### A SIMPLE PIPE-BENDING MACHINE.

The pipe-bending machine shown in the accompanying illustration has many new and valuable features. It is strongly constructed and will stand great stress when bending the heaviest pipes. The gears, which are cut and of heavy pitch, have a ratio of 25 to 1, giving it a powerful leverage. Hence a boy can bend a 2-inch pipe with little effort.

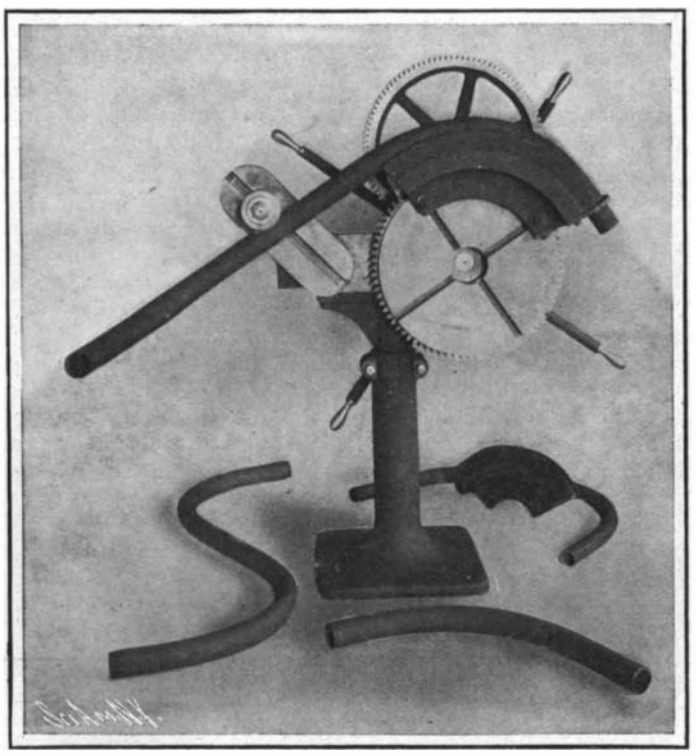
The continuous rotary movement of the faceplate upon which the quadrants or formers are placed is a distinct and desirable advantage and for many kinds of work it is obviously of much importance and convenience. The resistance stud is located on a movable arm provided with a "T" slot, permitting the stud to be placed anywhere within the radius of the arm. This arrangement provides the means for any kind of pipe bending.

The faceplate has four "T" slots upon which any style or shape former or quadrant can be attached. It will in consequence bend an infinite number of shapes without leaving any mark or disfigurement on the work operated upon. The machine is designed to be easily portable and has a telescopic stand which can be raised or lowered to a suitable height. When the base is fastened the upper part swivels. Plain or adjustable stands can be used as the requirements of the case necessitate.

Piping of steel, iron, brass, copper, or other material can be bent cold up to 2 inches in diameter. The machine is also adaptable by means of special formers for bending light angles, flat or tee bars. When pipes are coated by the Sabin process, galvanized, tinned, etc., this machine will bend such pipes to any desired shape without breaking the coating in any way.

The quadrants furnished with this machine are adapted for use on inch pipe with a radius of 6 inches; 1¼-inch pipe with a radius of 9 inches; 1½-inch pipe with a radius of 12 inches, and 2-inch pipe with a radius of 14 inches. While these four sizes are furnished with the machine, the fact that the smaller sizes of pipe can be bent in the larger quadrants makes it unnecessary to change the latter unless a shorter radius is desired than the larger quadrant will give.

The gears, the body of the machine, and the stand have been carefully proportioned to sustain the stress of the heaviest work. The weight of the machine complete is 750 pounds, and it is a very desirable adjunct in any plant where there is much pipe or conduit work.



A SIMPLE AND POWERFUL PIPE-BENDING MACHINE.

