Shay Truck Brakes

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Note: The truck brakes were initially grouped with the truck pivots. Later I decided to split the brakes from the pivots and rollers. The pivots wand rollers were then grouped with the trucks and all the brakes system components grouped together.

I must confess that I wasn't anxious to start machining the brake parts including:

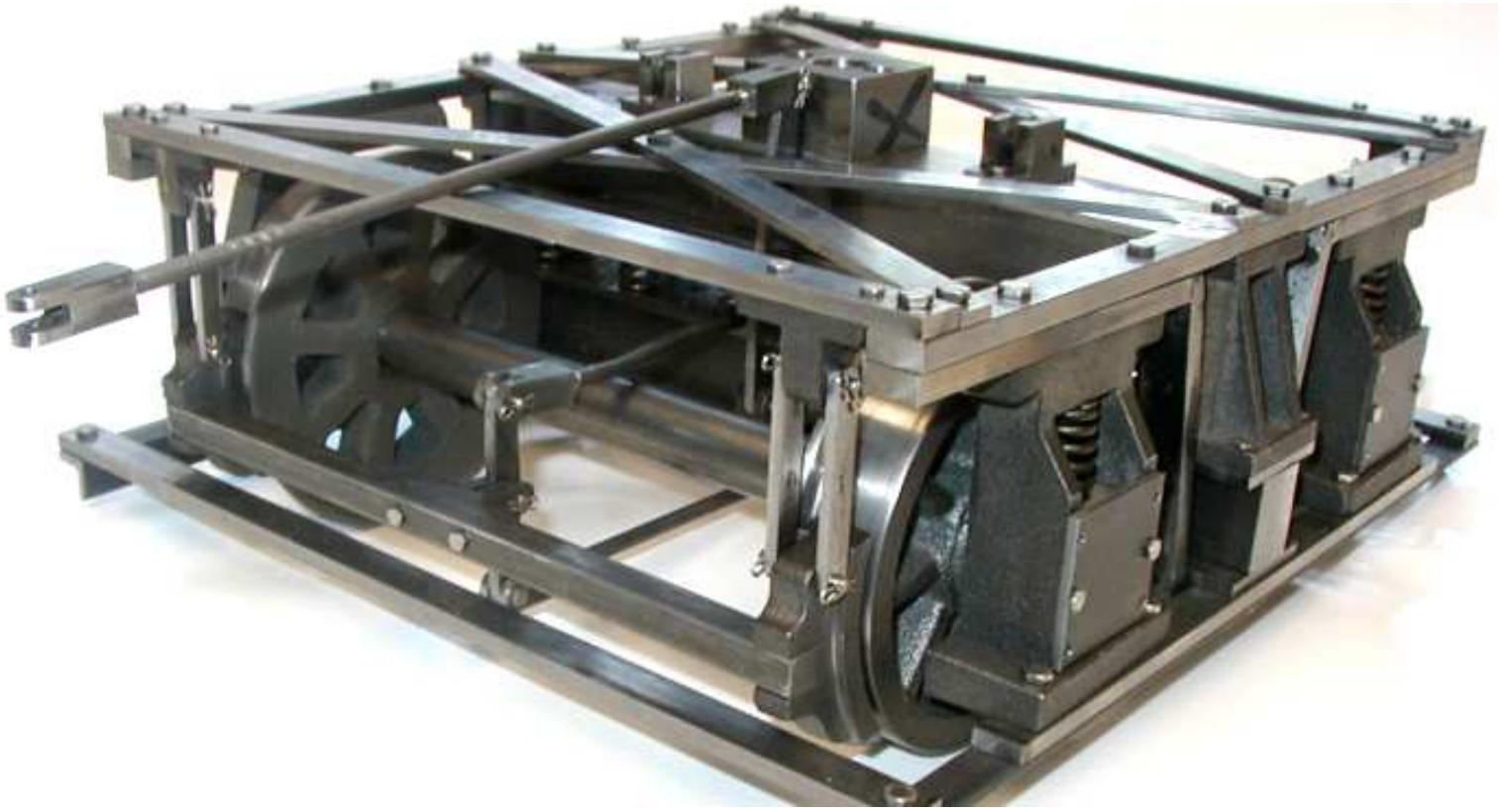
- 33 castings
- 24 hangers
- 12 levers
- 24 clevis
- 3 anchors
- 6 beams
- 12 rods
- ~ 60 clevis pins

