings consisted mostly of parts details, and a few erecting views in a variety of scales. The drawings often conflicted with each other – many lacked dimensions – and there was a complete lack of explanation as to how some parts related to others. Bob and I spent much time on the telephone trying to solve the puzzles these drawings presented. The finished plans represent the best of our combined efforts to understand how Barnharts were constructed and operated.

My feeling is that Barnhart Log Loaders are some of the most cockeyed machines I ever encountered. In my opinion, the chain drive system for swiveling the cab, and their traveling cable arrangement both qualify for "Rube Goldberg" awards.

By the way, the photo on page 21 in Part 1 in the last issue was miscaptioned. The Barnhart shown there was *not* in New Mexico. The caption should have read: "Probably a Model 10 Barnhart on the Cherry River Boom & Lumber Co. Photo, collection of the late, Benjamin F. G. Kline, Jr."

I am interested in hearing from anyone who has additional information on Barnharts. Write me in care of the **GAZETTE**. The Pennsylvania Lumber Museum is interested in hearing from anyone with experience operating or working with Barnharts. Write them at P.O. Box K, Galeton, PA 16922.

Barnharts were so large and complicated that I cannot show all the plans in one issue. I start in this issue with an overview of the cab, and the truck. Next time I will show the boom and boiler, and in the last part I will show the engine, the drums, and the traveling cable arrangement.



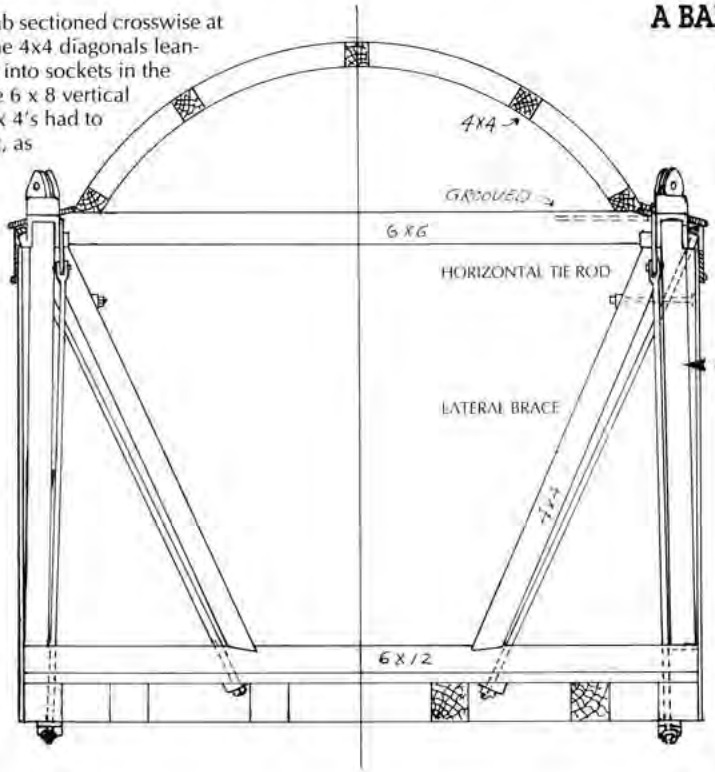
The back of the cab has two doors, and two small windows. These windows originally could be closed with shutters like those on the sides.

ROOF SUPPORT (2 REQ)

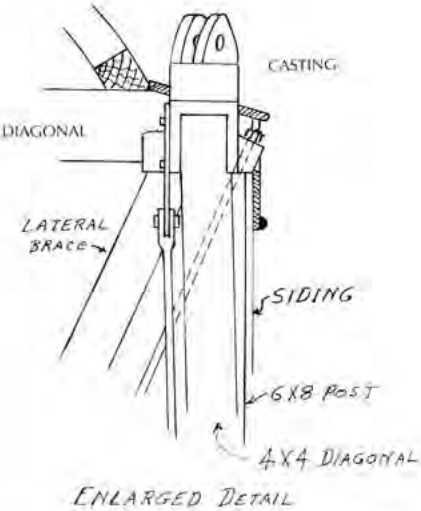
A BARNHART LOG LOADER — THE CAB

DRAWN BY AL ARMITAGE
SCALE: 3/8 INCH=1 FOOT
(except for small parts and details)

The plan showing the cab sectioned crosswise at the center post shows the 4x4 diagonals leaning inward slightly to fit into sockets in the castings at the top of the 6 x 8 vertical support beam. These 4 x 4's had to be "mortised" a bit to fit, as shown in the enlarged detail. The lateral braces had to be "dapped and gained" into the lower beam. The upper 6 x 6 cross-beam had to be grooved to clear the horizontal tie rod.



SECT. AT CENTER POST

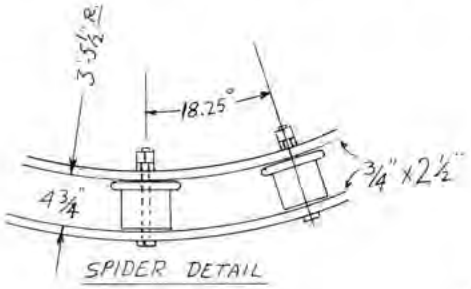


ENLARGED DETAIL

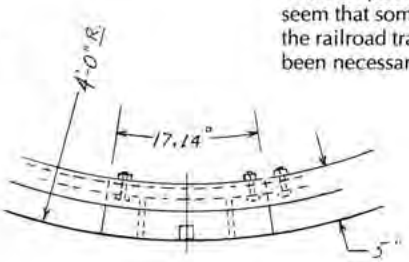
A BARNHART LOG LOADER — THE CARRIAGE (TRUCK)

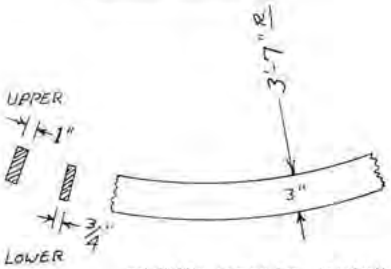
DRAWN BY AL ARMITAGE
SCALE: 3/8 INCH=1 FOOT (except for small parts and details)

The truck (carriage) was constructed of heavy timbers reinforced with steel channels, and bolted together to form a very rugged platform for the machine. The series of castings that form the base for the roller tracks are bolted into a circular ring that is fastened with lag screws to the truck's timbers. These castings also provide the "groove" for the chain drive that rotates the loader. The swivel roller track was welded on top of this ring, and a similar matching track was mounted under the cab. The 20 swivel rollers were held between two steel strap" rings" as shown in the spider detail. (left). The track clamps held the loader in position on a car while it was loading another car. It would seem that some method of stabilizing the car carrying the loader on the railroad track such as adjustable jacks or outriggers, would have been necessary. But, none was found in either plans or photos.