### SIMONIS LIQUID-AIR APPARATUS.

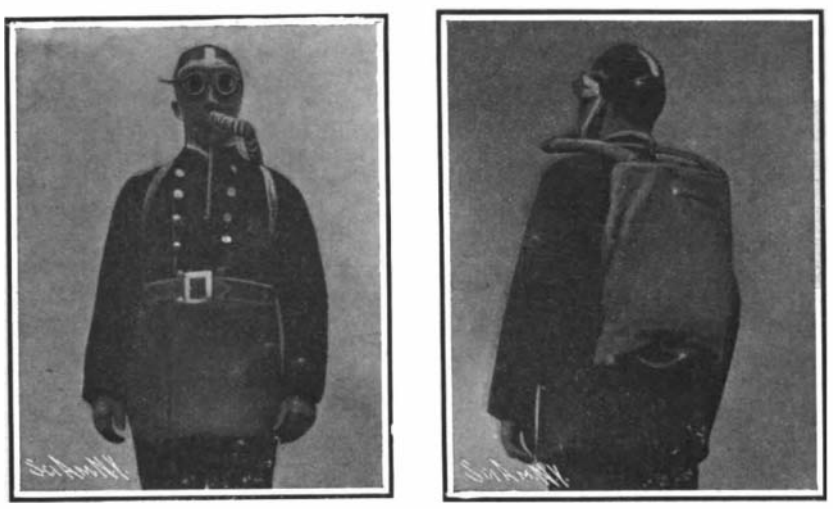
BY THE ENGLISH CORRESPONDENT OF SCIENTIFIC AMERICAN.

The possibilities of the application of liquid air to rescue apparatus for operation in coal mines, sewers, fires, and other inclosed spaces in which noxious and asphyxiating fumes prevail, is at the present moment arousing deep interest in Great Britain. This apparatus, which is the invention of Mr. Otto Simonis, of Norfolk House, Strand, London, has been evolved from the experimental to the practical stage, and is now being severely tested both by the Metropolitan Fire Brigade and the Royal Commission on Mines. The utilization of liquid air for rescue purposes has for some time past been attempted, but experimenters have found considerable difficulty in the handling of liquid air, as well as the control of its reversion to the gaseous state, in a manner coincident with the pressure requirements for human inhalation, without any resultant waste. These problems, however, have been satisfactorily and successfully overcome in the Simonis invention, which is known as the "Aerolith" apparatus, and the numerous experiments and practical application of the system that have been carried out in Lord Rothschild's Austrian coal mines have demonstrated its efficiency and value. Mr. Otto Simonis, who has for many years been associated with the evolution of fire-fighting and rescue apparatus, has been engaged for some time past in the application of liquid air for the latter purposes, having abandoned the oxygen system, with which he was originally identified.

The "Aerolith" apparatus, which we are enabled to describe and illustrate through the courtesy of the inventor, presents many ingenious and striking features, the most notable being the entire absence of valves of any description, as well as the novel means adopted for absorbing the liquid air, the discovery of the inventor, whereby this material can be brought under complete control by an easy expedient, constituting a most prominent feature. The apparatus is of a very simple character, and is comprised of a bag containing the liquid-air absorbing medium, which is strapped to the wearer's back like a knapsack, so that the arms are left entirely free. The apparatus is not unduly heavy, weighing only twenty-four pounds when fully charged. From the top of the knapsack extends a flexible tube connecting an upper section of the chamber containing the absorbed liquid air with the mouth, there being a mask fitted over the entire face with mica glazed apertures for the eyes, or simply a mask inclosing the eyes and mouth. This flexible coupling, which is about one inch in diameter, is connected by another short length of flexible tube of smaller diameter, the connection being made about six inches below the mouth to the liquid air container at the opposite upper section, as shown in the illustration.

The most essential part of the apparatus is the compartment containing the liquid air. This is filled with asbestos wool, which the inventor has discovered to be the very best of all absorbing substances, while at the same time it enables evaporation to be automatically controlled. This absorbent is thoroughly regulated by special means, so that not only is evaporation avoided when the apparatus is not in operation from external heat, but at the same time when evaporation is in progress, to affect it so gradually as to be just sufficient for the needs of the wearer's lungs. Attached to the apparatus and lying flat against its outer surface is a second bag, through which escapes exhaled air from the lungs.

