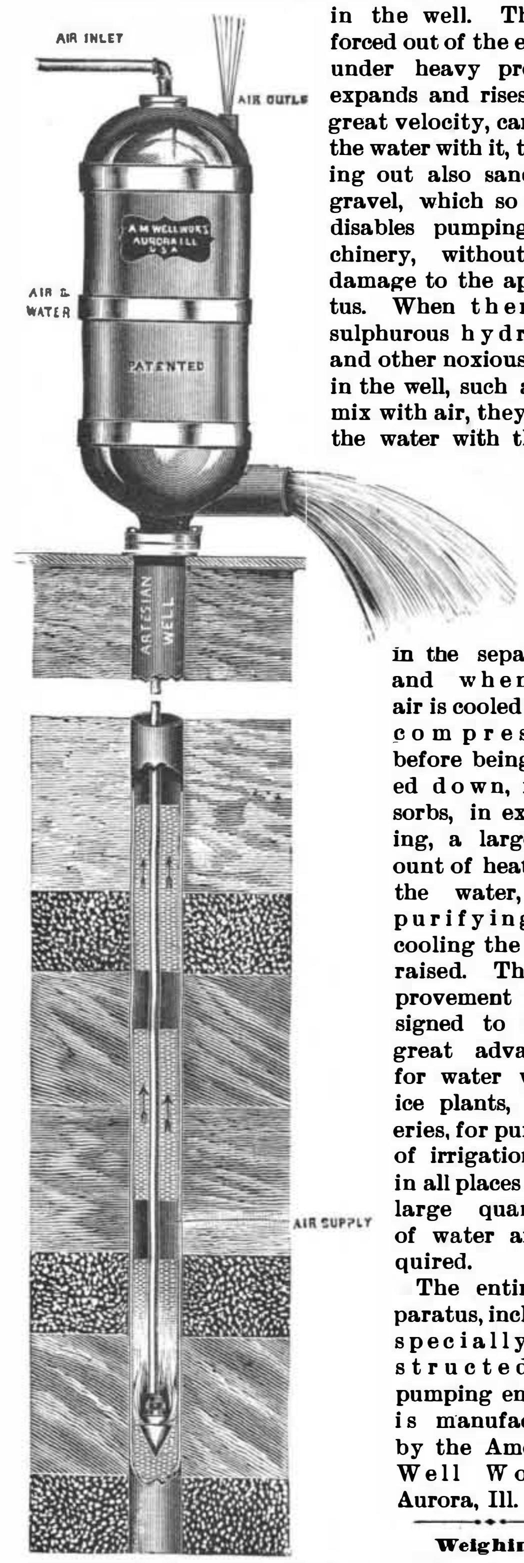
AN AIR-LIFTING PROCESS FOR WELLS.

The illustration represents the practical application of a novel process of causing non-flowing wells to flow without pumping, which is said to have proved eminently successful, and to be more economical than any other means at present employed for raising large quantities of water. The improvement consists in placing centrally in the well an air-pipe, as shown in the engraving, the pipe being connected with an air compressor and a separator at the top, and having at its lower end a peculiarly constructed ejector, the lower end of the pipe being carried down to a predetermined distance below the natural level of the water in the well. The air forced out of the ejector under heavy pressure expands and rises with great velocity, carrying the water with it, throwing out also sand and gravel, which so often disables pumping machinery, without any damage to the apparatus. When there are sulphurous hydrogen and other noxious gases in the well, such as will mix with air, they leave the water with the air in the separator, and when the air is cooled at the compressor, before being forced down, it absorbs, in expanding, a large amount of heat from the water, thus purifying and cooling the water raised. The improvement is designed to be of great advantage for water works, ice plants, breweries, for purposes of irrigation, and in all places where large quantities of water are required.



CHAPMAN'S AIR-LIFT WELL.

The entire apparatus, including specially constructed air-pumping engines, is manufactured by the American Well Works, Aurora, Ill.

Weighing.

The operation of weighing is so familiar to all that many are apt to forget what is actually done when anything is weighed. The method of weighing is adopted as a ready and easy means of finding the mass of a body—that is, the quantity of matter in it. This is done by comparing the attraction of the earth on the body in question with its attraction on another piece of matter whose mass is known. When the masses in the two scale pans of a balance are equal, the mass of the earth attracts them equally, and the beam of the balance stands horizontally; the balance is in equilibrium, and the substances in the two pans are said to be of equal weight. But the attraction of the earth on a mass near its surface depends on the distance of that mass from the center of the earth, so that a pound has less weight at the top of a mountain than in the valley below. The weights of bodies vary according to their position on the earth's surface, and the same mass has a greater weight at the poles than at the equator, because in the former place it is nearer to the center of the earth, and the earth's attraction for bodies outside it is the same as if the whole mass of the earth were concentrated at its center.