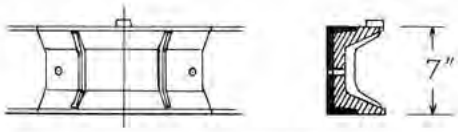


SPIDER DETAIL

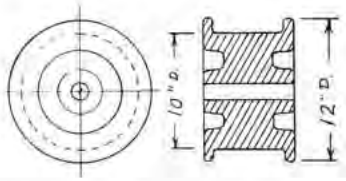




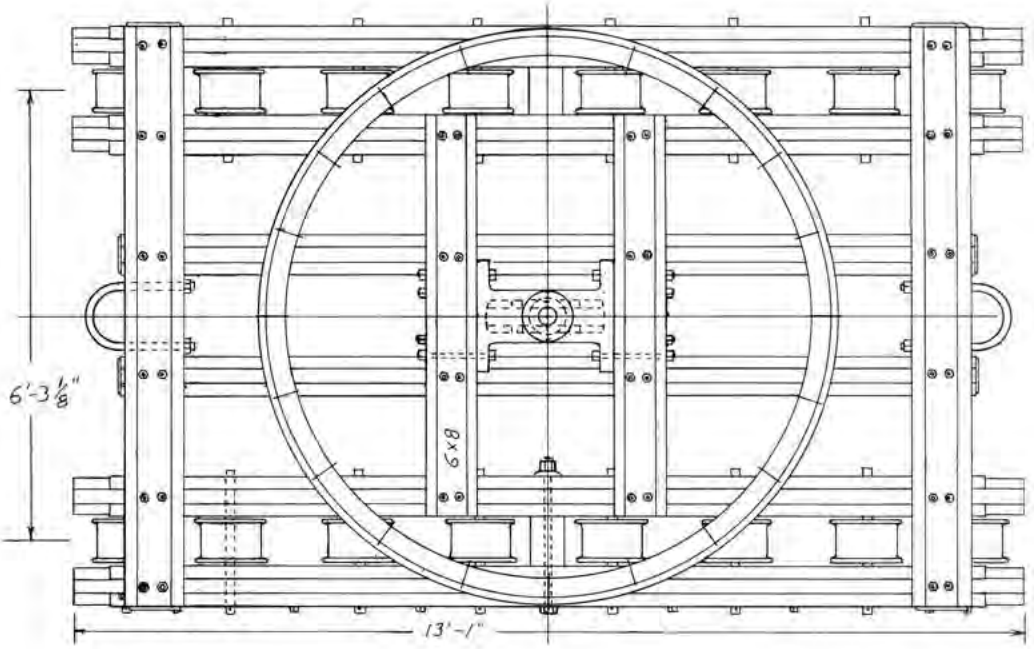
SWIVEL ROLLER TRACK
(2 REQ.)

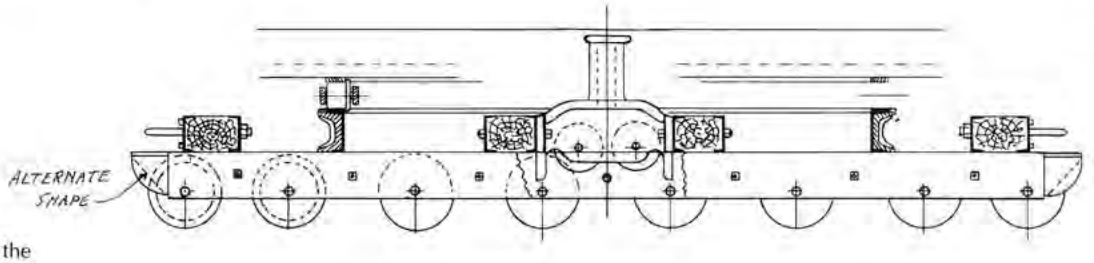


BASE CASTING FOR ROLLER TRACK
(21 PCS. REQ)



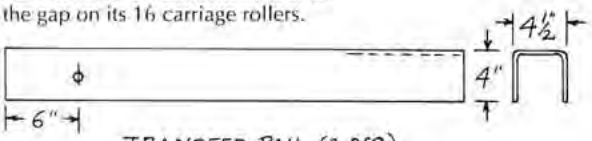
CARRIAGE ROLLER DETAIL
(16 REQ.)



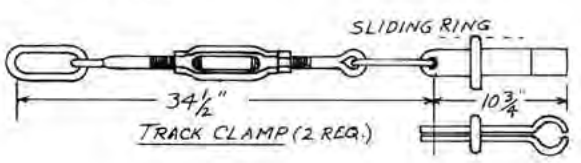


CARRIAGE DETAILS

Transfer rails were used to bridge the gap in the rails between cars. The Barnhart then winched itself across the gap on its 16 carriage rollers.



TRANSFER RAIL (2 REQ.)



TRACK CLAMP (2 REQ.)

