



# A SIMPLE RETORT

## How to make and use a simple retort for separating gold-mercury amalgam

Mercury is used in amalgamation to recover gold in its native or 'free' form. While mercury simplifies the process greatly, it must be remembered that it is a very dangerous substance, especially when inhaled or absorbed through the skin.

Mercury is an 'accumulative' poison, meaning that repeated exposure, even of very small amounts, can build up in the body, leading eventually to mercury poisoning.

Mercury released into the atmosphere is also dangerous because it combines easily with other substances (such as hydrocarbons) to form compounds which can easily be taken up by other organisms, such as fish and shellfish. A build-up of mercury in these organisms can make them dangerous to eat.

Signs of serious mercury poisoning include stomach pains, vomiting, headaches, shaking, collapse, diarrhoea and, occasionally, cardiac weakness. Indications of low-level poisoning include nervousness, depression, vague fears, sleeping difficulties, reduced vision and poor co-ordination of the limbs.

### The need for a closed retort

Because of these dangers, it is very important to handle mercury extremely carefully. When working with gold amalgam, the mercury should be distilled in a closed retort. This not only ensures the health of those involved and protects the environment, but the mercury can also be recovered for future use.

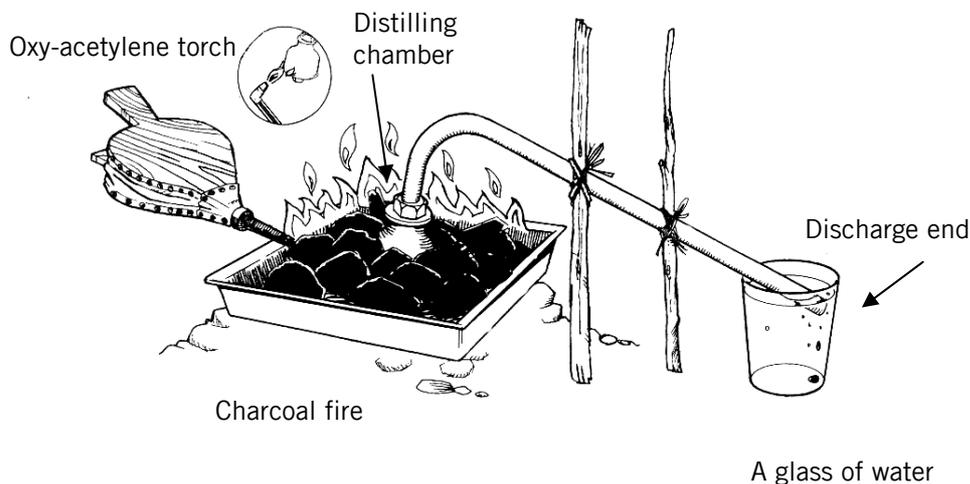


Figure 1: A simple retort

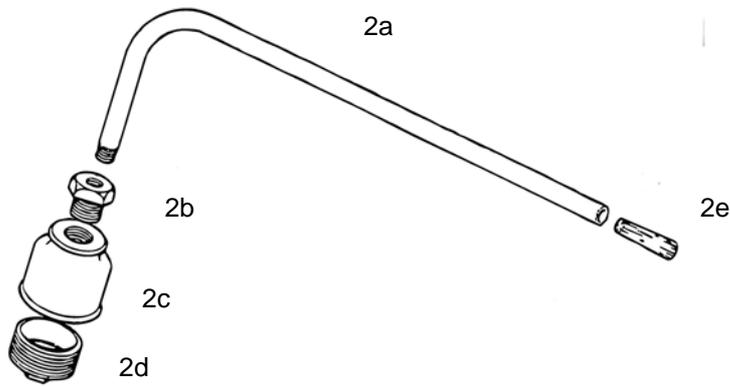


Figure 2: Part required for the retort

## Parts required

The retort's pipe and fittings, except for the wooden stopper (2e) should be made from ordinary galvanised iron. Piping made from copper or other metals should not be used as these combine readily with mercury.

1. One 20-inch length of 1/4-inch-diameter galvanised iron pipe {2a}, with screw thread at one end. If 1/4-inch pipe is not available, then use 1/2-inch pipe, but note that the smaller the pipe diameter the better.
2. One 1/2-inch to 1/4-inch galvanised iron reducing bush {2b}.
3. One 1/2-to-1 1/2-inch galvanised iron reducer {2c}.
4. One 1 1/2-inch galvanised iron plug {2d}.
5. A wooden stopper to fit the 1/4-inch pipe (or 1/2-inch) at the discharge end {2e}.

