Braking Trains

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Braking Trains

• Going and stopping
• Brakes
• Prototype systems
  • Air
  • (Vacuum)
• On the car models
  • KC
  • AB
  • UC
Making the train go

• Lots of boiler for “Horsepower”
Making the train stop

• Smaller parts for stopping
Tractive force = Cylinder force \times \left( \frac{\text{Weight of loco}}{\text{Number of wheels}} \right) \times \text{Coef. of friction}

Braking force = \text{Brake shoe force} \times \left( \frac{\text{Weight of cars}}{\text{Number of wheels}} \right) \times \text{Coef. of friction}

Coefficient of Friction

Steel on steel

Static \sim 7

Sliding \sim 0.5
Freight Car brake systems

Hand Brakes – Pretty much as it sounds
  – brakes are set by hand. Turn the hand-wheel manually on each car to apply the brakes.
  – Hand brakes still used for cars standing

Straight Air – air line pressure applies brakes
  The brake cylinder is directly coupled to the train line which is charged from the locomotive to set the brakes.

If the train breaks in two – NO BRAKES! Not Good!

Automatic Air –
  The train line and air reservoirs tanks on each car are charged from the locomotive, typically to 90 p.s.i., and the brakes are released when the tank pressure becomes equal to the train line.

  To apply the brakes air is released from the train line by the brake valve on the locomotive and the triple valve releases a proportional amount of air from the service reservoir to the brake cylinder, applying the brakes.

  If the train breaks in two, the pressure in the train line drops to zero and the air from the service and emergency reservoirs is released to the brake cylinder. Definitely better, but can cause problems such as flat wheels and even derailments. Both the KC/KD and AB systems are popular systems of this type.

The “magic” in the automatic air system is the “triple valve” that monitors the train line pressure and the car reservoir pressure and decides when to apply or release the brakes.
Air Brakes
Locomotive diagram
1909
Air Brakes freight cars
The “triple” valve

- Release (Recharge)
- Apply
- Emergency

Schematic Diagram of Air Brake System on Vehicle in Release Position
Freight Car Brake Cylinder “K”

Cross section

Triple valve   Air reservoir   brake cylinder   return spring
Type KC Combined Freight Brake Equipment

Type KD Detached Freight Brake Equipment

Fig. 21. PIPING DIAGRAMS
K system on freight car
Models (HO)

- Brakes applied
- Brakes released

- Chain
- Brake rod hanger
- Flatten wire end with NBW
- Triple Valve
- Dirt collector
- Cut-off Valve
- Retainer valve pipe
- Release Valve rod
- Pipe union
- Tee Connector
- Train Air Line
Car end appliances
Models (HO)

Underframe with train-line

Brake system fitted
Fittings

Train line
Signal line
Air Signal hoses
Brake chain
Brake staff
Retainer line/valve
Truck safety chains

Hooks for truck safety chains
Chain on brake staff
Air (& signal hose) connection
AB system on freight car

AB system provides two air tanks on each car one for “regular braking” and the other for “emergency braking”
AB schematic

TWO COMPARTMENT RESERVOIR

"AB" VALVE

EMERGENCY RESERVOIR
3/4" EMERGENCY RESERVOIR PIPE

AUXILIARY RESERVOIR

3/8" PIPE

ALTERNATE METHOD SHOWN BY DOT AND DASH LINES

PLUG

1-3/8" x 22" HOSE WITH FP-5 COUPLING

RELEASE CONTROL RETAINER

COMBINED DIRT COLLECTOR AND BRANCH PIPE CUT-OUT COCK

1" BRANCH PIPE (MAX LENGTH 18"

1-1/4" x 1-1/4" x 1" BRANCH PIPE TEE

BRAKE PIPE

1-1/4" PIPE

STANDARD 1-1/4" PIPE NIPPLE 10" LONG

3/4" BRAKE CYLINDER PIPE

BRAKE CYLINDER

NOTE: ALL PIPE TO BE EXTRA HEAVY (EXCEPT NIPPLES AT ANGLE COCKS, WHICH SHOULD BE OF STANDARD WEIGHT).
Sizes

PIPING:
Train line 1¼" OD
Brake Cylinder ¾ " OD
Branch Pipe ¾" OD
Emergency Reservoir ¾" OD
Auxiliary Reservoir ¾" OD
Retainer line 3/8" OD

RODDING:
Varies from 7/8" OD to 1¼" OD, the rods connecting the two levers and cylinder being ¼" larger than the other rods.

LEVERS:
Vary in both length and width, with the lever at the brake cylinder averaging 36" - 48" and the floating lever 30" - 36". Both levers are from 6" - 8" at the widest point and 2" - 3" at the ends.
Passenger Cars
Early passenger car brakes were similar to freight cars with hand-wheels at each end.
Where the “observation car” was invented
Steel passenger cars
The PC Passenger Car Brake Equipment.  Cylinders Pointing in opposite directions.
Vacuum Brakes

Vacuum brakes are an alternative to air brakes and are in use on many modern railways.
Vacuum brakes

Steam ejector vacuum source

Reinforced vacuum hose

Fixed hose end cap

Vacuum tank

Brake cylinders
Vacuum Systems

- Steam ejector to provide the “vacuum” (in the steam days)
Braking trains

Stopping is as important as starting

END