A SIMPLE HOME-MADE LATHE.

BY BUDD A. WRIGHT.

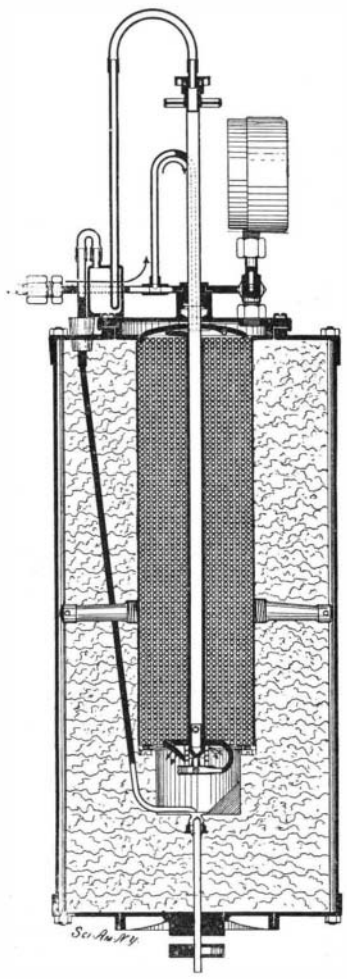
The boy of a mechanical turn of mind who finds that a lathe is a necessary part of his small shop equipment, and that he has not the necessary funds to buy one of the many foot-power machines advertised, need not be discouraged. It is easy enough to make a lathe which will meet all his simple requirements.

The bed of such a lathe consists of a piece of ⅜-inch pipe to each end of which a straight L is screwed. On each L an elbow is screwed, having flanges pierced to receive screws whereby the base may be secured to the table of a sewing-machine. The poppets can be made of a four-way ½-inch T, slipped over the ⅜-inch pipe and fastened thereto by a piece of ⅜-inch pipe about ½-inch long inserted through one of the holes of the T. A ½-inch plug screwed upon this arm of the T will force the ⅜-inch pipe tightly against the bed-pipe and hold the poppet rigidly in place. In the remaining arm of each T a piece of ½-inch pipe is screwed. Through the upper end of one of these ½-inch pipes a hole is drilled, parallel with the bed. The hole receives a wire nail (the point of which has been rounded off with a file) serving as the arbor of a pulley which is belted to the driving-wheel of the sewing-machine. A wire nail is similarly journaled in the ½-inch pipe of the other poppet. Between the two nails the object to be turned is held. To impart rotation to the work a nail is partly driven into the work between two spokes of the pulley.

The tool-rest consists of two parts, ⅜-inch piping being used. One part is carried on the bed-pipe, and is screwed to the second part. A piece of band iron is riveted to the top of the second part and serves as a tool-rest.

A LABORATORY APPARATUS FOR LIQUEFYING GASES.

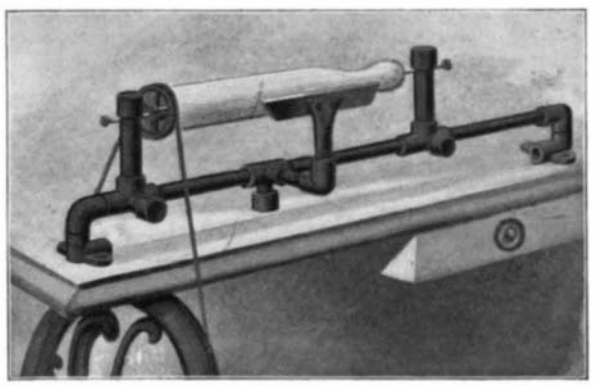
The various methods employed before 1895 by the original investigators for liquefying those substances which yield up their gaseous forms with great difficulty, have all been displaced by a most simple method which was apparently discovered by Siemens and described in the preliminary specifications for an English patent in 1857. "The invention relates to freezing and refrigerating by the expansion of air or elastic fluid. The air is first compressed by a cylinder, or by pumps of any suitable construction, by which the temperature is raised, and it is cooled while in the compressed state, and then allowed to expand in a cylinder or engine of any suitable construction, by which the temperature is lowered. The air thus cooled . . . . is then conducted through an interchanger, or apparatus by which it is made to cool the compressed air which enters the interchanger in the opposite direction, . . . The principle of the invention is adapted to produce an accumulated effect, or an indefinite reduction of temperature."* This description might almost be used without change of any of the machines which have attracted attention here and abroad during the last six years. Several ice-making machines were constructed upon this principle between 1863 and 1874, in which the water was frozen by the expansion of air.