## Fabricating the retort

### Preparation

1. Bend the pipe 4 inches from the threaded end into a smooth curve, with an angle of 60-70°. Use a pipe bending machine, if available. Otherwise, clamp pipe to a larger diameter pipe (4 to 6-inch) and then manually bend the pipe around it (Figure 3).
2. Heat the pipe and fittings until red hot, before assembly, to burn off the zinc coating (zinc reacts with mercury). Allow the retort to cool, then wash it.

### Assembly (Figure 2)

1. Connect the 1/2-inch to 1/4-inch reducing bush to the pipe (2b to 2a) by screwing tightly. *Note:* The reducing bush is not required if a 1/2-inch diameter pipe is used.

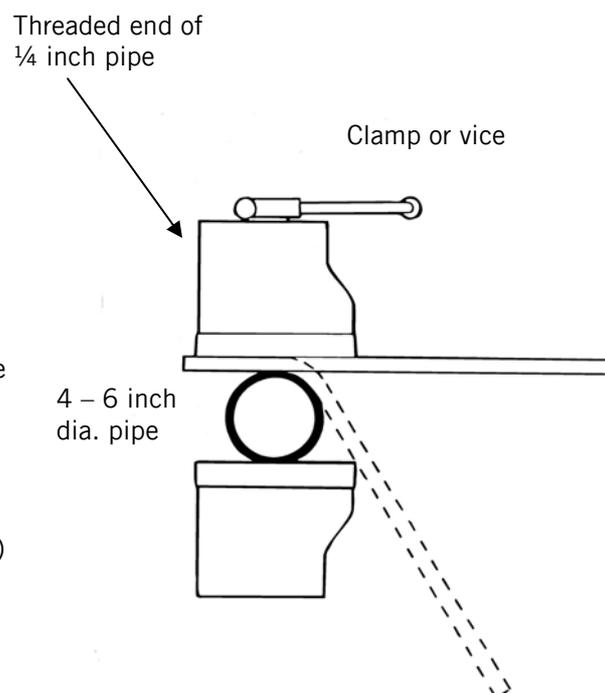
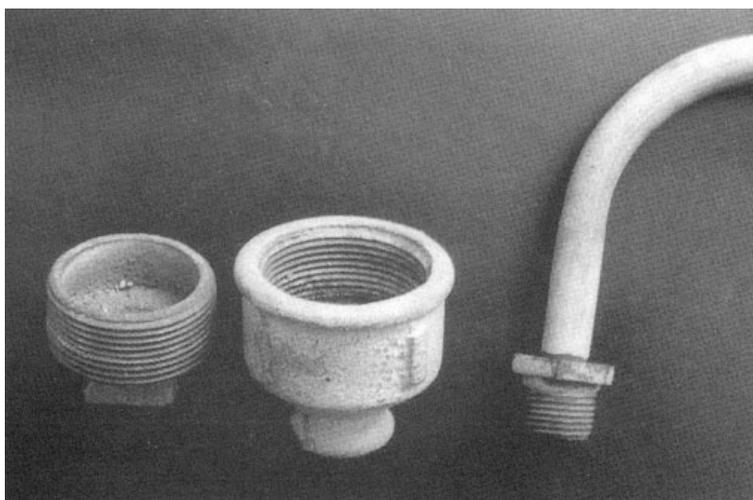


Figure 1: Pipe bending using a clamp or vice



Figure 4: Components of the assembled mercury retort

Figure 5: Separate components of the mercury retort



2. Connect the 1 $\frac{1}{2}$ -inch-to-1 V2-inch (2c to 2b) reducer to the reducing bush by screwing tightly.

3. Connect the 1 $\frac{1}{2}$ -inch plug to the reducer (2d to 2c). The retort is now ready for use.

#### Using the Retort

The purpose of the retort is to separate the gold from the mercury components of the gold amalgam. By applying heat to the amalgam (Figure 1), the mercury is burnt off as a gas, which passes along the pipe to re-condense as a liquid. The gold remains in the distilling chamber of the retort, while the mercury is collected at the discharge end in liquid form.

