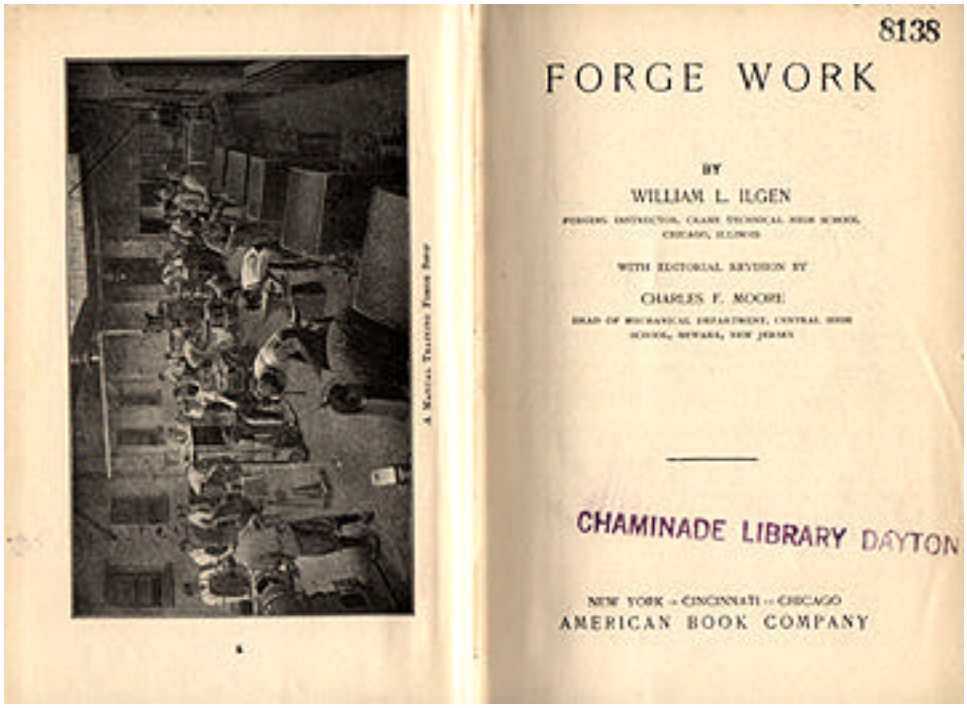

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FORGE WORK

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Preface to the expanded edition

William Ilgen's "Forgework" remains a classic contribution to the craft of blacksmithing. Originally written in 1912 and intended as a high school textbook, his book helped prepare countless students for the mechanical and ironwork trades.

The information in this book is still valid for many of today's blacksmiths, though the focus of blacksmithing in todays world has changed considerably. The primary market for the skills taught in Ilgen's day were industrial shops, railroad maintenance, and general repair work. While these skills are still useful, there are only a few smiths working in this type of environment. Many more are working professionally, semi-professionally and as a hobby in one-man shops. It is to these individuals that these additions are intended.

There is also the importance of safety in the blacksmith's shop. Ilgen only makes brief reference to this very important matter, writing in a day when workmen were frequently maimed or killed due to unsafe working conditions. The prevailing view was that safety was up to the individual, and employers and working environment had no responsibility for injuries.

Today, we take a different view. Keeping the work environment as safe as possible is critical to the daily operation of a blacksmith's shop, especially where employees are hired. Individual responsibility is still an absolute requirement in safe blacksmithing, but there are several areas where safety issues should be pointed out. Covering every possible hazard is impossible, but I believe I've added the most obvious deficiencies.

To differentiate between the original text and additions, I have decided on the simple convention of printing my comments in brown type, and leaving Ilgen's words in black. No copy has been removed, with the exception of correcting minor grammar or typesetting errors. Added drawings are noted in the captions, and new photos are in color.

Brian Gilbert, Editor

DISCLAIMER: Blacksmithing is an inherently dangerous activity. The author does not warrant, guarantee, or endorse any of the tools, materials, instructions or products contained in this document. The author

FORGE WORK
CHAPTER I TOOLS AND APPLIANCES

I. The Forge.–The forge is an open hearth or fireplace used by the blacksmith for heating his metals. The kind most commonly used by the general smiths is such as can be seen in small villages or where the ordinary class of blacksmithing is done. (See Fig. 1.)