SECTIONAL VIEW OF GAS LIQUEFYING APPARATUS.

In 1874 our own Prof. Edwin J. Houston suggested the use of such a method for the liquefaction of the incoercible gases. "There would appear to be no other limit to the reduction of temperature save what would arise from the strength of materials, or the liquefaction and subsequent freezing of the nitrogen, or the oxygen of the air, or of the air itself.* In 1877 Cailletet and Pictet liquefied oxygen and nitrogen by methods unlike this; but the apparatus suggested by Prof. Houston is a clear anticipation of those of Linde, and Hampson, made public in May, 1895, and of Mr. Tripler which attracted public notice in 1897. All of these machines have been described and illustrated in our columns.

We present at this time an account of a form of



A HOME-MADE LATHE.

Dr. Hampson's liquefier, designed so that it should be available for use in any laboratory, and also of moderate cost. It is claimed for it that it will begin to deliver liquid air in from 6 to 10 minutes after the admission of air, at from 150 to 200 atmospheres pressure, and will make over a liter of liquid per hour. The liquefier seen on the stand is a cylinder 17 inches high and 8 inches in diameter. With a compressor which can deliver air at or above 100 atmospheres it will work continuously day after day. When a compressor is employed the purifiers are used. The large one, standing on the floor to the right, is of low pressure; the small one under the liquefier to the left of the stand is of high pressure. Without a compressor the gas is delivered to the liquefier from cylinders, similar to our cylinders for containing oxygen and hydrogen for the stereopticon, and in such use no purifiers are needed. In this case the coils of the liquefier are first cooled by the expansion of liquid carbon dioxide, in the return pipes, surrounding the air under pressure previous to its expansion.

The essential feature in this, as in all machines of its class, is seen in the sectional view. The air under pressure flows in at the top on the left and traverses one system of pipes, whose numerous convolutions occupy most of the space within the packing, returning by the reverse system of pipes to go out into the open air. With a compressor there is no reason why this expanded and dry air may not be taken in and compressed again, thus saving some work for the purifying apparatus.

The expansion valve is seen at the bottom of the liquefier. The efficacy of the machine depends wholly upon the Joule effect, and no increase of cooling is brought about by compelling the expanding air to do work. This could hardly be expected in so small a machine. The Joule effect is, however, inversely proportional to the square of the absolute temperature; a fact which accelerates the action as the air grows colder. Thus expansion of air from 4½ atmospheres to 1 will cool the air from 0 deg. C. to 1 deg. below 0 deg. C.; that is, from 273 deg. to 272 deg. absolute temperature. But at two-thirds of that absolute temperature, at 182 deg. below 0 deg. C., or which is at 91 deg. absolute, an equal drop of pressure will produce a cooling represented by two-thirds squared and inverted, or nine-fourths as much, which is 2½ deg.

The points of merit claimed for the apparatus are a large surface of exposure between the compressed inflowing and the expanded outgoing air, as little separation as possible between these streams, and this of as high a conducting value as possible; having a small quantity of air in action at once. To attain these ends the pipes are of copper in close contact with each other, of small bore and of little thickness. These thermal advantages have been so carefully attended to that this is considered one of the most efficient hitherto designed.