1. Wrap the amalgam into small balls with a piece of paper (the foil from a cigarette packet is ideal). This will help prevent the gold from sticking to the distilling chamber under heat.  
*Note: Wear rubber gloves whenever you are handling mercury to avoid contact with the skin.*
2. Place the wrapped amalgam in the plug (2d) and screw tightly.
3. Seal all the joints with wet clay or mud. This will prevent mercury gases escaping into the atmosphere during the heating process.
4. Prepare the source of heat, normally charcoal (an oxy-acetylene torch can also be used).
5. Secure the retort on a stand that places the distilling chamber directly over the source of heat. At the discharge end, place a glass of water, with the end of the pipe submerged (Figure 1).

6. Use bellows to increase heat. Continue applying the bellows until the distilling chamber is red hot or bubbles stop coming out of the discharge end. This part of the process normally takes about 5 minutes.
7. Remove source of heat and allow the retort to cool down using a wet cloth or water, but taking care to keep the discharge end of the pipe submerged in water.
8. Lift the retort vertically with the discharge end still submerged in the water (Figure 6). Tap the pipe with a stick to dislodge any mercury still in the pipe.
9. Remove the retort from the water and cover the discharge end immediately with the wooden stopper.
10. Cool the distilling chamber further by dipping it in cold water.
11. Unscrew the plug and remove the gold. Screw the plug back immediately and remember to keep the retort fitted tightly together at all times after use, as some of the mercury will remain trapped.
12. Transfer the recovered mercury to a proper container. To prevent evaporation of mercury while being stored, put a layer of water over the mercury.
13. Store the container and the retort safely, out of sunlight, away from heat and out of reach of children.

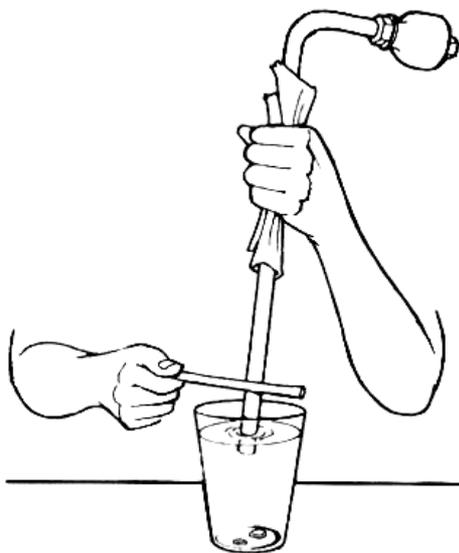


Figure 6: Tap the pipe to remove the mercury

### First aid treatment for mercury poisoning

1. **Inhalation** Remove the victim to a cool, well ventilated area; lay him on his back; loosen collar and belt; speak reassuringly; if victim is coughing badly, make him inhale (breathe) through a clean cloth soaked with a little ethyl alcohol or ether.
2. **Swallowing** Make the victim rinse his mouth with cold water; take him to a cool, well ventilated area; loosen collar and belt; give plenty of water to drink; induce vomiting; if possible, feed with milk and raw egg, raw egg alone or table oil.
3. **Skin contact** Remove clothing on affected area, wash affected area with running water; rinse and dry carefully.
4. **Eye contact** Wash affected eye immediately under running water with eyelids held wide apart and the victim's eyes moving in every direction; continue washing to be sure no particles of mercury remain in the eye; prevent victim from rubbing eyes.  
**Notes:** In all cases of mercury poisoning, refer victim to a doctor after giving First Aid. Never try to make an unconscious person take a drink. Never use any oily substance or ointment without medical advice.

**Note:** Do not worry if, the first time you use the retort, only a small part of the expected amount of mercury is recovered. Most of the mercury is normally trapped in the retort, and will be recovered in second and subsequent uses.

Practical Action  
The Schumacher Centre for Technology and Development  
Bourton-on-Dunsmore  
Rugby, Warwickshire, CV23 9QZ  
United Kingdom  
Tel: +44 (0)1926 634400  
Fax: +44 (0)1926 634401  
E-mail: [inforseiv@practicalaction.org.uk](mailto:inforseiv@practicalaction.org.uk)  
Website: <http://practicalaction.org/practicalanswers/>

Practical Action is a development charity with a difference. We know the simplest ideas can have the most profound, life-changing effect on poor people across the world. For over 40 years, we have been working closely with some of the world's poorest people - using simple technology to fight poverty and transform their lives for the better. We currently work in 15 countries in Africa, South Asia and Latin America.

# technical brief