The operation of the apparatus is extremely simple. The wearer clamps the mask carrying the mouthpiece from the liquid air chamber to his mouth, and commences to breathe in a normal manner. The warm expired air from the lungs passes through the tube, and enters the chamber containing the absorbed charge of liquid air. The temperature of the volume at once causes the evaporation of a small quantity of liquefied air of the same volume as would be exhaled by a man under ordinary circumstances. This evaporated charge passes up the second tube, and by the next inhalation is drawn into the wearer's lungs. This cycle of operations is repeated, the warm expired breath evaporating charges of fresh air until the supply has become exhausted. The atmosphere evaporated from the absorbing material is cool, fresh, and pure, the intense cold of the vaporized air being warmed by its passing through the tube, so that by the time it reaches the mouth, it can be inhaled without the slightest discomfort. The expired air, after passing over the absorbing medium and relea[illegible] the requisite quantity of fresh air i[illegible]age, finally escapes into the outer atmosphe[illegible]



FRONT AND REAR VIEW OF WEARER OF A SIMONIS LIQUID-AIR APPARATUS.

The liquid-air absorbent reservoir is charged from a supply carried in a small receptacle, the liquid air being stored in a spherical vacuum vessel of the type evolved by Prof. Dewar. This reservoir is well insulated, the loss from evaporation being very small. It is made of varying capacities according to requirements, the average capacity ranging from 0.7926 to 1.5852 gallons. As air in its liquefied state is compressed into one eight-hundredth part of its own volume, 1.32 gallons of liquid air evaporate into about 244,080 cubic inches of pure air at atmospheric pressure; this quantity is sufficient for about three hours' use.

In connection with the evolution of the "Aerolith" apparatus, the inventor has also devised a cheaper method of producing liquefied air than those in use at present. With the apparatus he has designed, the cost of production is approximately eighteen cents per gallon, but by the aid of some recent modifications in the plant, it is anticipated that the cost will be reduced to five cents per gallon. In the case of large coal-mining areas, such as those existing in the north of England, Westphalia, and Pennsylvania, it would be more economical to erect one central generating station to serve a large number of mines. A plant occupying a total space of not more than 45 square feet, with an 8-horse-power engine and capable of producing one gallon of liquid air per hour, can be erected for about $2,000. One of the greatest objections to the general use of liquid air is the difficulty experienced in transporting it on account of leakage, but when stored in reservoirs of the insulated vacuum type, as constructed by Prof. Dewar, the loss by evaporation is reduced to a minimum.

The advantage of the Simonis invention is that it is compact, and being void of controlling valves there is no mechanism which is liable to become deranged. As it is comparatively small in size, it can easily be strapped to the back without inconveniencing the wearer, and therefore is peculiarly well adapted for work in dangerous mines. The possibility of the supply becoming exhausted is well provided against, as the rescuer carries a small alarm clock in his pocket, which gives at least twenty minutes' warning before the supply becomes exhausted.

The London Metropolitan Fire Brigade is giving the apparatus a severe and practical trial, and it has already been adopted exclusively in the Rothschild mines in Austria, where after several months' use it demonstrated its great efficiency and reliability.

### Electric Operation of Spanish Standard-Gage Railways.

According to the Continental technical press electric operation on standard-gage railways is now to be introduced into Spain, where on a section 22 kilometers (13.6 miles) in length of the Linares-Almeria line an experimental service is to be started. This section, from Santa Fé to Gergal, shows a practically constant gradient of about 2.75 per cent.

According to the scheme adopted, electric locomotives are to haul trains 150 to 300 tons in weight at a constant speed of 25 kilometers (15½ miles) per hour, thus allowing a train to be dispatched each hour, while trains at present cannot follow up each other at intervals of less than two hours.

A special steam-driven power station is to be erected at Santa Fé. Later, if expectations are realized, the water power available in the neighborhood will be used for electrifying other parts or the whole of this line. Rotary current operation has been chosen, as on one hand a considerable saving is obtained by recovering energy on the down-hill journey, while experience on the other hand goes to prove the simplicity and reliability of this system, especially for heavy traction purposes.

Five locomotives are to be supplied by a Swiss electric company, which also constructs the whole of the electric equipment. The double-pole overhead trolley line will be worked at a tension of 5,500 volts. The locomotives are of the double-axle type and are designed for an output of 320 horse-power each. The course generally adopted will be to couple two such locomotives to the head of the train, while for yard purposes these locomotives will be used singly.

The Cunard steamship "Mauretania"—sister ship to the "Lusitania"—has just undergone successful speed trials off the east coast of England.