Again, at the equator, the motion of the earth about its axis tends to cause a body to fly away from the axis and to decrease the weight of the body. Thus the weight of a body, far from being a constant quantity, varies as the body is moved from place to place. Nevertheless, the method of weighing is an accurate way of determining the amount of matter in a given body, because by this operation we simply compare two attractions, and the forces of attraction on the body and on the standard weights with which it is compared vary equally as the balance is moved from one position to another; thus, although a body is lighter at the equator, so also is the standard pound against which we compare it.

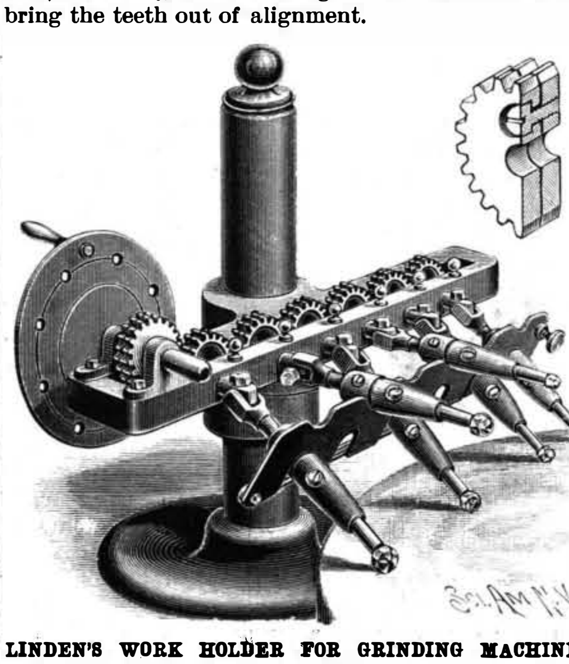
The comparison of weights is simple and familiar enough, but can we weigh the earth itself or find its mass? What can we compare it with? Here, again, what is to be done is to compare two attractions. If we can find the attraction of some mass—a part of the earth—on another mass, and then compare this attraction with that of the earth on the same mass—that is, with its weight—the problem is solved.—*Knowledge.*

Patents and Population.

The following facts are significant: Mississippi takes one patent for every 20,469 of her population; Connecticut, one for every 1,018 of hers; South Carolina, one for every 23,490; Massachusetts, one for 1,055; North Carolina, one for every 21,288; Rhode Island, one for 1,191; Georgia takes one for every 14,817, and New York one for 1,635. Alabama takes one for every 18,457, Illinois one for 1,944.—*University Quarterly.*

A WORK HOLDER FOR GRINDING MACHINES.

This is a device for holding precious stones on the abrading face of the lap or other grinding wheel, facilitating the grinding of a number of stones of various sizes at the same time. The improvement has been patented by Mr. William Linden, of Helena, Montana. Upon a post having a suitable base to give steadiness a collar is adjustably held at the desired height by means of a set screw, and on top of the collar loosely rests a hub forming part of a horizontally extending frame forming bearings for a series of short shafts. The outer ends of the shafts are connected by universal joints with drops adapted to support the work at their outer lower ends. Each drop has at its outer end a short rod, on the extremity of which is cemented or otherwise fastened the stone to be ground, the rod being adjustably held by a set screw in a sleeve, while the other end of the sleeve is adjustably held on a rod carrying part of the universal joint connecting the drop with one of the short shafts, whereby the holder can be lengthened or shortened according to the size of the stone. On the inner ends of the short shafts are segmental gear wheels, as shown in the small figure, in mesh with one another, an end wheel being in mesh with a driving gear wheel turned by a handle, and adapted to be locked in place by a pin passing through one of several apertures in an indicator wheel and into an aperture in the frame. As shown, there are eight apertures in the indicator wheel, and when one facet is ground by the revolving of the lap, the moving of the indicator wheel to the next registering aperture causes a corresponding rotation of the short shafts through the gear wheels, giving all the drops a like turn, so that a new surface is presented to the abrading surface of the lap. The several drops are engaged by a guide, preferably made of light sheet metal, having on one side recesses engaging annular grooves in the sleeves, and a pivoted locking arm extending over the entrance openings of the recesses. While grinding the facets the operator, by moving the guide, brings the work continuously on different places on the abrading face of the lap, insuring uniform grinding, and in case one facet is finished before the others, the locking arm is opened and the drop holding this facet is swung upward, carrying the work out of engagement with the lap. The segmental gear wheels on the short shafts are each made in two parts, as shown, to take up lost motion caused by wear or other reasons, the parts being connected by a set screw whose head and part of the shank passes loosely through a slot in one section, admitting of the setting of the two sections to bring the teeth out of alignment.


