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9 Steering Wheel to Front Axle

Unlike an automobile, where individual front wheels pivot on steering knuckles, a traction engine steers by swinging the entire front axle assembly. The steering gear provides enough mechanical advantage for the operator to control this heavy axle smoothly and accurately.

9.1 Steering Linkage

9.1.1 Steering Wheel

The steering wheel is large to give the operator leverage. Because the steering system is heavily geared down, the wheel must be turned many revolutions to swing the front axle from lock to lock.

9.1.2 Steering Shaft

The wheel turns a steering shaft that runs diagonally down toward the front of the engine. This shaft is supported in bearings and ends in the worm gear.

9.1.3 Worm Gear

At the bottom of the steering shaft is the worm, which engages a worm wheel or worm segment. This provides:

- very high mechanical advantage
- slow, controlled steering
- self-locking action (the front wheels cannot kick back)

The worm turns the chain roll.

9.1.4 Chain Roll (Steering Drum)

The chain roll is a horizontal drum with grooves or flanges to guide the steering chain. As it rotates:

- one side of the chain is wound in
- the other side is paid out

This converts the worm's rotation into a controlled pull on the steering chains.

9.1.5 Steering Chains

The steering chains run from the chain roll down to the front axle. They pull **directly on the axle** (through the steering springs). Winding in the left chain and paying out the right turns the axle left; reversing the drum turns it right.

9.1.6 Steering Springs

Between the chain and the axle are steering springs. These springs:

- keep the chain tensioned
- absorb shocks from rough ground
- prevent sudden jerks from reaching the worm gear
- allow the axle to rock without slackening the chain

They ensure smooth, quiet steering and protect the gearing.

9.2 Front-end Structure

9.2.1 Front Axle

The front axle assembly allows two distinct motions:

1. **Horizontally**, for steering — the entire axle swings left or right as a unit.
2. **Vertically**, to follow uneven terrain — the axle rocks up and down around its central pivot pin.

This dual-pivot action allows the engine to steer while also keeping both front wheels on the ground over bumps and ruts.

9.2.2 Pedestal (Front Axle Pivot)

The pedestal is the heavy casting at the front of the engine that carries the axle pivot pin. It supports:

- the weight of the front of the engine
- the side loads from steering
- the rocking motion of the axle over uneven ground

It is the structural anchor for the entire steering system.

9.2.3 Reach

The reach is the long structural member connecting the pedestal to the boiler and hornplates. It:

- keeps the pedestal aligned with the engine frame
- carries fore-and-aft loads from steering and road shocks
- prevents the pedestal from twisting or shifting
- maintains correct geometry between the front and rear axles

Without the reach, the pedestal would have no structural reference to the rest of the engine.

Summary

The steering system is a worm-and-chain mechanism that gives slow, powerful, shock-free control. The load path is:

Steering Wheel → Steering Shaft → Worm Gear → Chain Roll → Steering Chains →
Steering Springs → Front Axle (horizontal + vertical pivot) → Pedestal → Reach →
Hornplates

This arrangement is simple, durable, and perfectly suited to the heavy, low-speed work of a steam traction engine.