Kenneth specifies the finished dimensions of the castings and most the other parts. The clevis pins however aren't specified. After reviewing the drawings and checking over some old photos from Cass, I decided to take another trip to Cass to check out the brakes more carefully. (It was a good excuse to get off the leash for a couple days.) The major difference found was that the hanger dimensions were narrower and thicker than Kenneth specified. The photo at right shows that the hangers which are 2" wide and 1" thick. The hanger clevis pins are 1" diameter and use cotter pins at each end. These scale to 1/8" X 1/4" hangers and 1/8" diameter clevis pins. The pins in the levers are similar except that they have a head on one end.

Once I made these design changes I got more interested and the fabrication was rewarding. (My daughter claims that men aren't happy unless they put their own stamp on things, like a dog with a fire hydrant.)

The next photo shows the finished brake parts for one truck. There is an error in the photo, only four hangers are shown while a total of eight hangers are required per truck.

The following three photos show these parts installed on the tender truck. If you look close you'll see that hairpin rather than cotter pins are used at the ends of the clevis pins. The hairpins are convenient during the construction process. The hairpins will be replaced with standard 3/64" diameter cotter pins before the engine is actually run because I'm afraid the hairpins may work loose and parts will fall off.



Park Brake: Kenneth's drawings show how to link the two main frame trucks to the steam brake cylinder. He doesn't show how to link the tender truck to the steam cylinder. Because of this I looked at the tender brake linkage last fall on a trip to Cass. It was a bit confusing so I took some photos to enable later recreation. Later I found these photos useless --- I couldn't understand them.

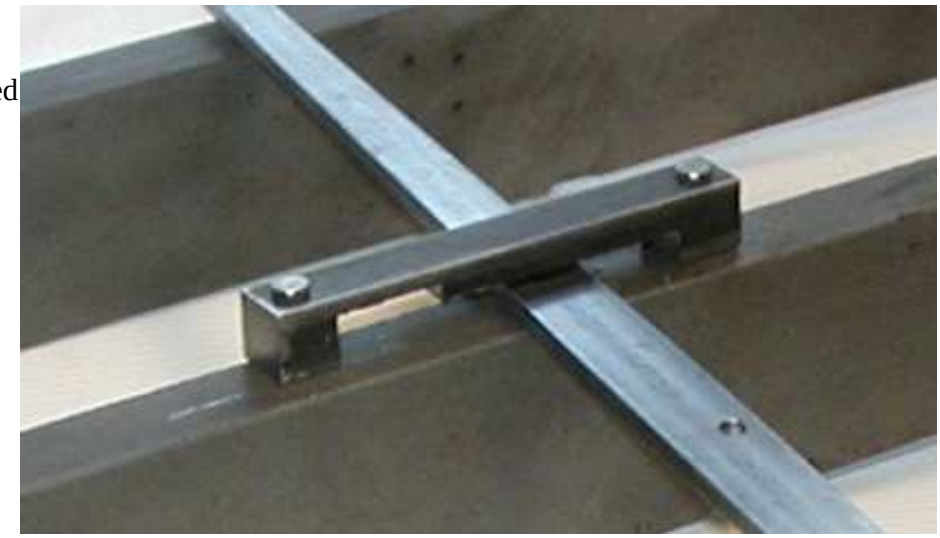
Some time later I asked Kenneth how he linked the tender brakes to the steam cylinder since no linkage was visible in his photos. He explained that there is no linkage on his model; he instead uses the tender brakes for a park brake function. He said this is very handy on tracks where the parking sidings are

