meters, or 33 centimeters. M. Bertillon has adopted the following scale of reduction: 1/7, 1/5, 1/4, 1/3, 1/2.5 and 1/2 corresponding to the focal lengths 25, 33, 40, 50, 57 and 67 centimeters, or about 10, 13, 16, 20, 23 and 27 inches.

Each of the movable front combinations is marked with the focal lengths and the reduction which it produces when combined with the fixed back lens, thus: focus 25 centimeters, reduction 1/7. The camera, which is mounted with its axis vertical as shown in the illustration, is a large rectangular wooden box supported by three legs. In one side are six slots at distances from the optical center corresponding to the focal lengths of the six combinations of lenses, and the plate holder, measuring 24 by 30 centimeters (about 10 by 12 inches) is inserted in the slit corresponding to the combination used.

The optical center is exactly 2 meters above a fixed horizontal plane, the plane of reference or median plane, which is itself 20 centimeters (8 inches) above the floor. Hence, as the lens has a focal depth of 40 centimeters it will give a sharp image of any point within a distance of 20 centimeters above or below the median plane.

Portions of the object situated above this plane and consequently within less than 2 meters of the lens will, of course, be less reduced than equal areas of the plane of reference. It has been determined that the scale of dimensions increases by 1/100 for each 2 centimeters of elevation, between the limits of 180 and 220 centimeters from the lens. Hence, if the photograph is surrounded by perspective scales, as shown in one of the illustrations, the real dimensions of a part of the object in any plane parallel to the photograph can be computed from measurements of the corresponding part of the picture. Thus the photographs possess the valuable properties of the diagrams of descriptive geometry and orthogonal projections. The method appears susceptible of numerous applications, especially to anatomy and natural history. In photographing objects smaller than the human head some such series as 1/2, 1, 2, 3, 4, and 5 diameters might be employed, and the fixed distance might be made less than 2 meters in order to diminish the space occupied by the apparatus.

A NOVEL APPARATUS FOR DEMONSTRATING ATMOSPHERIC PRESSURE.

BY DR. ALFRED GRADENWITZ.

Mr. B. Rheinisch, an engineer living in Görlitz, Germany, has for some time been engaged in systematic investigations on the upward pull exerted by the atmosphere, with a view to utilize atmospheric pressure for the lifting of loads.

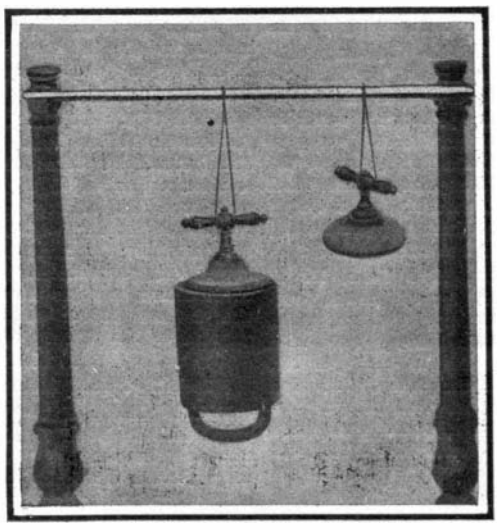
Special attention was paid to the specific weight of all animal bodies carried by the air, such as birds, beetles, and butterflies, and constant ratios between the volume and weight (within certain limits) were given in these three classes of bodies. While a full account of the scientific results reached in this connection is reserved for a future article, the first practical achievement was the construction of what the experimenter calls the "Görlitz pneumatic disks." These disks are intended to interest scientists in the investigation of the displacement of air while affording an illustrative demonstration of the essence and effects of the invisible force due to atmospheric pressure. Owing to its extreme simplicity, the apparatus can be advantageously substituted for the classic Magdeburg hemispheres designed by Otto von Guericke.

Mr. Rheinisch uses two flat, elastic segments of a hollow sphere which are slightly compressed against each other, thus displacing any air contained in the intervening space. Each segment is supplied with a suitable handle, which is of great assistance in making experiments. After discontinuing the compression, the experimenter has practically an absolute vacuum between the two segments of the apparatus.

The two halves of the apparatus can be separated with difficulty by two men seizing the handles and exerting their strength to the utmost. If the disks are compressed against a smooth surface, each can be loaded with a weight of 110 pounds by a pull acting at right angles to the surface, no matter whether the load is applied in a downward, upward, or lateral direction. In the case of two elastic disks applied to the varnished wooden surface of a door frame, the charge can be represented by the weight of a grown man loading each handle with 99 to 110 pounds, while a child will be able with its weight to load one handle.

The experimenter further used marble blocks, 22 to 66 pounds in weight, and polished on one side. It was especially interesting to note how awkward were those lifting the stones from the ground without the pneumatic disks, while with the use of the disks the more comfortable position for handling the block was found to be of great advantage.

