Beverage-can stove

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Beverage-can stove (pot stand omitted for clarity).

A **beverage-can** (or **pop-can**) **stove** is a homemade, ultralight portable stove. The simple design is made entirely from cans (typically soft drink or beer cans) and burns alcohol, typically denatured. Countless variations on the basic design exist.

Total weight (including a windscreen/stand) can be less than one ounce (less than 30 g). Due to the low weight compared with some commercial stoves, backpackers can reduce some pack weight with this stove; this makes the design popular among ultralight backpackers. This advantage may be lost (or reduced) on hiking trips that feature longer gaps between resupply stops, however, because the stove is less efficient and requires more fuel than alternatives such as hexamine fuel tablets – especially when cooking for more than one person.

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[edit] History and design

The basic design dates back more than a century.[1] It consists of a double-wall gas generator, a perforated burner ring, and an inner preheat chamber. A similar design was patented in 1904 by New York coppersmith J. Heinrichs.[2] Trangia has been selling a commercial version of the design since 1925, and Safesport marketed a stainless-steel stove in the 1990s. The Trangia stove burner is made from brass, although all the other associated parts that come with it are aluminium. A plastic bag is provided for the burner, so that when packed away the two dissimilar metals do not corrode.

In the unpressurized open-top design the double wall acts as a gas generator, transferring heat from the flame to the fuel. This effect enhances combustion, producing more heat than other passive designs. The inner wall also creates a convenient preheat chamber for starting the stove. Once the fuel has warmed up, its vapor will travel up the hollow wall, pass through the perforations, and form a ring of flame. Vapor also rises from the center of the stove, but will pass through the ring of flame for efficient combustion as long as a pot is over the stove. Other pressurized designs aim for efficient combustion through closing the fuel chamber after filling, or by filling through the gas-jet holes.

Fuel is poured into the stove and ignited, burning in the center.

The flame heats the fuel and interior of the stove, causing the fuel to vaporize.

When the temperature is high enough, vapor pressure causes fuel jets and a ring of flame.

[edit] Aluminium-can construction

Three-piece beverage-can stove (exploded view).

The stove is made from two aluminium can bottoms. An inner wall is cut and rolled from the can material. A ring of holes is pierced into the top with a pin. Parts are glued with high-temperature epoxy, or sealed with thermal foil tape. Total height is less than two inches (50 mm), though dimensions may be increased to hold more fuel or decreased to take up even less space.

The choice of aluminium has several advantages—light weight, low cost, and good thermal conductivity to aid vaporization of fuel. Alternative construction materials have been used, including stoves made of tin cans such as cat food tins, tuna cans, and juice cans—the basic design is very similar.[3] Windscreens/stands can be fabricated from tin cans, cut to size with ventilation holes added.

[edit] Operation and performance

Each stove is designed for one or two people. When used to cook larger meals (greater than 2 cups (0.5 litres), it is less efficient than a more-powerful stove which delivers more heat to a pot. This is because a longer cooking time is required, during which more heat is lost to the surroundings. A more powerful, pressurized version is shown below.

To use the stove, a small amount of fuel is poured into the stove and ignited. The pot is then placed above the stove, on a windscreen or stand. The flame is small at first, only burning from the inner chamber. Once the fuel has warmed up (requiring about one minute) its vapor will pass through the perforations and form a ring of flame. Enough heat from the flame is passed to the fuel to maintain full combustion until the fuel runs out.

[edit] Ratings

- Heat output: ~4800 BTU/hour (1400 W)
- Time to boil 2 cups (500 ml): ~5 minutes (<2 tablespoons (30 ml) of fuel)
- Time to boil 4 cups (1 l): ~12 minutes (<3 tablespoons (45 ml) of fuel)
- Burn time: ~9 minutes with 2 tablespoons (30 ml) of fuel
- Burn time (full): ~30 minutes with 5-6 tablespoons (75-90 ml) of fuel

[edit] Comparison with other stoves

The stove can outperform some commercial models in cold or high-altitude environments, where propane and butane canisters might fail. Ronald Mueser, in *Long-Distance Hiking*, surveyed hikers on the Appalachian Trail and found that this stove was the only design with a zero-percent failure rate[4].

Fuel usage (by weight) is about fifty percent greater than a butane/propane stove[5]. Can stoves weigh less than an ounce, compared with three ounces for the lightest gas stoves. Many commercial stoves also require special fuel canisters, adding to overall stove weight. No such canisters are necessary in a can stove; denatured alcohol can be carried in virtually any lightweight container, such as a plastic soda bottle. The weight advantage of the beverage-can stove is diminished by the greater fuel consumption (especially on longer hikes), but may still be offset by its reliability and simplicity.

Other attributes of the beverage-can stove are its nearly silent operation and its suitability as an emergency backup. Denatured alcohol is a (relatively) environmentally-friendly fuel that does not leave a residue of soot, although it is toxic to drink. (Pure ethanol is rarely used as stove fuel in the United States, since it is usually subject to a liquor tax.) Denatured alcohol is commonly available at camping outfitters and hardware stores. These stoves operate well on 90% isopropyl alcohol, marginally on 70% and not at all with 50%.

Unsealed alcohol stoves are inherently dangerous, since spilling is possible and the fuel burns with a nearly invisible flame[*citation needed*]. Trangia offers an anti-flashback fuel bottle with an auto-shut-off pourer.

[edit] Variations

Beverage-can stove variations with cross sections in yellow. From left to right—standard design; inverted two-piece; side-burner; pressurized.

A side-burner stove built from a single can as part of a Scouting project.

Standard
: The classic ultra-lightweight backpacking stove. Designed for one person, lighter than commercial models of the same design

Inverted two-piece
: Smaller and lighter than the standard version; difficult to fill

Side-burner
: Doubles as its own pot stand (holes are in the side). A tight-fitting pot can increase fuel pressure

Pressurized
: A more powerful version, but heavier and more difficult to make. The stove is sealed with a thumbscrew after filling with fuel; this allows the stove to control the rate of heat output. An additional base is used to hold fuel for preheating

Back-Pressured
: Back-pressured stoves simplify the pressurized design by eliminating the thumbscrew and the base needed for preheating, while still controlling the rate of energy output

Insulated
: A variation on the standard design, with an inner wall and insulated with fiberglass

Other
: Numerous designs in use

Multiple-unit
: When cooking for a larger number of people, nothing prevents the use of more than one unit under the same pot

Wood gas
: Uses wood for fuel in a single or double-wall stove. Wood is gasified in a pyrolysis zone in the stove, the smoke drafts upward and is ignited by a secondary combustion.

[edit] Safety issues