TURNTABLES
A SHORT HISTORY
AND THEORY OF OPERATION

Presented by BOB VAN CLEEF, MMR
of the North River Railway
IN THE BEGINNING ...

- The first turning device, like the wheel was invented by some nameless inventor.
- The history of railroad turntables however can be traced back to the turning plates within English coal mines of the 18th century.
- Space was scarce and something was needed to help maneuver the heavy wagons of coal.
- Since this presentation is about railroad turntables, this seems like a good place to begin.

Inside an English coal mine somewhere around 1830. Not a whole lot of extra room here.
ANCESTOR OF MODERN TURNTABLE

- Simple turning plates similar to the one shown here allowed the turning of carts within the close confines of English coal mines.
- These were NOT used to turn the cart around. They were located at the junction of shafts and would simply be rotated 90 degrees to access a side passage.
- The carts were then pushed back and forth to the working seam.
TURNPLATES

• These turn-plates were simple and rather crude devices for turning loaded coal wagons up to about 10 tons.

• Early versions simply used steel balls for bearings in a circular track.

• More advanced versions used a “spider” to keep the balls evenly spaced.

• These plates had to be opened frequently to remove dirt. Lubrication was more or less non-existent.
TURNPLATES MOVE ABOVE GROUND

- This slightly larger 1836 turn plate made it possible to turn a streetcar without un-hitching the horse at the end of the line.
- The horse itself pulled the 1-2 ton car around for the return trip.
- This again was a great savings in time and effort.
The Gallows table represented a quantum leap in turning heavy loads. One man could turn a 100 ton engine on a good day.

It incorporated many new design principles that became the de facto design for turning engines.
• For one, the Gallows used a series of rollers called a “spider” to concentrate the load’s weight at the center of the table.
• The wheels at the end supported weight only as an engine entered or exited the table.
• The resulting leverage of pushing the table around a much smaller pivot point and the use of wheels for bearings made turning the table much easier.
• Also, moving the wheels above ground level reduced the amount of dirt fouling the turning point thus making maintenance easier.
Detailed view of Gallows Turntable Spider.
No original Gallows tables are known to remain today. Wood decays and rots with time leading to the collapse of the base structure.
SO WHY TURNTABLES?

- Interestingly, large tables like this were built in America, but not in Europe.
- America had much denser concentrations of locomotives in cities and in certain areas.
- Also, locomotives were larger, and designed to run primarily in one direction with faster and longer runs.
- Turntables offered a relatively simple way to turn equipment to head in the opposite direction.
- They also provided faster access to a larger number of engines within a much smaller space than other methods.
MORE REASONS

The turntable was often a more practical alternative to a wye track.

- It took up much less expensive real estate.
- It provided for a faster access and more compact storage of engines.
- This was of key importance as while a steam locomotive could maintain enough steam to move for up to two hours the amount of steam available was limited once its fire was dumped in the ash pit.
THE FIRST RAILROAD ROUNDHOUSE

- By the way, the first and oldest surviving roundhouse was constructed in Derby, England during 1839 by four different railroads.
- George Stevens of the Rocket fame was heavily involved in the project.
- Gridley Bryant (of the Granite Railway fame) built the first American roundhouse soon after during the 1840s.
• Early and almost all small tables were of the ARMSTRONG type. Poles at both ends were pushed around the rim of the pit to turn the table.
• Actually there were many other ways to turn a table.
• Horses, tractors, Bulldozers and other machines have been known to help turn these table in inclement weather.
Many early tables used compressed air to drive the table.
Air or steam was always readily available at the roundhouse.
Air brake hoses on the engine could also be connected directly to the table as shown here and away you go.
ANOTHER COMPRESSED AIR TABLE

Some of these tables have even survived to this day like this one in Canada.
• Look carefully and you can find a boiler, stack, steam dome, and cylinders.
• Could we say that it in itself was a locomotive? It was after all a machine that moved itself under it’s own power.
A FEW TABLES OPERATED VIA VACUUM

These were mostly in England or before the 1860’s and the invention of Westinghouse air brakes when some train brakes operated with vacuum.
Most tables from about 1900s until after the age of steam were electrified. This was due to the availability of electricity and the invention of the electric motor along with larger and heavier locomotives.
MODERN GAS POWERED TABLE.

The table at Danbury was originally the typical electrical type but the wires were cut 25 years ago during hard times. Now the table is powered by a jury-rigged 35 hp gas motor.
HANGERS

• A table is usually “hung” by two extensions from the top of the bearing housing. (more on this later)
• These may or may not be visible from the outside.
• The (2) double rows of rivets shown here mark where the brackets used to “hang” the table are mounted.
• Guess what is inside that hole?
INTERNAL SLIP RINGS

• This particular table was electric and received its power from underground instead of from overhead wires.
• Next time someone complains there are no wires over your table you can explain about this.
• Note the solid walls on either side. These are the hangers.