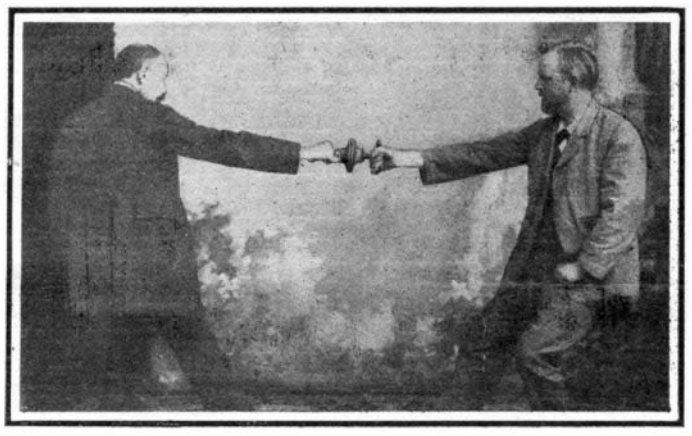
It is supposed that these disks will be used to replace ordinary gymnastic implements, because of the ease with which they are fitted to ceilings or door-frames, leaving no marks, while fully capable of bearing the weight of a grown person. The German Museum of Masterpieces of Science and Industry, which has been recently opened in Munich, is exhibiting these disks. Many schools have adopted this simple apparatus for the demonstration of the working of atmospheric pressure, thus dispensing with the use of an air pump. We are informed that the inventor is communicating with a number of foreign governments, offering his apparatus, free of patent obligations, in the interest of scientific investigation.



The Görlitz Pneumatic Disks.

Eggs Without Shells as Freight.

Russian exporters, to avoid an excessive freight on eggs as well as to avoid loss from breakage and from spoiling by heat, ship them without the shell, i. e., broken, and the contents put up in air-tight block tin boxes, with or without salt, according to the taste of the customer. Each box contains several eggs, and is sold by weight, the size running from half a kilogramme up to a *pud* (some 16 kilogrammes). The price of the latter is 5 rubles. For use in cooking and for a limited time, these tinned or preserved eggs seem to answer very well; that is, on the Continent, for England doesn't take kindly to them. London, for instance, which buys large quantities of Russian eggs, pays 8 rubles per *pud* for them (against 5 for the preserved eggs), besides the weight of the shells and the extra freight tariff on eggs. Each block-tin box of "conserved" eggs, whether it be of half-kilo (a kilo is a little over two pounds) or 2 *pud* size, must bear the date and hour of its closing, thus guarding against getting stale eggs. The amount of eggs put up in boxes and annually exported is enormous and constantly growing.—National Druggist.



Separating the Two Segments Held Together by Atmospheric Pressure.

Disks Attached to Polished Surface, Supporting the Weight of a Boy.

A NOVEL APPARATUS FOR DEMONSTRATING ATMOSPHERIC PRESSURE.

Paper Pinions.

The driving of machinery by means of gear wheels is rapidly extending, the three chief factors in the development being the increasing use of electric motors, the tendency to save every inch of space occupied by machinery, and the greater attention now paid to the prevention of variation in speed and loss of power.

Where belts are used for driving it is impossible to avoid "slip" with consequent undue wear and tear, loss of power and great variations in speed. Gear wheels give a positive drive with no loss in speed between the driver and driven, and if properly designed and constructed the wear and tear and loss of power is extremely small.

Noise is the chief objection to driving by means of gear wheels, and although this objection has to a great extent been overcome by the use of rawhide pinions which gear with spur wheels having machine-cut teeth, these pinions cannot be considered as finally solving the problem, because under the most favorable conditions their life is comparatively short and they must be protected from moisture, oil, and changes in temperature—three difficult things to avoid in ordinary practice. In consequence of these difficulties experienced, a British firm began experimenting with different materials, and found that pinions made from a high-grade Manila paper were the best available. The paper after being cut into blanks was subjected to the requisite pressure in 1,000-ton hydraulic presses, and the result is a paper pinion that has the strength of a cast-iron gear of the same dimensions.

Different from the rawhide pinions, those made of paper are not subject to variations of temperature and other untoward conditions. A paper pinion is more elastic than one of cast iron, and it is even lighter in weight—i. e., 23 cubic inches equal 1 pound—than rawhide; consequently it has a very decided advantage over either of these gears. When in operation there is no vibration, and there is a total absence of the ringing sound so prevalent in metal gears when they become a trifle worn. After working a short time and being lubricated with graphite, the compressed paper assumes a highly polished surface, which reduces to an appreciable extent the friction between the paper and the metal teeth.

A paper pinion is very simply manufactured by compressing the paper between flanges of hard brass, gun metal, or steel; in the smaller sizes the flanges are held up to their work by suitably spaced rivets, and in the larger sizes by special steel studs with conical heads countersunk.

Prof. Pickering Elected a Member of the Royal Society.

Dr. Edward Charles Pickering, the well-known Director of Harvard College Observatory, was elected June 6 a foreign member of the Royal Society of London, for his signal contributions to astronomical knowledge. The importance of the election may be gathered from the fact that only fifty foreign members have thus far been elected to the Royal Society, a very jealously-guarded list. Those in America who are already foreign members are Simon Newcomb, Alexander Agassiz, George William Hill, and Albert A. Michelson.

In 1886 the Royal Astronomical Society of London awarded Dr. Pickering its gold medal for his photometric work in connection with astronomy.

Prof. Pickering was born in Boston in 1846, and was graduated from Harvard in 1865 with the degree of Bachelor of Sciences. He started his pedagogic career as an instructor in mathematics in the Lawrence Scientific School of Harvard, which post he held from 1865 to 1867. From 1867 to 1877 he was professor of physics at the Massachusetts Institute of Technology, which chair he relinquished to assume the directorship of the Harvard College Observatory, a post he still holds. He has received many academic and honorary degrees from many institutions, notably California, Michigan, Chicago, Harvard, and Victoria (England). Besides two Royal Astronomical Society medals, he has also received the Rumford and Draper medals.

From 1893 to 1905 the tractive power of passenger locomotives in the United States has increased from 15,250 pounds to 24,648 pounds, an increase of 55.6 per cent.