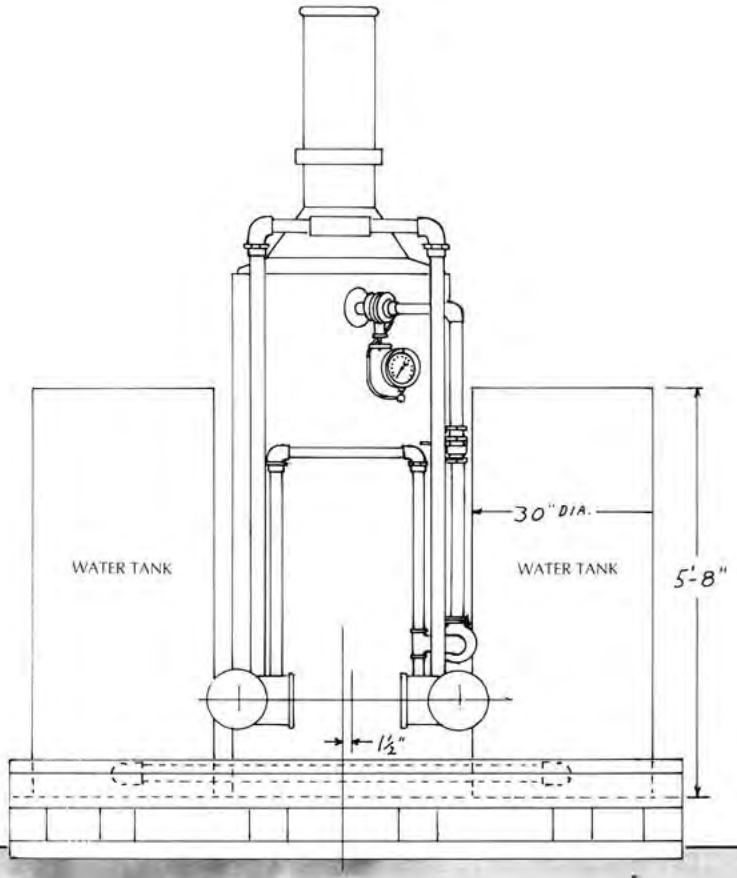
Barnhart Log Loaders

Part 3: The Boiler and Boom

by Al Armitage

These plans have been prepared to assist the Pennsylvania Lumber Museum and museum volunteer, Lester Jordan, in the restoration of the only known surviving Barnhart, Model 10 loader.

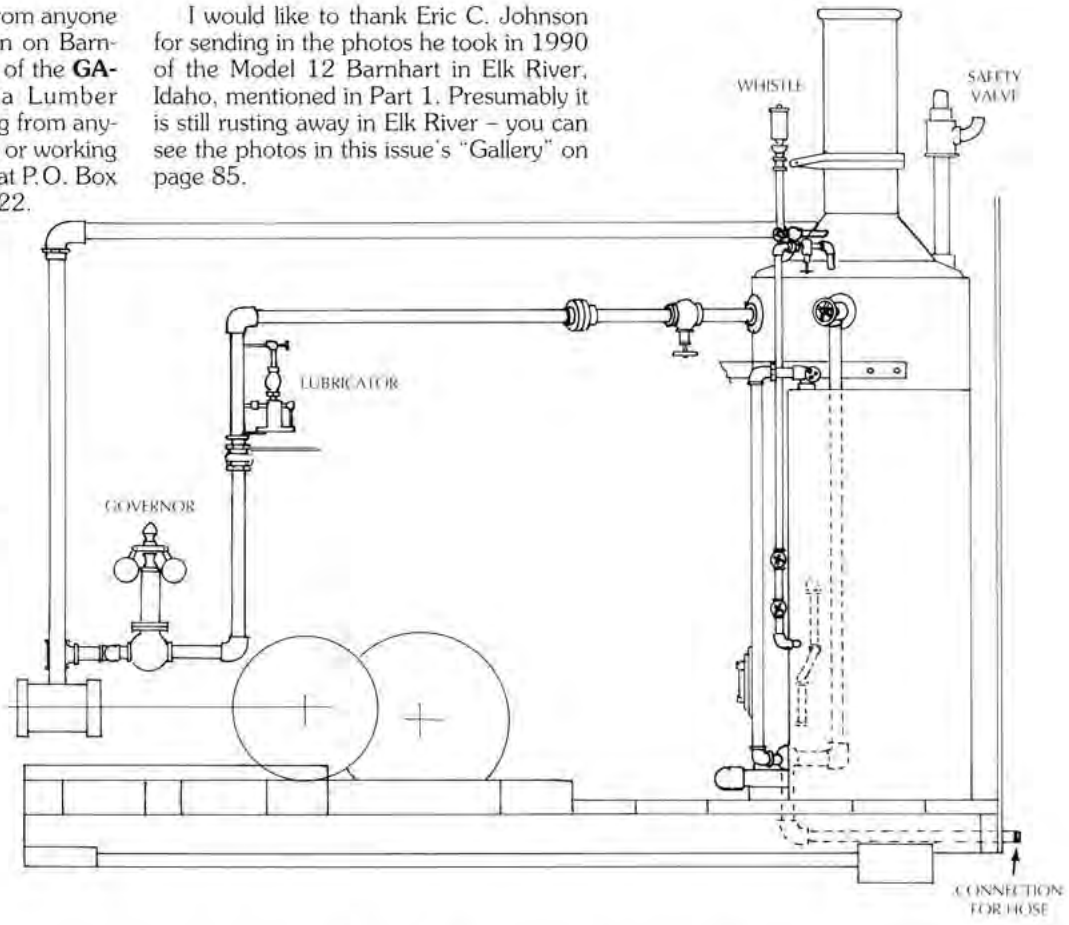
Barnharts were so large and complicated that I could not show the entire plan in one issue. Part 1 in the November/December 1993 issue was a general description of Barnharts by Bob Hartford. My plans began in Part 2 in the with an overview of the cab and the truck. In this issue I will show the boiler and boom, and in Part 4 in the next issue, I will show the engine, drums, and traveling cable arrangement.

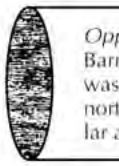


I am interested in hearing from anyone who has additional information on Barnharts. (Please write me in care of the **GAZETTE**.) The Pennsylvania Lumber Museum is interested in hearing from anyone with experience operating or working with Barnharts. Write to them at P.O. Box K, Galeton, Pennsylvania 16922.

I would like to thank Eric C. Johnson for sending in the photos he took in 1990 of the Model 12 Barnhart in Elk River, Idaho, mentioned in Part 1. Presumably it is still rusting away in Elk River – you can see the photos in this issue's "Gallery" on page 85.