LINDEN'S WORK HOLDER FOR GRINDING MACHINES.

SOME ANCIENT REACTION ENGINES.

BY W. F. DURFEE.

There seem to have been several recent attempts, said to have been fairly successful, to apply modern science to the perfecting of the oldest known form of steam engine, that described in the "Spiritalia" of Hero of Alexandria, which was written about B. C. 150. Of the real antiquity of the machinery described in this work we have no certain knowledge, for Hero in his

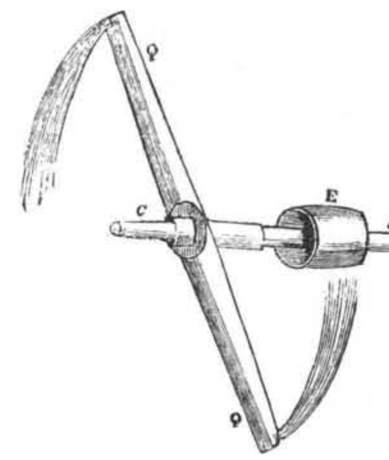


Fig. 2.—AVERY'S ROTARY ENGINE.

preface says he has "thought proper to arrange in order what has been handed down by former writers, and to add thereto our own discoveries;" but unfortunately he nowhere designates either his own or the more ancient inventions; hence the reaction engine may be among the mechanisms that were old even in Hero's time.

The reaction engine is the simplest form of mechanism yet suggested for utilizing the power of heat in the

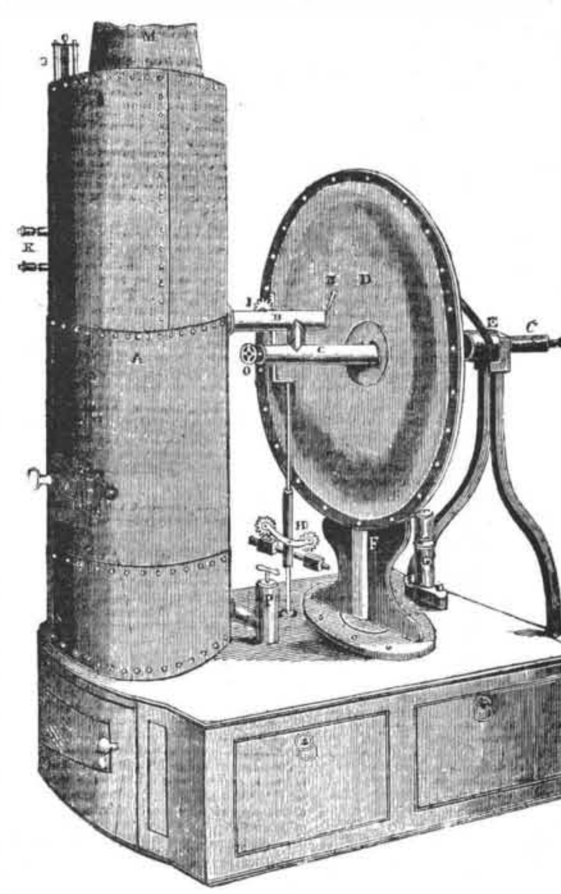


Fig. 1.—AVERY'S ROTARY ENGINE.

form of steam, and it will be a remarkable reversion if, after a couple of centuries of heterogeneous and ponderous complexity of design in steam machinery, we should return to the simple ideas of 2,000 years ago.

Since steam began to be employed as a motive power for manufacturing purposes, there have been several efforts to introduce engines for its use more or less like that described by Hero, and in view of the present tendency toward a careful study of the utilization of steam in reaction engines, it may not be untimely to recall some of the particulars of a reaction engine which was manufactured and used to some extent in this country sixty years ago.

The illustrations and description are taken from Vol. 24 (No. 637, October 24, 1835) of the *Mechanic's Magazine* (English). Its editor says:

AVERY'S ROTARY ENGINE.

"We have quoted at different times from the American journals some very favorable notices of a rotary steam engine invented by a Mr. Avery, which had been introduced into two or three manufactories, where it had given great satisfaction, and been applied in one instance with success to a railway carriage. Mr. Minor, of Wall Street, New York, has had a small engine on this principle built for his printing office, and in a recent number of his excellent *Railroad Journal* there is the following account of its construction and performances." Ed. *M. M.*

In No. 12, Vol. 4, of the *Railroad Journal* is pub-