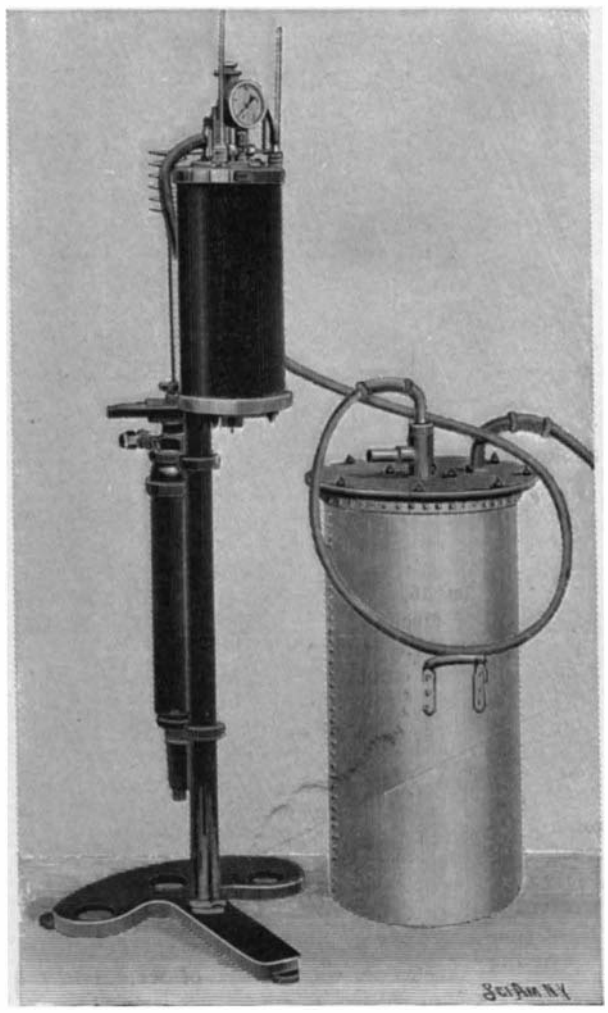
With supplementary arrangements even hydrogen has been liquefied by it. Numbers of these are in use in university laboratories in various countries, and some have been brought to the United States.

Iron and Steel Production of the United States.

The American Iron and Steel Association, in a report recently issued, states that the total production of pig iron in the first half of 1901 was 7,674,613 gross tons, against 7,642,569 tons in the first half of 1900, and 6,146,673 tons in the second half. The production of Bessemer pig in the first half of 1901 was 4,582,187 gross tons, against 4,461,391 tons in the first half of 1900, and 3,482,061 tons in the second half. The production of basic pig iron in the first half of 1901 was 645,105 gross tons, against 581,868 tons in the first half of 1900, and 490,508 tons in the second half. The stocks which were unsold in the hands of manufacturers or their agents on June 30, 1901, amounted to 374,129 tons, against 442,370 tons on December 31, 1900, and 338,053 tons on June 30, 1900.

A Contemplated Balloon Trip.

Count Henri de la Vaulx, the famous French aeronaut who holds the world's record for having covered the longest distance in a balloon, contemplates some interesting experiments which, if successful, will be of more than general interest. He proposes to cross the Mediterranean from Toulon to Algiers, a distance of 496 miles. In point of mileage it is not so great an achievement as the one he accomplished last year when he went from Paris to Kiev in 36 hours. His main object this time is to ascertain whether it is possible to steer the ordinary spherical balloon. A special steering apparatus has been invented by M. Hervé. The steering appliance is not to be attached to the balloon itself, such as was the case with André, but is to float on, or to be submerged in, the water. The apparatus comprises a series of boards connected together and forming a combination of parallel helms. These will be towed by the balloon while submerged at a depth of about 15 feet below the surface of the water. To this arrangement is to be attached another appliance termed the "steadier," which is a kind of ship's keel floating on the surface of the water. This steadier weighs about 900 pounds. The balloon will be attached to this by a rope 300 feet in length, and the aeronaut opines that the weight of the steadier will prevent the balloon rising above that height. Beneath the car will be attached a zinc cask provided with a pump, from which extends a thin pipe communicating with the sea below. The idea of the aeronaut is to utilize sea water as ballast, the pump enabling the cask to be emptied or filled according to the exigencies that arise. The cask when full will weigh approximately 400 pounds. He will also carry a quantity of oil in case the sea proves boisterous, while he has observed the precaution to render his car waterproof and floatable should accident attend the experiment. The trial is to be semi-military in character. Complete signaling apparatus and powerful searchlights are to be carried, while he will be accompanied on the expedition by two lieutenants of the French navy. The various governments have been notified of the trial, so that the cutting of the balloon from her steering appliances may be averted. The



LABORATORY APPARATUS FOR LIQUEFYING GAS.

scope of the trial is to prove that if, in the event of war, a hostile fleet occupied the Mediterranean at this point, France could still maintain communication with her African colony by means of balloons. The logic of this contention, however, appears to be irreconcilable, since an opposing fleet could capture or destroy the efficacy of such a service if such steering apparatus as that to be used on this trip were to be utilized. The projected voyage is to be made in September.

* Harden, "Liquefaction of Gases," p. 182, $1.50.

* Jour. Frank. Inst. 1874, p. 9 et al.