PIPING ARRANGEMENT





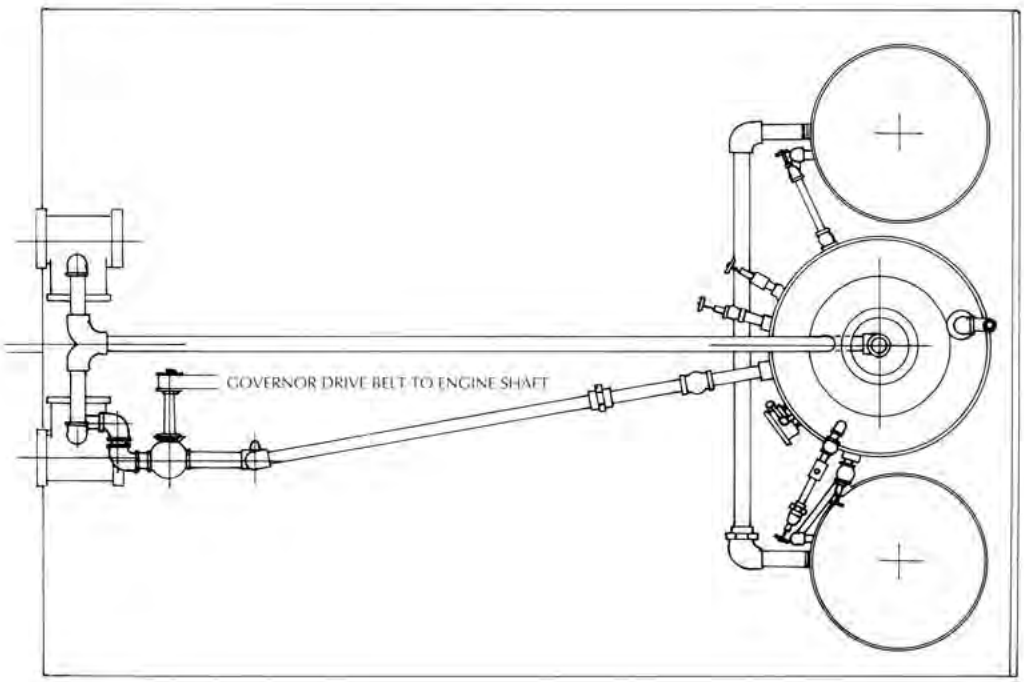
Opposite: The hose for filling the boiler of this battered Barnhart Log Loader is hung on its battered back. The photo was taken in 1939 at the Conasauga River Lumber Co. in north Georgia where the machine was loading yellow poplar and oak. *Photo, courtesy of the National Forest Library.*

Here are three views of the boiler, the two water tanks, and attendant piping. Note that the two tanks are connected by a pipe at the bottom, and that a "filler" pipe extends out through the rear cab wall for a hose connection. This filler pipe was connected to a "siphon" (actually a venturi pump) powered by steam from the boiler, and could be used in conjunction with a hose to draw water from nearby streams. Most of the photos of Barnharts show a hose hung on the cab in various positions.

A BARNHART LOG LOADER – THE BOILER AND WATER TANKS

DRAWN BY AL ARMITAGE
SCALE: 3/8 INCH = 1 FOOT
(except for small parts and details)

PIPING – PLAN VIEW



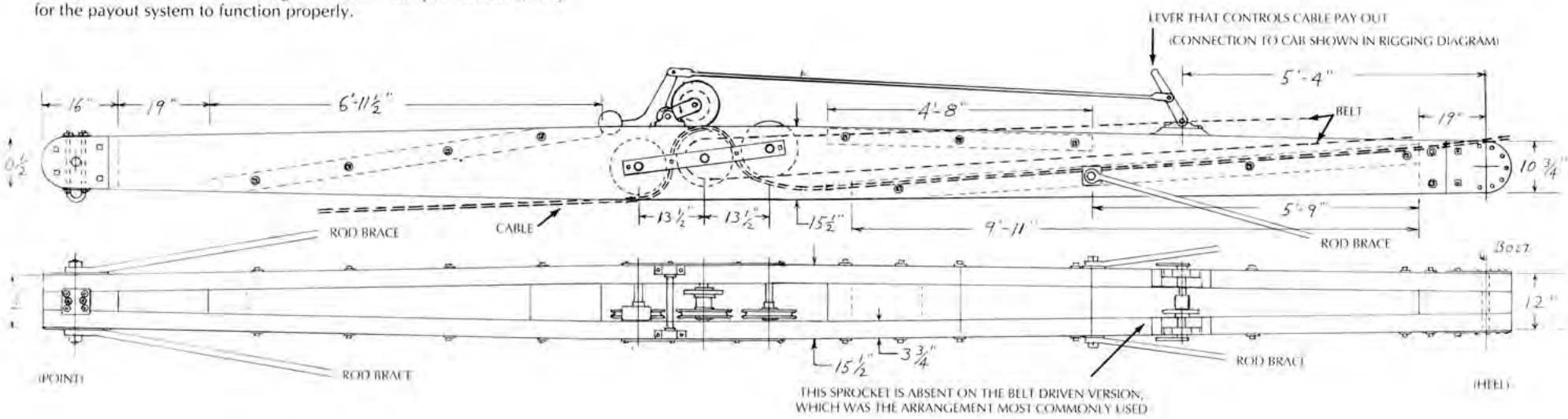
A BARNHART LOG LOADER – THE BOOM

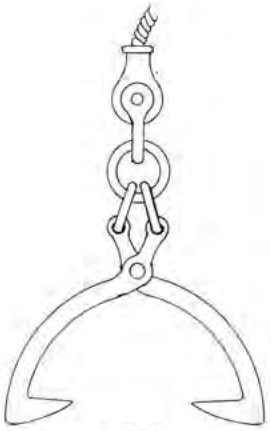
DRAWN BY AL ARMITAGE
SCALE: 3/8 INCH = 1 FOOT (except for small parts and details)

Since the tongs were too light to pull the hoisting cable down to a log, a system was devised to pay out the cable as needed. This system involved a belt, driven by a pulley on the engine shaft that ran up the boom to a pulley. There it turned a sheave that could be brought to bear against the cable as it passed over another sheave "cramping" it, thus paying out the cable. The diagrams shows this arrangement, including the rods and lever that controlled the belt. From the tong sheave, the cable passed under the first idler sheave, over the middle, or "friction" sheave, under the rear idler sheave and on to the hoisting cable drum. This path was necessary for the payout system to function properly.

