PASCAL'S VASE.

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The law of the pressure produced by a column of water is very perfectly illustrated by the apparatus known as Pascal's vase. In the illustration is shown a method of constructing it that is far better adapted to the purposes than the usual one. Several experiments or modifications of experiments can be carried out with it that the regular apparatus does not admit of. As shown, it is very simply made, and its construction will be within the capacity of any one of moderate mechanical ability.

For the vase, a wide-mouthed bottle is selected. This should have as true a neck as possible, as regards its lower face. The bottom is first cut off. This may be executed in various ways, the most reliable, perhaps, being the time-honored method —with a hot poker. The neck has now to be ground. Some sand is placed upon a glass plate resting on a table, and is well moistened with turpentine. The bottle is held on this neck downward and rubbed around for half an hour. Care must be taken to hold it steady, so as not to rock it. In this way a flat surface is produced, which may be smoothed off with ground pumice, used like the sand. The sharp edge, where the bottom was cut off, may be removed by similar grinding or by a few strokes of a file.

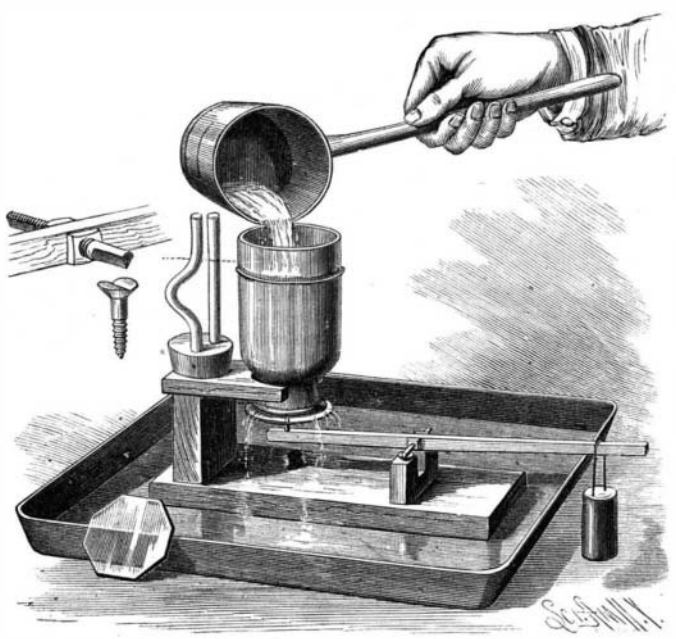
If the grinding is well done, the bottle, when placed with its open neck downward and resting upon a piece of glass, can be filled with water, which it will hold with scarcely any leakage.

A wooden frame is next made to hold the bottle. A semicircular opening grasps it tightly near the shoulder, holding it a couple of inches above the base. If it rocks or moves, a band of paper can be used as packing to secure it. To close its neck, a plate of perfectly flat glass is cut a little larger than the outside diameter of the neck. The plate may be square, octagon, or circular. The latter is the best shape.

A support for a balance beam is mortised or screwed fast to the base. A slot is cut in its axis, within which the balance beam can play. For fulcra, or bearings, for the knife edges, two wood screws are driven into the top on each side of the slot, and shallow open grooves are filed in them. The beam works upon knife edges, which are thus constructed. An iron bolt, about three-sixteenths inch diameter, is selected, one which has a long thread being best. Two nuts are required. One is screwed up as far as it will go. A hole is made through the balance beam, and the bolt is thrust through it until the nut comes against the beam. Then the other nut is screwed up so as to hold the beam in place. The projecting portions of the bolt are filed off to a straight and true knife edge, and the head of the bolt is cut off. If the threaded portion of the bolt should be too short to admit this treatment, one nut may be reamed out and passed beyond the thread upon the cylindrical portion of the bolt. There it must be secured by soldering. This forms a good abutment for the beam to bear against. Care should be taken to have the bolt perpendicular to the beam. The knife edges are quite hard enough for the limited work the balance is required for.

Upon the upper surface and near the end of the beam a notch is made. Into the other end at the upper surface an iron pin is driven as near as possible to the center of the opening of the neck of the bottle when the beam is in its bearings. This pin is filed to a sharp point. A couple of lead weights are arranged to hang from the notched end of the beam. These are easily cast in paper. A sheet of paper is rolled around the end of a round stick of wood, such as a broom handle, so as to project a couple of inches beyond the wood, and tied securely with string. The paper should be eight or ten layers in thickness. Into the cylindrical cavity thus formed the lead is poured when just melted, and while still fluid the suspending loops are placed in it, and held until all is solid. Two weights of different sizes should be provided.