There is a prototype for everything!
One thing railroads throughout the ages tried to avoid was something like this. While this was the result of an extreme misalignment, only an inch or two could have similar results. Here are a few of the many schemes were invented to prevent exactly this type of accident.
SIMPLE “DOG BONE” ALIGNMENT

- A simple “dogbone” and its variations are the most common alignment tool on small or little-used tables.
- This simple bar is slid along the web of the rails to keep them in alignment as the engine enters and exits the table.
SIMPLE LOCKING BAR

- There were many variations of PIN and SOCKET alignment schemes
- Here, a bell-crank connected to a lever at the head end of the table pushes a pin into a socket.
- This allowed the dependable alignment of either end from a single location.
Modern Hydraulic Alignment Pins

A more modern and sophisticated alignment system uses hydraulics to withdraw or move the alignment pin in place
Welcome to the Danbury Railroad Museum

• This Museum maintains the other operational turntables in Connecticut.

• Many exhibits are also available.

• The museum building also houses both models and prototype exhibits.
Danbury Floods of 1955

Built in 1903 for the New Haven, the yard was highly active before the floods of 1955. This view shows an active and prosperous industry including the turntable, roundhouse and engine facilities.

Little remains of the engine facilities except the turntable. The yard now contains historic and antique equipment. Metro North does continue to use the outer loop around the yard to turn trains as rails to the west have been washed out forever.
The Roundhouse survived until shortly after May, 1959 but was first partially dismantled then destroyed by fire. The structure was eventually leveled and the foundation buried by 1986.

The table itself still worked up to 1970 but then the wires were cut and the pit used for trash disposal until about 1996 when restoration began.
THE 95 FOOT TABLE IN DANBURY

- Restoration of the turntable was completed in about 1998
- 2005 saw its use on weekends and during special events
- Both the Station and the Turntable are listed on the National Register of Historic places.
- Going for a spin is one of the popular attractions at Danbury.
Old vs. New pit Wall

Part of the restoration was to smooth over the original stone wall with a smooth concrete veneer.
MOUSE HOLE or Pocket

• One detail omitted on most models is the maintenance pocket.
• This was used to apply grease and maintain the end bogies (wheels) of the table
INSIDE MAINTANANE POCKET

This is the view from inside the pocket showing one of the (4) wheels supporting one end of the bridge.
INSIDE THE TABLE

- The internal bracing can be seen here.
- Note the ties overhead and the bridge sides.
INSIDE THE TABLE

• The underside of a table is very much like any bridge.
• Note the narrow clearance of an inch or two between the pit floor and the bridge. The same is true on both ends.
• The pillar and pivot are barely visible at the table’s center.
• This portion of a blueprint shows that the bridge appears to be a fairly simple structure.
• Note the pivot at the center bottom that supports the table’s weight.
• This bearing is similar to the one buried under the Danbury table.
• While the appearance is much different than the old gallows spider, it serves exactly the same function.
• It is, however, encapsulated in a pod and surrounded by oil to reduce friction and keep out dirt and contaminants.
Another detail often omitted from models is the grate for water drainage.

Railroads were quick to realize that water could and sometimes did cause problems with the pivot bearings.

They didn’t invent drain basins but they were very active in their use and refinement.
Look carefully and a gap can be seen between the wheel and the ring rail.

This demonstrates that when the table is in balance (or turning) the end wheels support no weight at all.
A BALANCING ACT

- The rails on the bridge are designed to be slightly above the approach track when the table is balanced.
- An engine pushes the end down as it enters the table.
- The engineer can actually feel the table rock slightly back to balance as the engine becomes centered over the main bearing.
- Note the dog bone is shown here in its retracted position.
The Dog house is mounted on a hinged platform.
This allows the drive wheel(s) to remain on the ring rail as the main bridge rocks back and forth.
It take a surprisingly small amount of effort to actually turn the table in normal conditions.
The table will actually coast a bit once set in motion until the brake is applied.

The table end with the controls or “dog house” is considered the “head” end while the other end is the tail.
INSIDE THE DOGHOUSE

• Starting the gas motor that turns the table is much like starting a lawn-mower
• The controls are rather simple. After all, how complicated can they be? Clockwise, Counter clockwise, Fast, slow and “whoa there”.
Tables are usually fully decked, even between the rails.

The oil pipe to lubricate the bearings is located between the rails under the sheet of plywood.
Connecticut Eastern Railroad Museum
(a Chapter of the National Railroad Historical Society)
Connecticut Eastern Railroad Museum
(a Chapter of the National Railroad Historical Society)
The Connecticut Eastern surrounds the engine facilities of what was once known as the Columbia Junction as shown in the turn of the century photo above.
RESTORED ROUNDHOUSE AND TABLE

View before the approach tracks were installed
UNFINISHED DECK

• The Museum maintains the other surviving operational turntables in Connecticut and it was only recently re-installed.