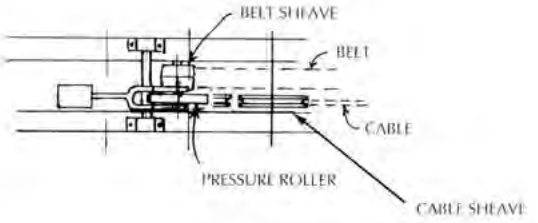
Before the belt drive came into use, a chain and sprocket system was used instead of the pulleys. The hoisting cable was ⅞-inch in diameter and 150 feet long.

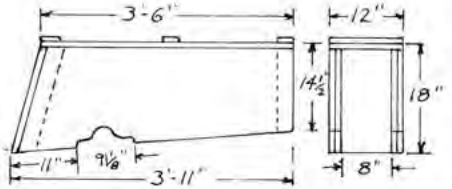
Some photos of Barnharts (including one here) show a wood housing over these sheaves and levers, perhaps as a protection from the weather, and to prevent twigs and leaves from fouling the works. The housing is shown in the detail drawing.





TONGS

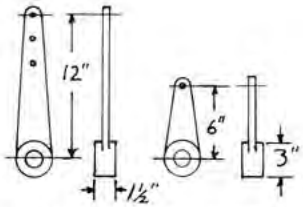




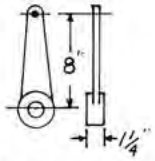
HOUSING USED WITH BELT DRIVE
(1 REQ.)

A BARNHART LOG LOADER – THE BOOM

DRAWN BY AL ARMITAGE
SCALE: 3/8 INCH = 1 FOOT (except for small parts and details)

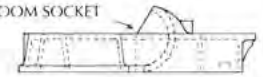


LOWER BOOM LEVERS
(1 EA. REQ.)



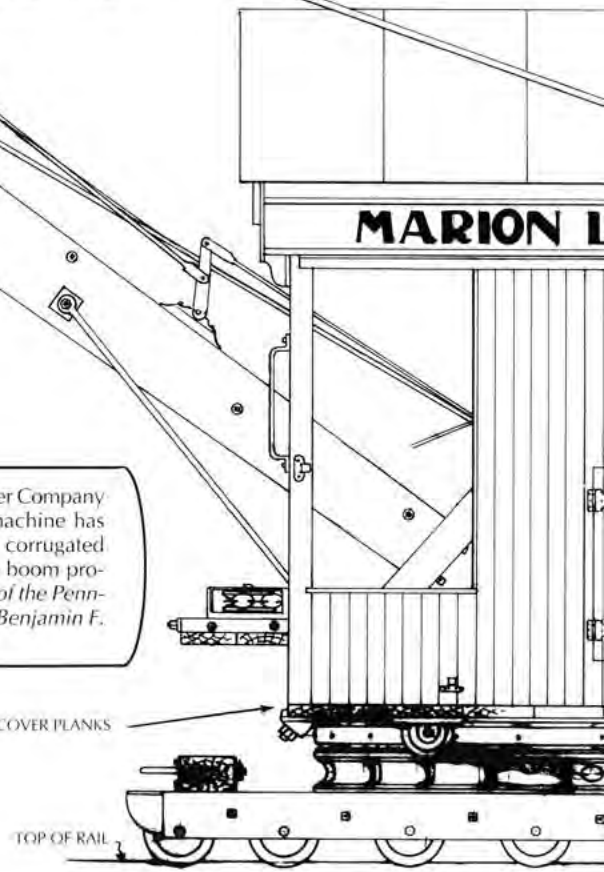
ARM ON ENGINE LEVER SHAFT
(3 REQ.)

The boom has some features that may be confusing if not explained. The heel, or lower end, fitted into a socket in the engine base casting as shown in the detail. There was no mechanical attachment of the boom here – only gravity and the four rod braces held it in place.



RIGGING DIAGRAM

A Barnhart on the Lackawanna Lumber Company in Cross Fork, Pennsylvania. This machine has lost a door but still has its original corrugated metal roof. Note the housing on the boom protecting the sheaves. *Photo, courtesy of the Pennsylvania Lumber Museum, from the Benjamin F. G. Kline, Jr. collection.*



This loader, belonged to the Alamogordo Lumber Company. Here it is shown working in the Cocomino National Forest in Arizona. *Photo, collection of Bob Hartford.*