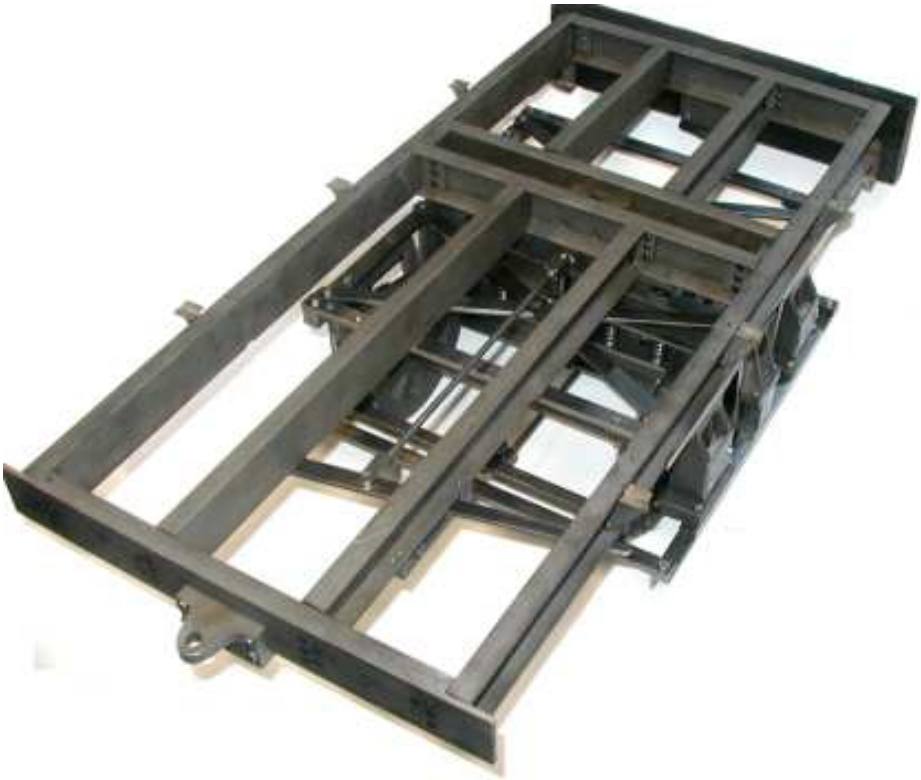
sloped. I immediately thought this was a good idea; virtually all of my track will be sloped. Sure seems better than a rope and anchor.

The middle and upper photos on the right show the lever I made to control the tender park brake. The tender frame is upside down in these photos. The lever pivot is installed on the sloped part of a frame channel which makes the idle orientation of the lever to be sloped downward. The strap holds the lever up and roughly level. The slot milled toward the front of the strap is the brake engaged position. When the lever is in the forward position the downward force on the lever holds the lever in the slot.

The lower photo shows the frame correct side up and the park brake lever connected. The lever is positioned in the "brakes off" in the photo. The lever seems to have enough friction to hold it in the released position. If this loosens up I'll add a spring between the lever and the bolster to hold the brakes off.

Note: I later modified the park brake lever and rear truck linkage as the rear truck brakes were connected to the steam brake cylinder.





The following shows details on machining some of the brake parts.

Brake Shoes: The brakes shoes appeared to be the biggest brake machining challenge because of the odd shape. The process I used is shown in this sequence of photos.

The first step was to mill the 3/8" slot for the brake beam. A couple pieces of bar stock were put in the milling vise to position the shoe. Note that one end of the shoe is propped up 1/8" higher than the other end.

A jig was made to drill the retaining screw holes through the shoe. I changed Kenneth's design a bit here. Kenneth threaded the upper part of the shoe 6-32. I drilled a 6-32 clearance hole through the lower tab and part way through the upper tab. I threaded the mating hole in the brake beam. The shoes are held to the beam with 3/4" long 6-32" set screws.

