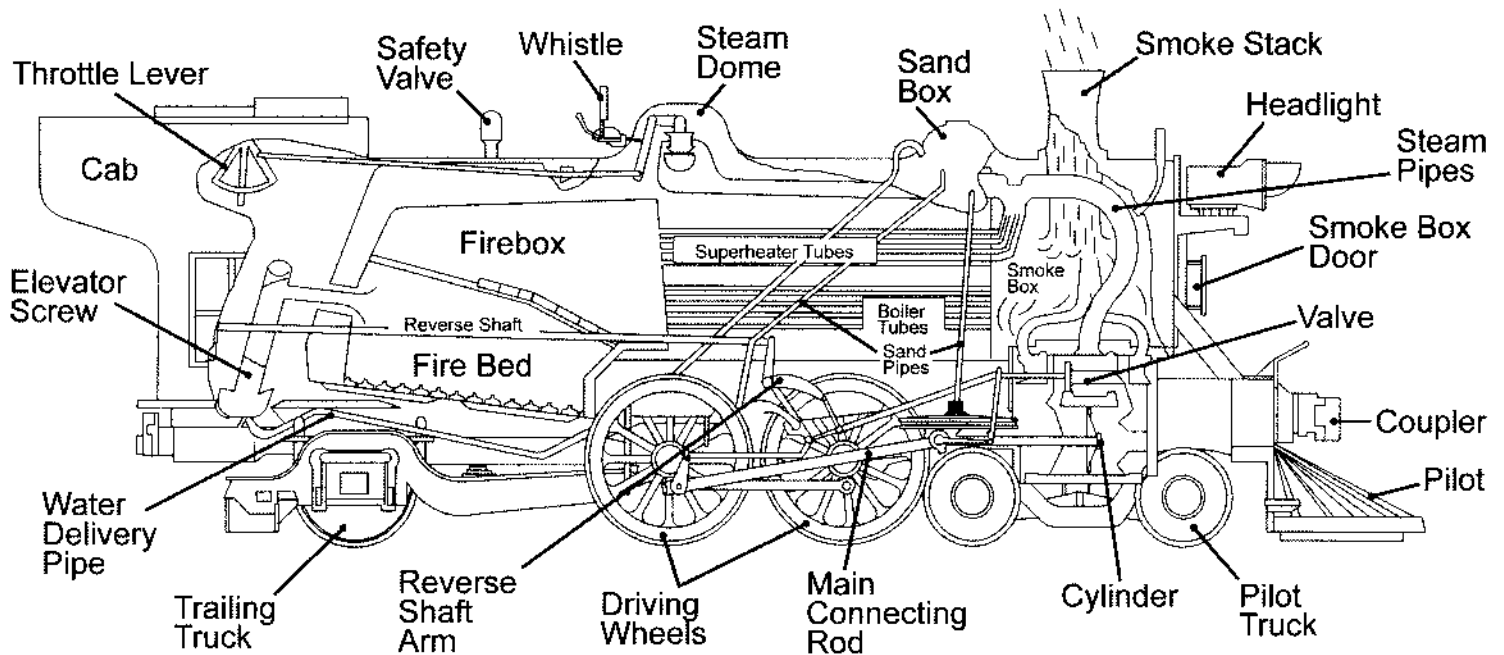
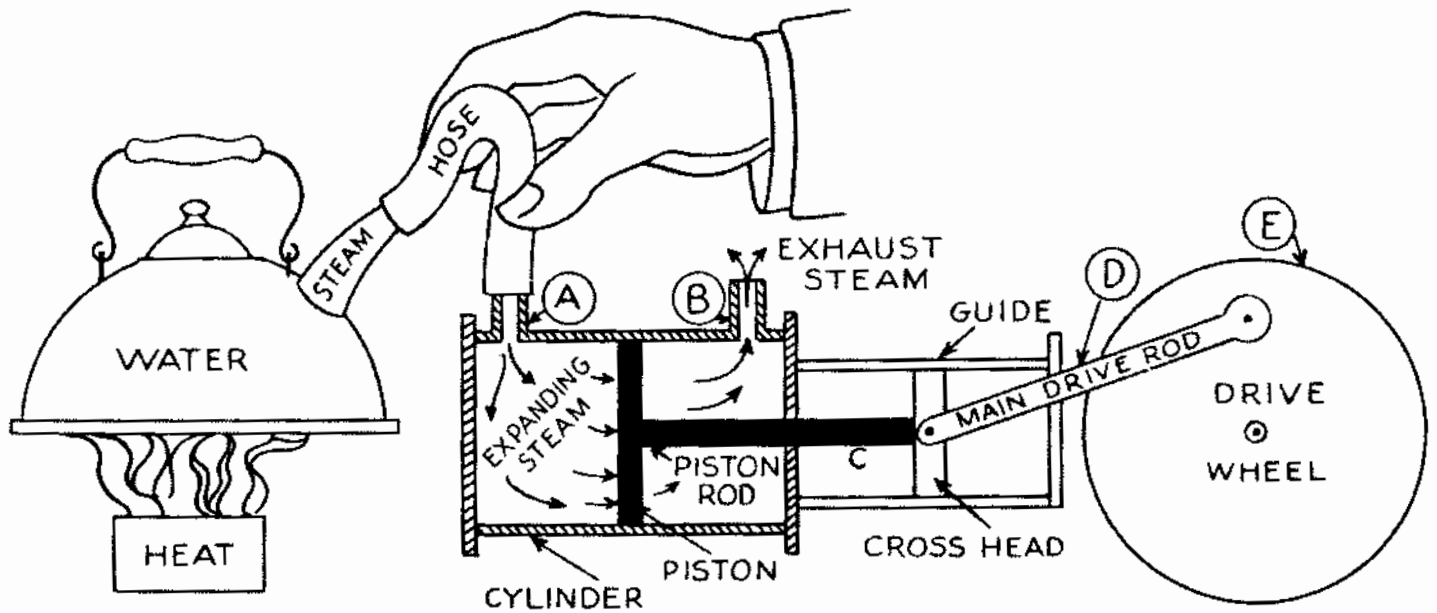