Barnhart Log Loaders

Part 4: The Engine, Drums, and Traveling Cable Arrangement

by Al Armitage

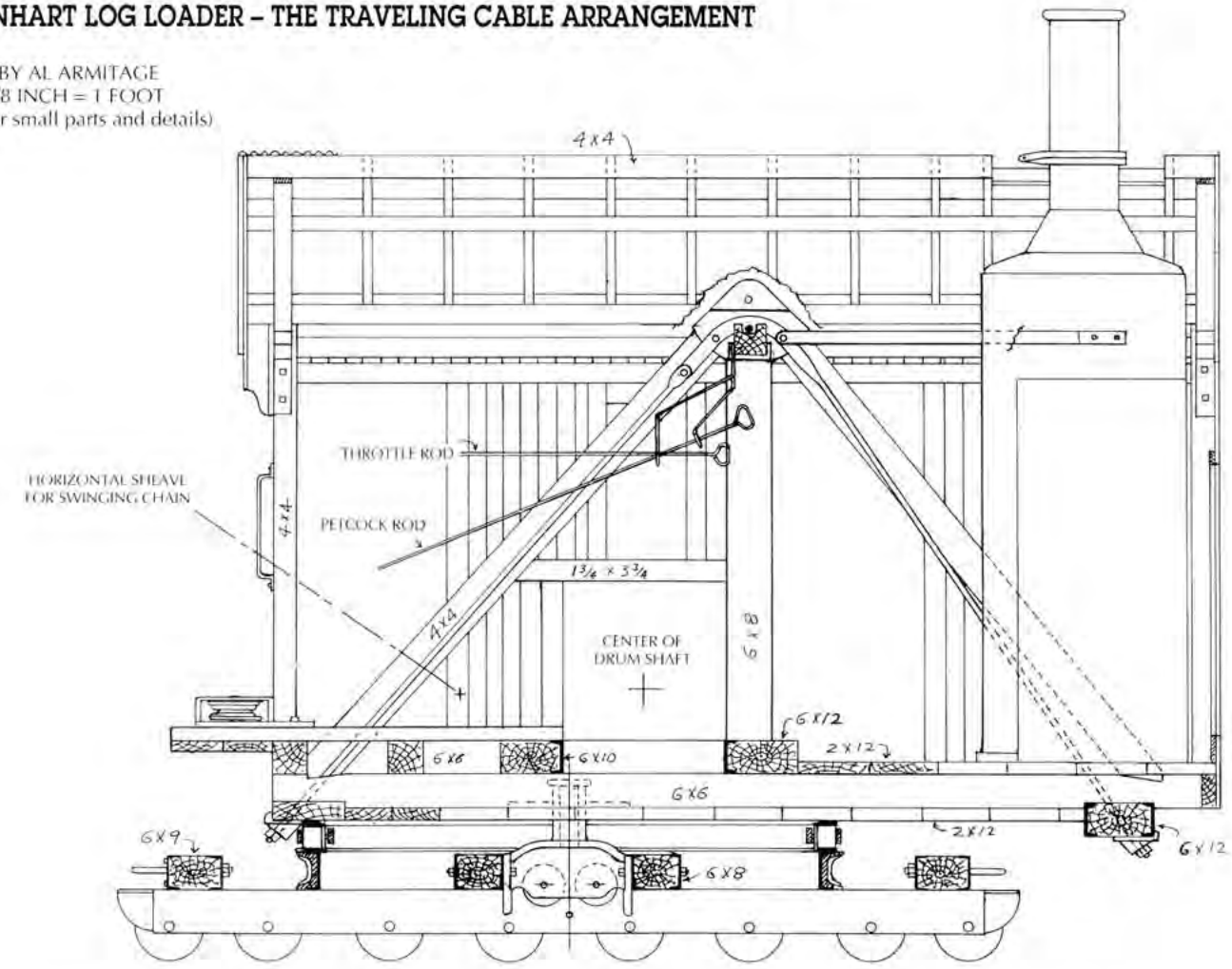
This is the fourth and final part in my series of Barnhart log loader plans. These plans have been prepared to assist the Pennsylvania Lumber Museum and museum volunteer, Lester Jordan, in the restoration of the only known surviving Barnhart Model 10 loader. Barnharts were so large and complex that I could not show the entire plan in one issue. Part 1(November/December 1993 issue) was a general description of Barnharts by Bob Hartford. Part 2 in the January/February 1994 issue began with an overview of the cab and the truck. In the March/April issue I showed the boom and boiler. In this issue, I will show the engine, drums, and traveling cable arrangement.

All the photos of loaders in this series showed various configurations in various stages of disrepair. Some of the configurations were produced at the factory, others were modifications by Barnhart owners. Some of the weird features of Barnharts may have resulted from the fact that they were not designed "from scratch." These curious machines were adaptations of a Marion steam shovel or derrick. In spite of their weird features, these monstrosities were a great success in the Eastern woods, and many other parts of the U. S. Barnharts, however, never gained favor in the Pacific Northwest, supposedly because logs there were too heavy for them to handle.

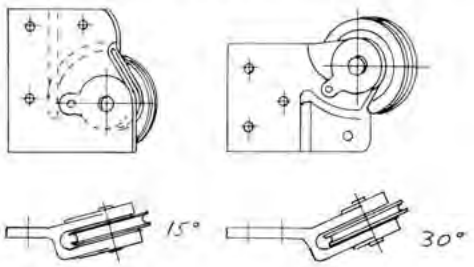
If any reader has knowledge of errors or omissions in my drawings, or text, or can provide additional information on the Barnhart, write me in care of the **GAZETTE**. The Pennsylvania Lumber Museum is interested in hearing from anyone with experience operating or working with Barnharts. You can write them at P.O. Box K, Galeton, Pennsylvania 16922.

A BARNHART LOG LOADER – THE TRAVELING CABLE ARRANGEMENT

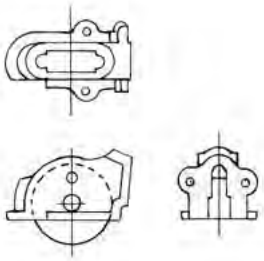
DRAWN BY AL ARMITAGE
SCALE: 3/8 INCH = 1 FOOT
(except for small parts and details)

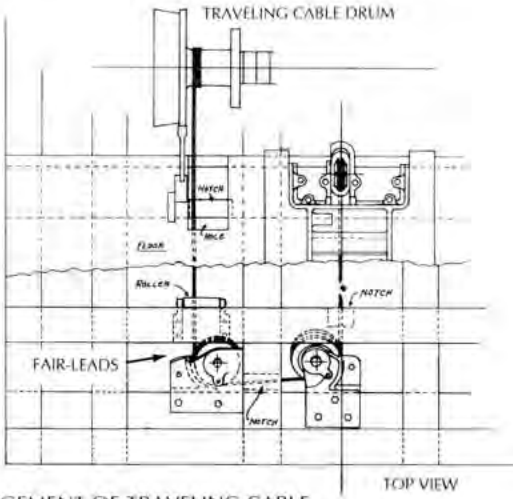


FAIR-LEADS
(1 EA. REQUIRED)



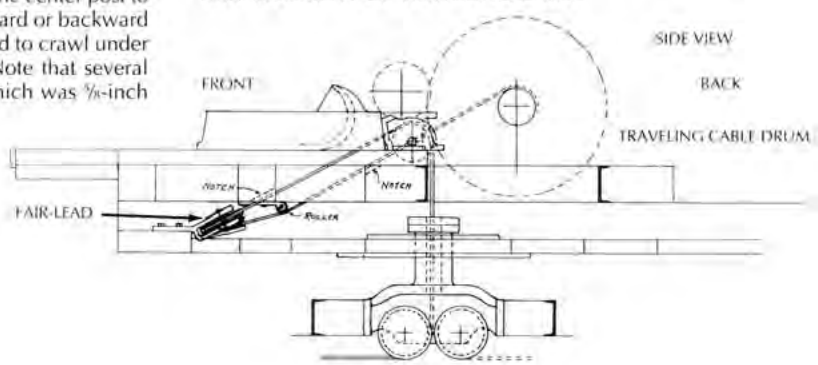
FAIR-LEAD
(FOR TRAVELING CABLE)