This photo shows the jig being used to drill a shoe.

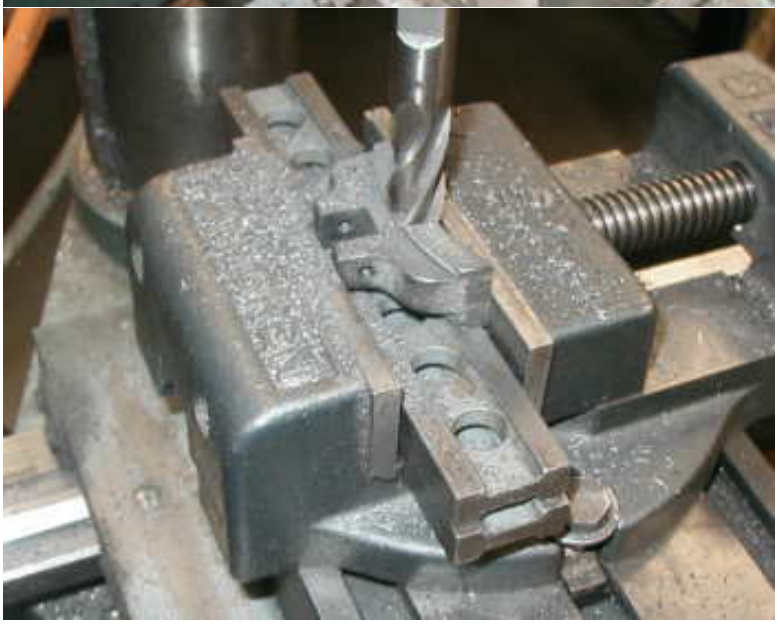
This is the second jig made to hold the shoes. The 3/8" square stubs are the same cross section as the brake beam.

This photo shows the jig being used to drill the hanger hole in a shoe.

This shows surfacing the inner surface of a shoe. If you look carefully you see that the jig has only one 3/8" square stubs. The second stub shown in the earlier photo was added later.

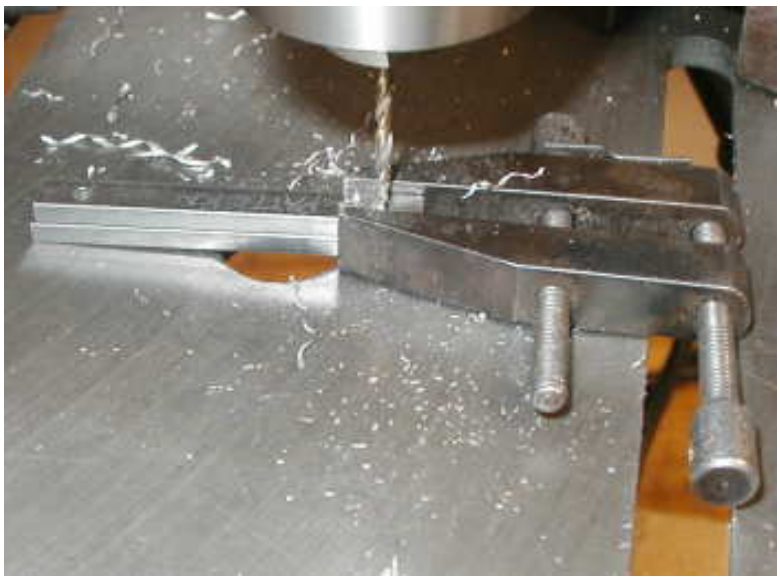
This photo shows machining one side of a shoe. The part adjacent to the wheel is not machined in this step. That second stub was added when I machined the other side of the shoe. The objective here is to thin the mounting stem to 3/8" for the hangers.

The final step was to machine the sides of the curved end of the shoe as shown on the right.