# Inside a Steam Locomotive



- 1.** The fireman shovels coal from the tender into the firebox and levels the coal to assure a good, clean fire bed. If the engine has a stoker, he simply adjusts it to do the same job.
- 2.** The fireman checks the steam gauge and water level in the boiler, and adds water accordingly.
- 3.** The engineer checks steam, water and air gauges, makes an airbrake test and obeys starting signals from the conductor.
- 4.** Inside the firebox of a steam locomotive, the coal fire produces hot gasses, which pass through the boiler inside metal tubes. Much of the heat produced is used to boil the water, which creates high-pressure steam.
- 5.** The hottest steam rises into the steam dome. By adjusting the throttle in the cab, the engineer can open a valve in the steam dome. This allows steam to be fed down the steam pipes on the other end of the engine, through a valve and into the cylinders, where it forces the pistons (extending from the cylinders) to move.
- 6.** The pistons are connected to the wheels by rods. As the pistons move, they force the rods to move, which turns the wheels.
- 7.** A vacuum created in the smoke box by the exiting steam, and the draft passing through grates in the bed of the firebox, help to pull the hot gasses through the boiler tubes. The result is a fine-tuned machine that uses about three-quarters of the heat energy produced. Unfortunately, just as the steam is used to push the pistons one direction or the other, it is released from the engine, never to be used again.
- 8.** However, if the fireman keeps a good fire going, and the right amount of water fed into the boiler, new steam can constantly be created to keep the locomotive moving down the tracks.
- 9.** When starting out, the engineer adjusts the reverser (power or manual) to cause the locomotive to move in the desired direction. He then pulls the whistle to sound the proper signal, rings the bell if required, releases the brakes and proceeds in the appropriate direction.
- 10.** If the drive wheels slip, the engineer increases the valve cutoff by moving the reverse lever and closing the throttle enough to stop the spin. If he can not regain enough traction to start moving again, he may apply sand, only after the drive wheels have stopped spinning.

# A Tea Kettle on Wheels



A steam locomotive is like a tea kettle on wheels. To make tea or hot chocolate, you have to put water into a kettle and heat it on a stove. The stove acts like the fire box on a locomotive, and the tea kettle acts like its boiler.

The water itself in the tea kettle is not enough to make the locomotive move. It is the pressure that results from water being boiled that really does the work. When water boils in a tea kettle, it starts to change from a liquid to a gas, but one that is under pressure. It wants to get out, to break free of the kettle. Usually, it lets you know that it is ready by whistling and then escaping out the spout into the air. What is left is hot-very hot, boiling water for your tea or hot chocolate.

If we could connect that boiling tea kettle to a cylinder, a piston and a set of drive wheels, we could harness that steam to make the wheels move. In this way, we will have created a working steam locomotive.

Remember, it is the pressure of steam that creates the power that we need to operate the locomotive. Without it, we are going nowhere!