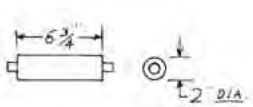


ARRANGEMENT OF TRAVELING CABLE

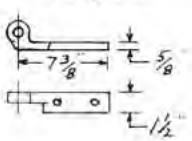
One of the drums is for the traveling cable, used to haul the loader from car to car as the cars are loaded or unloaded. The diagrams show how the traveling cable leads from the drum, through a hole in the floor to a roller, then to a pair of fair-leads, and up to a sheave on the back of the engine base, then down through the center post to two sheaves mounted on the carriage that led the cable either forward or backward depending on which way the machine was to move. Somebody had to crawl under the machine and move the cable in order to reverse direction. Note that several notches in the timbers are required for clearance for the cable which was ⅞-inch diameter and 125 feet long.



ROLLER
(1 REQUIRED)



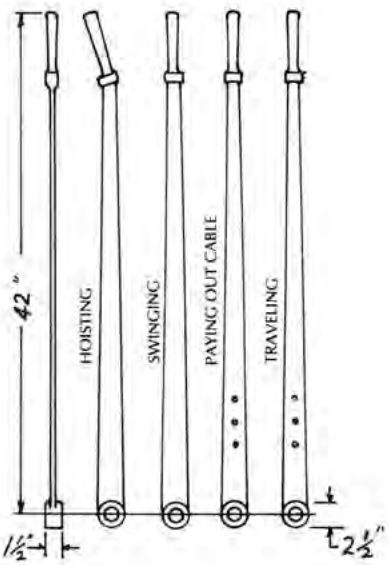
BRACKET
(FOR TRAVELING CABLE)
(2 REQUIRED)



A BARNHART LOG LOADER – THE ENGINE AND DRUMS

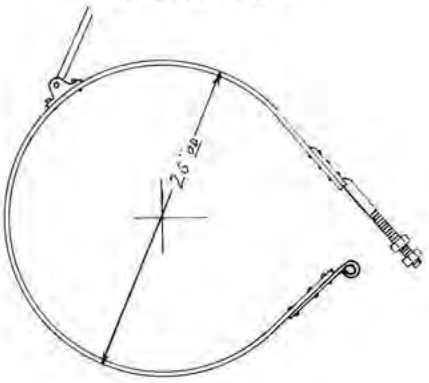
DRAWN BY AL ARMITAGE
SCALE: 3/8 INCH = 1 FOOT
(except for small parts and details)

HAND LEVERS
(1 EA. REQUIRED)



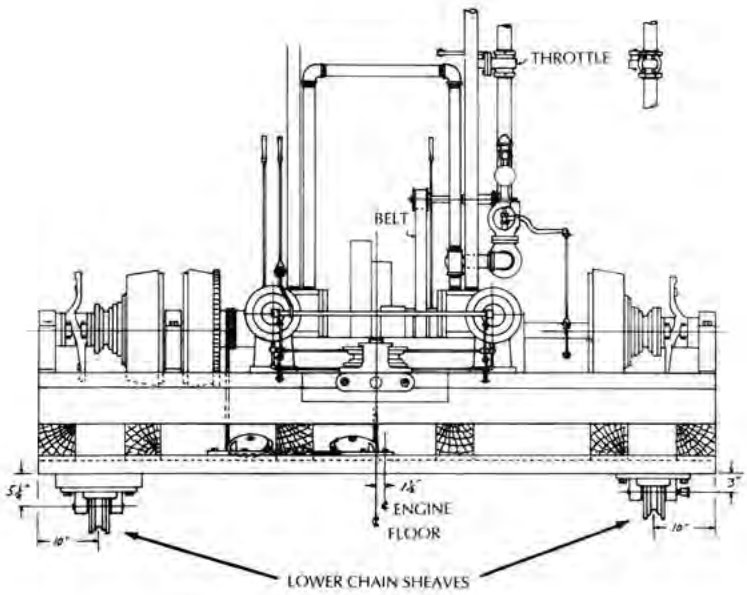
The chain drive, for turning the cab through 360 degrees, was continuous and followed the path shown in the diagram. (The circular ring that the cab rotated on was shown in Part 2. This ring was grooved for the chain drive.) The horizontal sheave, at the front, was a spring-loaded chain tightener that kept a constant tension on the chain. The front view shows that the lower chain sheaves under the floor were at different levels. Why this was so is unclear.

FRICTION BAND
(GOES AROUND DRUM)