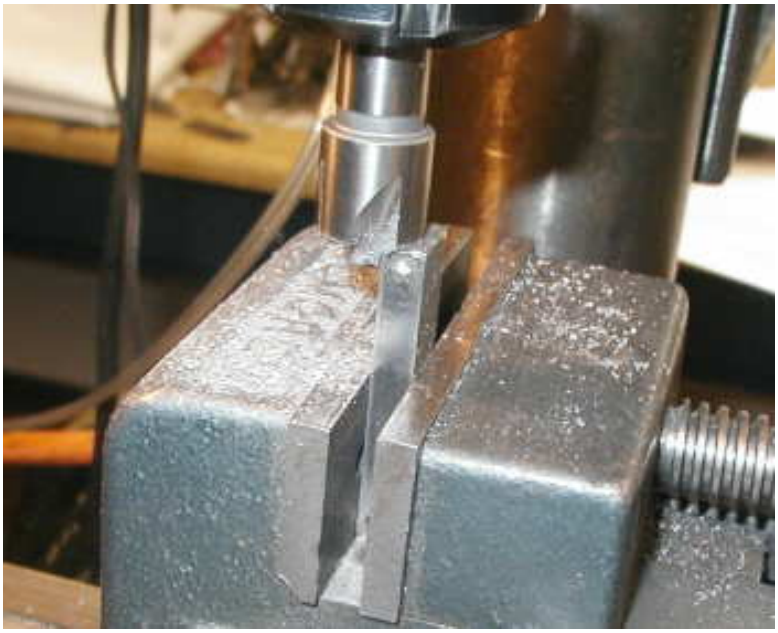


This photo shows an installed shoe. It was worth the effort.

Brake Hangers: The following photos show making the brake hangers. The first step was to drill the holes in 1/8" X 1/4" bar stock as shown on the left. Note the use of a pattern to position the holes. The next step was to group 4 hangers together using 2-56 screws as shown on the right.



The ends were then trimmed to the correct length using an end mill as shown below on the left. The ends were then rounded using a rounding end mill as shown on the right below. The final step was to drill out the holes to the correct size for the clevis pins.

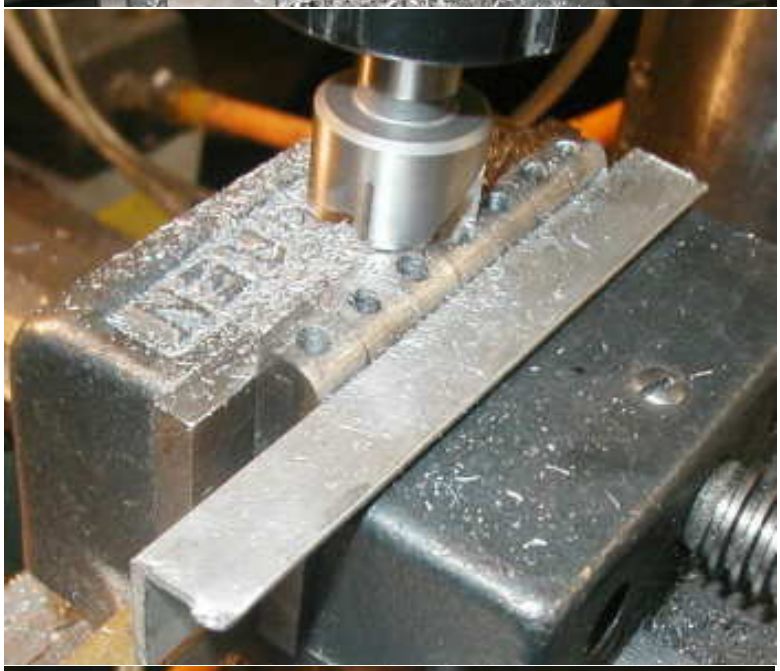


Levers: The levers were fabricated using techniques similar to that used on the hangers described above. One difference was that the levers were held together using expansion pins. The left photo below shows making the taper on the sides of beam levers. Note the brass pieces used to prop up the expansion pins on the left end. The right photo shows rounding the end of the brake levers with a rounding end mill.