• This table is surrounded by a completely rebuilt roundhouse.

• Many exhibits are also available on grounds.
The bridge at Connecticut Eastern was purchased second hand.
Several bridges like this were built around the Civil War era.
BUILDING A PIT

• The pit was dug out first to fit the bridge.

• A concrete pier for the main bearing was buried in the center.

• The stone wall was installed around the perimeter.

• A ledge for the ring rail was then added.
LAYING THE RING RAIL

• Here, the ring rail is being fitted for the proper radius.

• The rails on this table are laid directly on the stonework without ties.
MORTARING THE RING RAIL

- The rail is bolted down and held in place by cement.
- Only about half the weight of an engine is carried by the ring rail, and only then as the engine enters and exits the bridge.
The wheel bearings

• The center of the bearing is NOT concentric with its housing.
• This also allows a certain amount of adjustment in deck height.
• The bridge now rests almost solely on the center bearing.
PREPARING THE TIES

- Holes are drilled in each tie to clear the rivets.
- A recess is then cut in the bottom of the ties.
- This allows the ties to seat firmly on the bridge top and helps to prevent lateral movement.
The ties are also notched to prevent sideways movement.
DECK PARTIALLY COMPLETE
One has to literally squirm under the end to get inside the bridge and it takes a skinny teenager to get all the way inside to paint it.
Looking from inside the bridge out to the pit wall.
The pivot on this table is just under the bridge deck.
PIVOT CONSTRUCTION

Bridge Hanger bolts support the weight of the bridge and allows the Bridge to swing along its length if the locomotive stops too quick thus limiting the force on the table.

Pivot pin allows the bridge to self level as the Locomotive is moved across the bridge.

Saddle carries the weight of the Bridge and table on the pivot pin.

Pivot Bearing Plate supports pivot pin.

Cast Iron Cone supports the weight of the bridge and locomotive.

Tapered Roller Bearing with Dust Shield allows bridge to rotate with minimal friction.

Cone Securing Bolts mortaced into the Granite.

GRANITE FOUNDATION STONE

CONE ASSEMBLY DETAIL
“FEELING THE BALANCE”

- Centering an engine on the CT. Eastern table is a bit different than most tables.
- This table has a single pivot with a minimum of travel.
- Most tables are “double hung with (2) balance points.”
FIRST APPROACH TRACK

The basic decking is now complete.
1\textsuperscript{st} LEAD TRACK

Track is ballasted and jacked to proper height.
2nd TRACK INSTALLED
LOCKING THE TABLE IN PLACE
DOG BONE LOCKING TABLE
ENGINES CAN NOW BE STORED
A FULL HOUSE
IN MEMORY OF FRANK JOHNSON

This old time gallows signal was built in memory of Frank Johnson, a long time member of the Nutmeg Division NER, NMRA
END OF AN ERRA

Sadly, Turntables were no longer necessary after the age of steam. Some were ingloriously repurposed as regular bridges both for other parts of the railroad and for highways. A very few went to museums. Most were simply sold for scrap.
FOR MORE INFORMATION

- Progressive Examinations of Locomotive Engineers and Firemen http://www.catskillarchive.com/rreextra/EXAMENFI.Html
- American Railroads http://www.american-rails.com (HOME PAGE)
  (You have to scroll way down to find movie)
This presentation has been brought to you by the North River Railway

Bob Van Cleef
46 Broadway
Coventry, CT 06238
http://www.northriverrailway.net
AUTOMATIC TURNTABLE
(BUILDING THE MODEL)

Presented by BOB VAN CLEEF, MMR
of the North River Railway
TABLE MODEL OVERVIEW
DECK END CONSTRUCTION
DECK END DETAIL
BRIDGE CENTER
TURNTABLE WITHOUT SCENERY
SHAFT FOR TURNING TABLE
VIEW OF COMUTATOR AND CELLS
PRINTED CIRCUIT SLIP RING

• This printed circuit board (PCB) is mounted under the drive disc and provides connections to the rotating bridge.

• The Center and first band provide power to the “light gun”

• The next band provides power to one of the bridge rails. Note the split to allow proper reversing.

• The outer band energizes one opposite pair of stall tracks at a time.
MAIN DRIVE DISK
SIMPLE LIGHT “GUN”
Drive Train

Parts normally used to build hobby robots form the drive train used to rotate the turntable.
PROTOTYPE CONTROL PANEL
MAIN CIRCUIT BOARD
This presentation has been brought to you by the North River Railway

Bob Van Cleef
46 Broadway
Coventry, CT 06238
http://www.northriverrailway.net

THE END