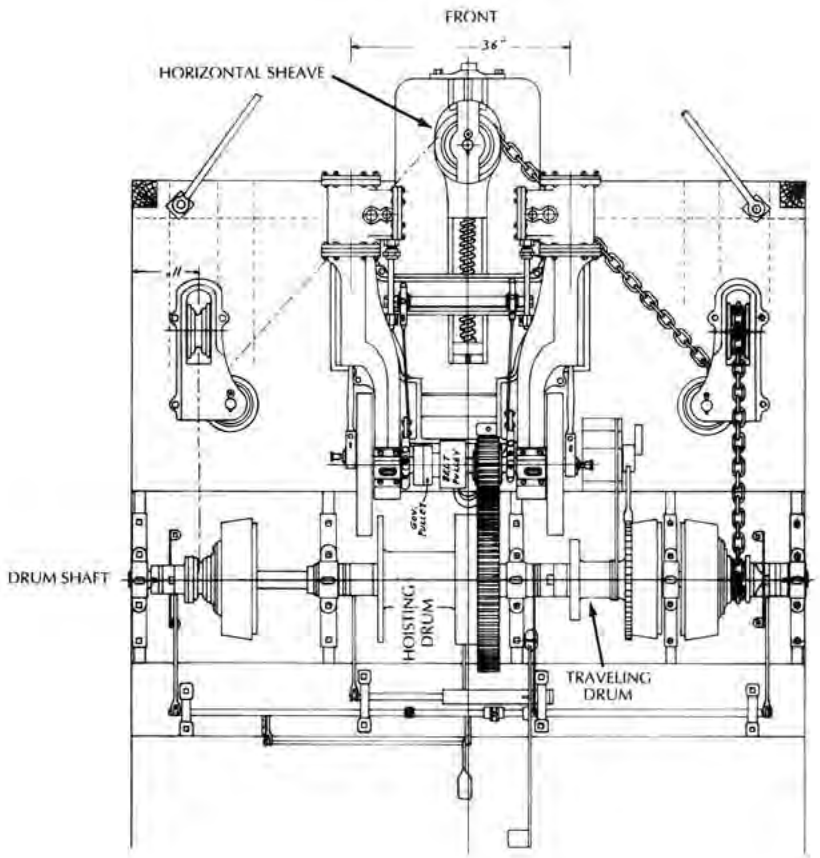


The drum shaft is similar to that of a donkey engine in that it rotated constantly as long as the engine was running. The various drums and "gypsy heads" for the chain drive, were engaged independently as desired by the operator, through a set of levers shown in the side view of the engine. The drums were actuated by a system of "fly weights" that bore on the inside surface of the drum. This method was quite different from the one used in most donkey engines.

FRONT VIEW



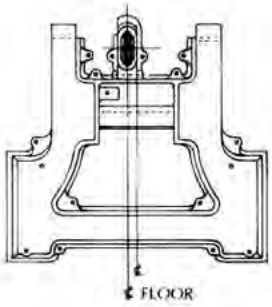
TOP VIEW



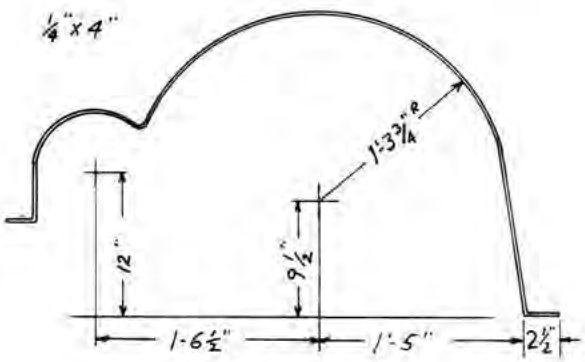
A BARNHART LOG LOADER – THE ENGINE AND DRUMS

DRAWN BY AL ARMITAGE
SCALE: 3/8 INCH = 1 FOOT
(except for small parts and details)

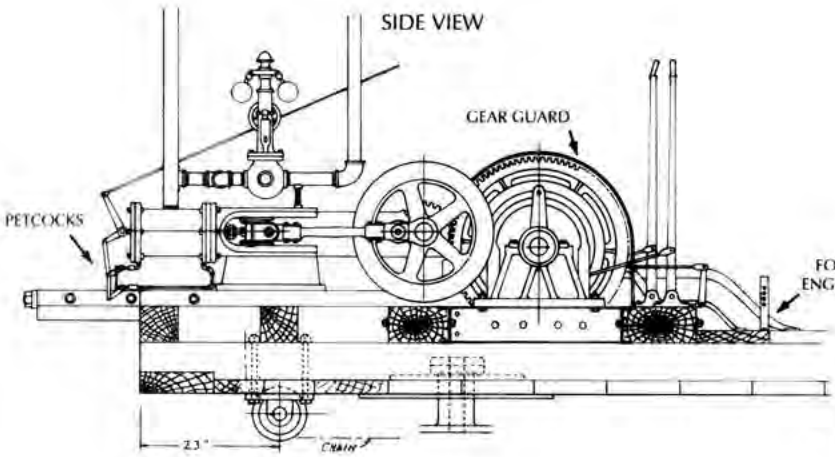
ENGINE BASE



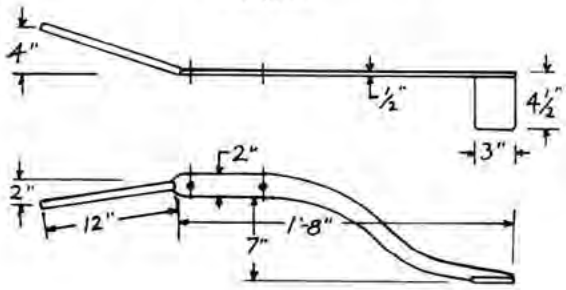
GEAR GUARD
(1 REQUIRED)



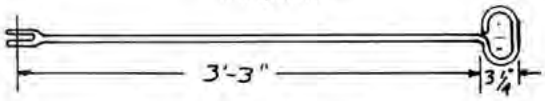
SIDE VIEW



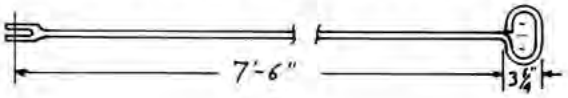
FOOT PEDAL FOR ENGINE LEVER SHAFT
(1 REQUIRED)



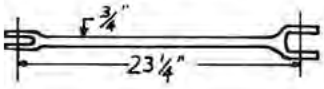
THROTTLE ROD
(1 REQUIRED)



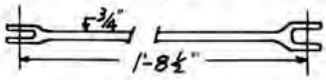
PETCOCK ROD
(1 REQUIRED)
(SEE SIDE VIEW OF CAB ON PAGE 53 FOR ROD POSITIONS)



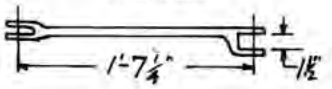
SWINGING ROD
(1 REQUIRED)



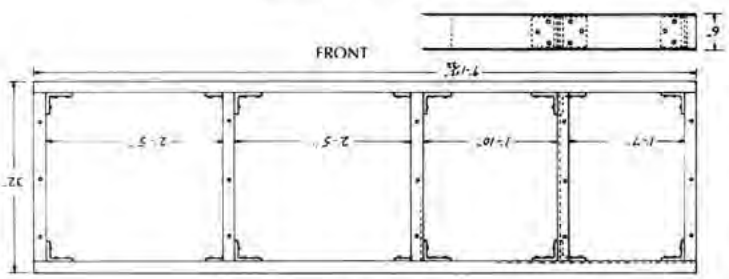
TRAVELING ROD
(1 REQUIRED)



HOISTING ROD
(1 REQUIRED)



DRUM SHAFT FRAME



THESE RODS CONNECTED THE HAND LEVERS TO THE CLUTCHES ON THE DRUM SHAFT