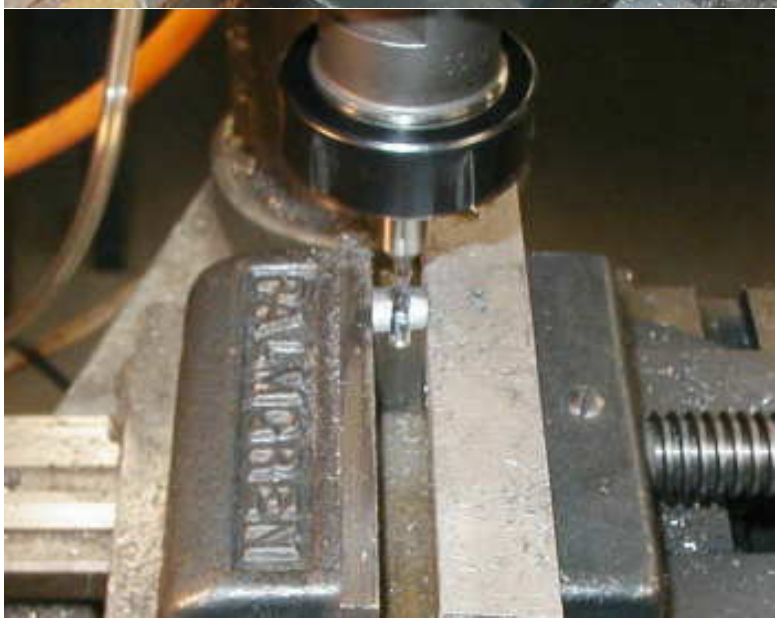
Clevises and Anchors: The clevises and anchors are made from 3/8" bar stock. A total of 24 clevises and 3 anchors are required so some thought was given to speed the process. The best choice would be to use a 3/8" square collet in the lathe. I don't have any square collets. Instead, I made the fixture shown on the right and mounted it in the 4-jaw chuck.

The first step was to drill the center of the bar stock and cut it to the correct length. The cutoff operation is shown on the right.

The next step was to use a rounding end mill on the ends. Note that seven are being machined at the same time. The angle is aluminum. Aluminum has some give so that the side forces are equalized insuring that each piece is held firmly. (The ends of the 3 anchors are not rounded.)



The next step was to make the slot in the clevis. The slot was first rough sawed with a hacksaw. The slot was then finished with an end mill as shown on the right. (The anchors weren't slotted.)



The individual clevises and anchors were then mounted again in the fixture and tapped.

The fixture was then used to drill the hole for the clevis pin in the clevises and the hold down screw in the anchors as shown on the right.

Clevis Pins: There are 50 or 60 clevis pins required for the three trucks. The nasty job is cross drilling the rods for the cotter pins. The jig shown on the right made the job a lot easier. The jig is made from brass hex stock. Steel hex stock would have been better but I didn't have any. Square stock could have also been used but hex can be easily mounted in the 3-jaw lathe chuck to center drill the jig. That is a hanger clevis pin being drilled in the photo. The right hole was drilled first and the Allen wrench inserted in the hole to hold the pin in position. After the left hole was drilled the jig was used to hold the rod while the excess length was sawed off.

This photo show drilling the single hole in a lever clevis pin. Note the multiple holes in the jig. The holes tend to enlarge with use and can be used to drill only about 20 holes. The jig was also used to hold the pin when the little tip was ground off the head and the head finished with a fine file.

Note: If I had it to do over I'd probably purchase the clevises from Clippard. You can check out their products at http://www.clippard.com/store/search.asp?sku=rc- The RC-0881 looks very similar to Ken's drawings and the smaller RC-0581 might also be usable, Note that they come with the pins.

This finishes the truck part of the brake system. The linkage, steam brake cylinder and brake valve are described in separate notes.

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