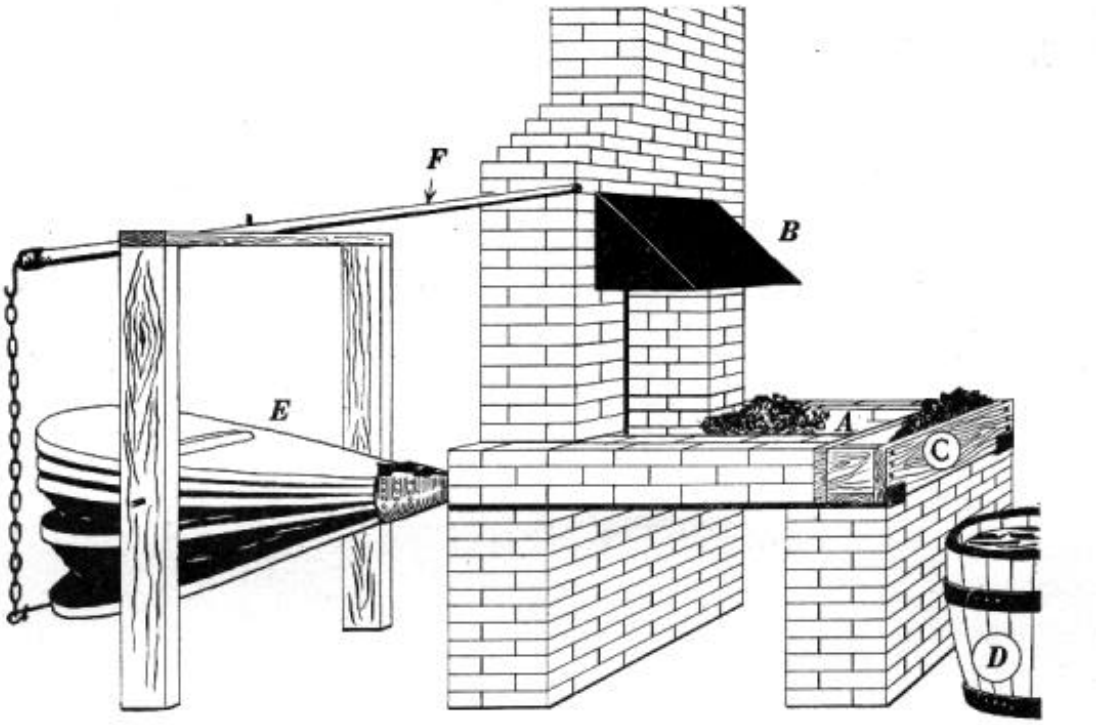

FIG. 1.—THE FORGE.

Forges are usually built of brick; in form they are square or rectangular, and generally extend out from a side wall of the shop. The chimney is built up from the middle of the left side and is provided with a hood B, which projects over the fire sufficiently to cateh the smoke and convey it to the flue.

The fire is kindled on the hearth A under the hood and over the tuyAre iron. This iron, the terminal of the blast pipe that leads from the bellows E, is made in various forms and of cast iron; sometimes it has a large opening at the bottom, but often it has none.

The bellows are operated by the lever F, which expands the sides and forces air through the tuyere iron, thereby causing the fire to burn freely and creating a temperature sufficient for heating the metals.

The coal box C is to the right, where it is convenient. The coal should always be dampened with water to prevent the fire from spreading. This will produce a more intense and more concentrated heat, so that a

certain part of the metal can be heated without danger of affecting the rest. The watertub, or slack tub D, as it is more properly called, stands at the right of the forge the coal box, where water for dampening the coal can be most readily obtained. It is used for cooling the iron or tongs and for tempering tools. Modern forges are made of cast iron or sheet steel. There are various kinds designed mostly for special purposes. They are generally used with the fan blast instead of the bellows and have a suction fan for withdrawing the smoke.

The forge illustrated in Fig. 2 was designed for manual training use and is excellent for such a purpose. The bottom or base has six drawers which provide convenient places for keeping exercises and individual tools. As each drawer is provided with a special lock, much of the trouble resulting from having the tools or the work mislaid or lost is prevented.

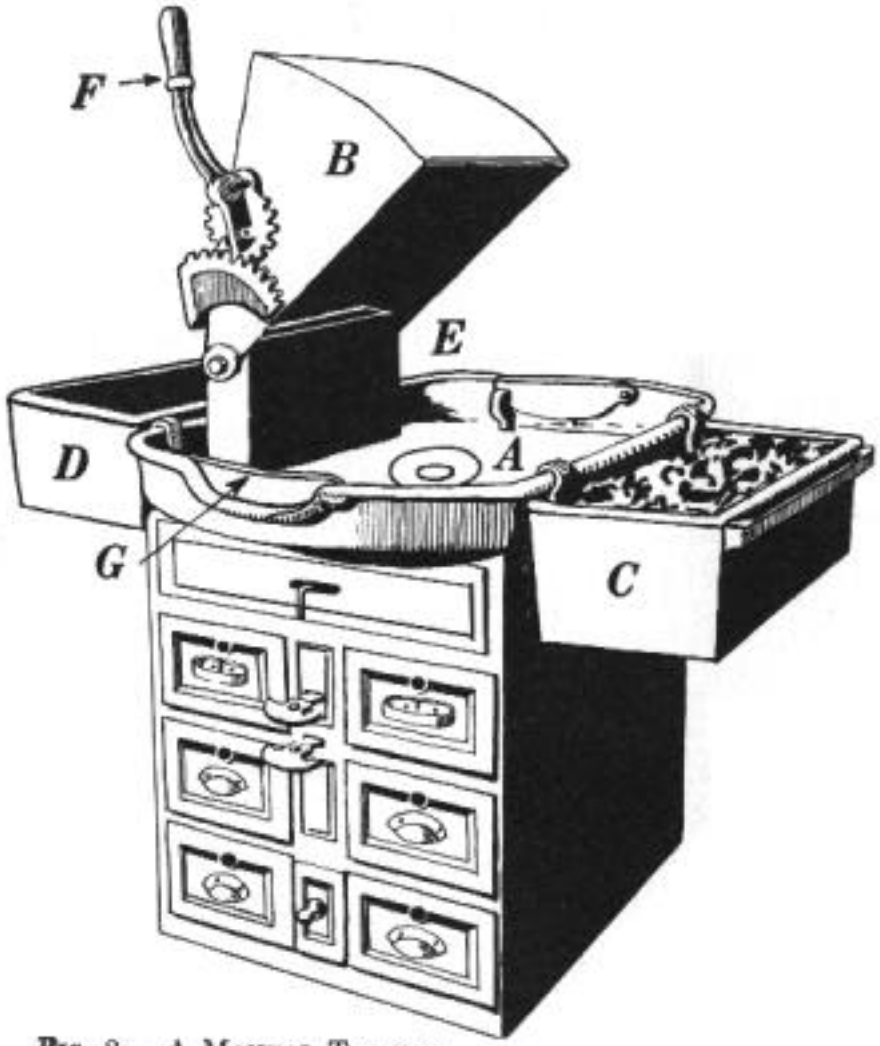

FIG. 2.—A MANUAL TRAINING FORGE.

The hearth A where the fire is built is provided with a cast-iron fire pot or tuyere. This is constructed with an opening at the bottom where there is a triangular tumbler which is cast upon a rod projecting through the front of the forge; by revolving the rod and tumbler the cinders or ashes can be dropped into the ash drawer at the bottom of the forge without disturbing the fire. A sectional view of these parts is shown in Fig. 3, also the valve which regulates the blast.

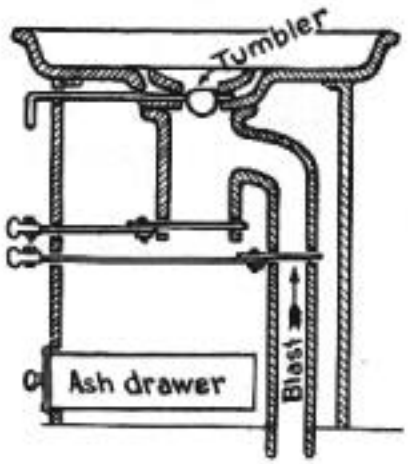

FIG. 3.—SECTIONAL VIEW OF THE FORGE SHOWN IN FIG. 2.

Suspended on the upper edge surrounding the hearth, and located to the right and left of the operator, two boxes C and D are located, which are used for storing an adequate supply of coal and water, where they may be conveniently obtained.

In front are two handles; the upper one operates the clinker or ash valve, the lower one regulates the blast.

The front and back edges surrounding the hearth are cut out, so that long pieces of metal can be laid down in the fire. These openings can be closed, when desired, with the hinged slides shown at G.

The hood B projects over the fire sufficiently to catch the smoke and convey it to the opening of the down-draft pipe E. When necessary the hood can be raised out of the way with the lever F, which is constructed with cogs and provided with a locking pin to keep the hood in position.

In current years, fewer and fewer sources of good coal remain. In response, many smiths have converted to forges operated with propane or natural gas, with propane being more common. These are available commercially, or are often shop built.

There are two basic burner types, naturally aspirated or atmospheric burners, and forced air burners. In an atmospheric burner, air is drawn into the forge by the venturi effect. Gas is injected through a narrow hole down the center of a bell-shaped tube. The gas pulls air into the tube, where they mix and are ignited in the body of the forge. These designs have become quite refined over the years, and with careful adjustment and tuning are capable of reaching forge welding temperatures. Most designs are not this refined, though, and usually can operate at 1800 degrees or so.

A forced air burner has the air supplied by an electric blower. These are simpler designs, and can often reach welding temperature due to the extra air available. There is a slightly greater risk when operating these, since a blower failure due to power failure or mechanical breakdown could result in an explosion. For this reason a forced air forge should never be left unattended for any reason.

2. Fire Tools.–The necessary tools required for maintaining the fire and keeping it in good working condition are shown in fig. 4. A is the poker with which the coke can be broken loose from the sides. B is the rake with which the coke can be moved over the fire on top of the metal to prevent the air from retarding the heating. The shovel C is used for adding fresh coal, which should always be placed around the fire and not on top. In this way unnecessary smoke will be prevented, and the coal will slowly form into coke. The dipper D is used for cooling parts of the work that cannot be cooled in the water box. The sprinkler E is used for applying water to the coal, or around the fire to prevent its spreading.

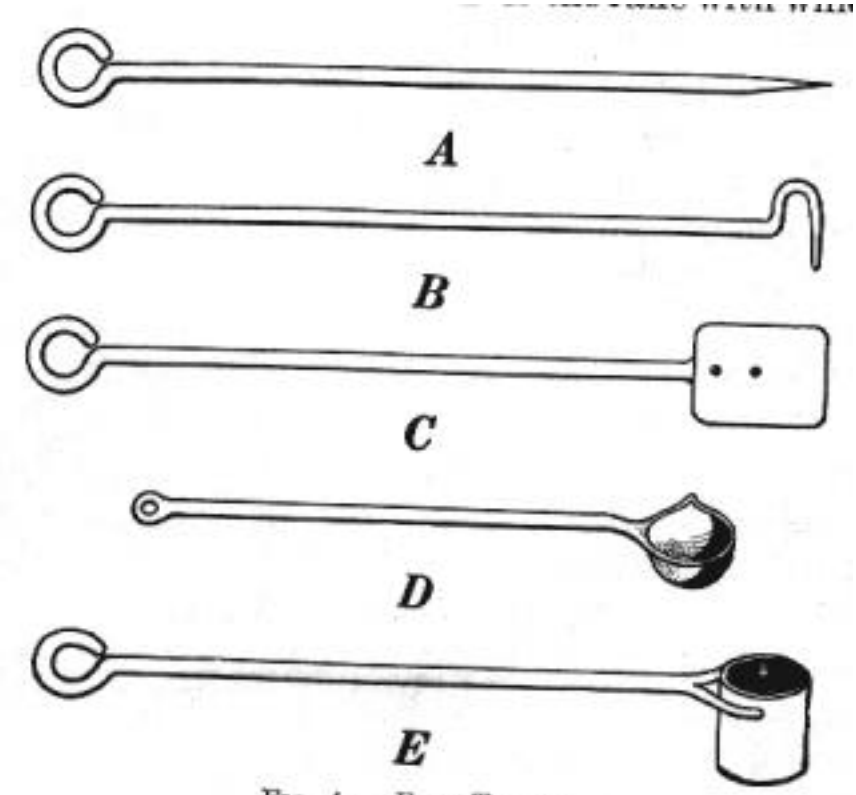

FIG. 4. — FIRE TOOLS.
A, poker; *B*, rake; *C*, shovel; *D*, dipper; *E*, sprinkler.

3. Fuels.–The fuels used for blacksmithing are coal, coke, and charcoal. Most commonly a bituminous coal of superior quality is used. It should be free from sulphur and phosphorus, because the metals will absorb a certain amount of these impurities if they are in the fuel. The best grade of bituminous coal has a very glossy appearance when broken.

Coke is used mostly in furnaces or when heavy pieces of metal are to be heated. It is a solid fuel made by subjecting bituminous coal to heat in an oven until the gases are all driven out.

Charcoal is the best fuel, because it is almost free from impurities. The most satisfactory charcoal for forging purposes is made from maple or other hard woods. It is a very desirable fuel for heating carbon steel, because it has a tendency to impart carbon instead of withdrawing it as the other fuels do to a small extent. It is the most expensive fuel, and on that account, and because the heating progresses much more slowly, it is not used so generally as it should be for heating carbon steel.