The apparatus is arranged as shown in the cut. The weight holds the glass plate against the bottle, only the sharp point of the pin on the balance touching its under surface. Water is now poured into the vase. If the weight is not too heavy, as soon as a certain level is reached the water will begin to run out between the glass plate and the ground surface of the neck. The level of the water where this occurs is marked by springing an India rubber band around the bottle. This illustrates the downward pressure of water. The flask can never be filled any deeper. Any excess of water introduced escapes until that level is reached. The flask may now be emptied, and a cork fitted with two small tubes of any size and shape is inserted from above into the neck. Water is now poured into these. The object of having two tubes is to permit air to escape from the space between the cork and plate. A single tube, if of sufficient diameter, will answer. As soon as the marked level is reached, the plate is again forced off its seat and water escapes. The tubes can only be filled to the same level as the large vase. Finally, the tubes are removed, the flask is half filled, and a solid cylinder, such as an empty bottle, is immersed in the water so as to raise its level. Nothing happens until the mark is reached, when again the plate is forced off its seat and water escapes.



PASCAL'S VASE.

Thus the law is proved that the pressure exerted by a column of water on a given area varies with the height of the column of fluid producing it, and not with its volume or shape.

THE ELECTRICAL TYPE WRITER.

BY F. HIGGINS.

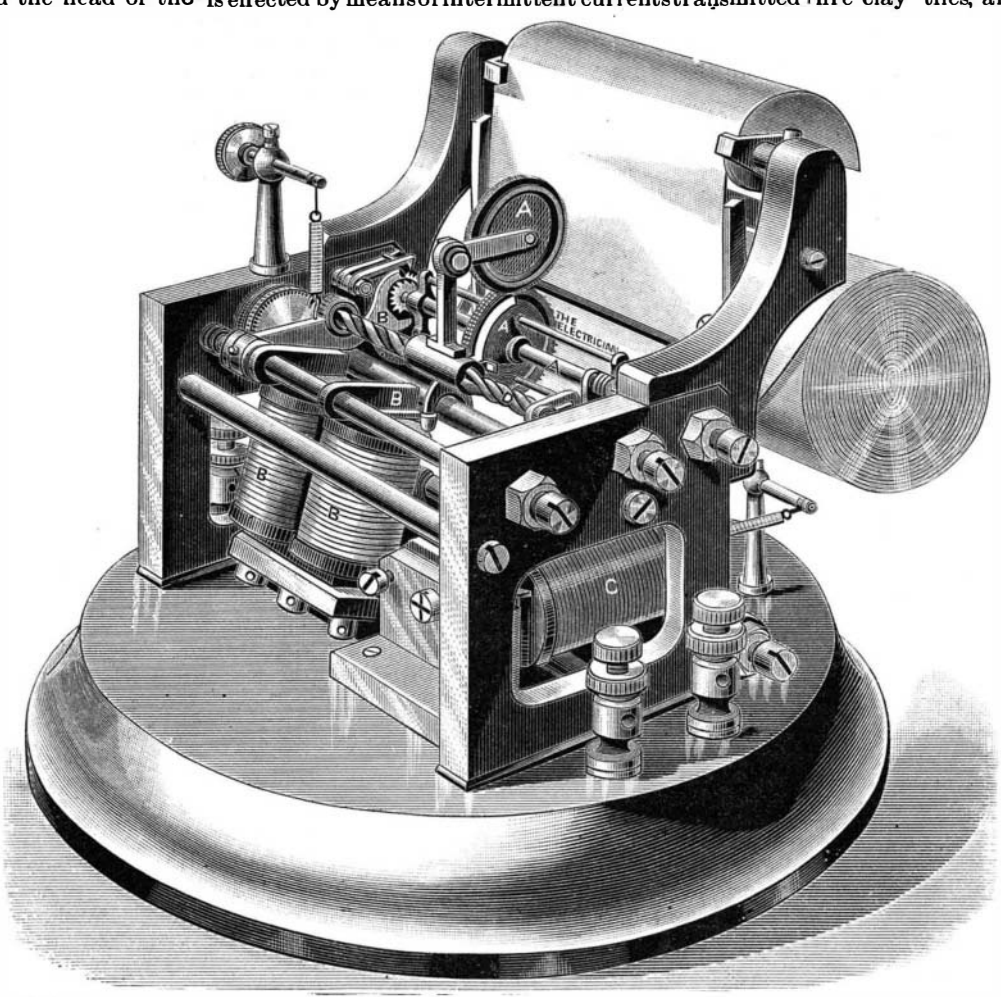
This apparatus, which fulfills the functions of a type writer at any distance from the keyboard, consists of a type wheel, which contains the letters of the alphabet, numerals, and stops. The rotation of the type wheel is effected by means of intermittent currents transmitted from a commutator under the control of a pianoforte keyboard acting on propelment pallets carried by the lever suspended over an electro-magnet. The number of currents transmitted determines the position of the type wheel with respect to the swinging frame, which serves as a guide to the paper, and at the same time as a platen to make the impression. This frame is pivoted at its end, and carries an armature, which is acted upon by an electro-magnet.

The type wheel is automatically traversed horizontally after the printing of each letter, in order to take up a position for the succeeding character until the end of the line is reached, when the operator restores the type wheel to the starting position by pressing the appropriate key. At the time this takes place the paper is advanced sufficiently to space between the lines, and the operator may by making successive contacts rapidly advance the paper as much as may be required, either to commence a fresh subject or to eject sufficient paper to bring the end of the message well into view.

The lateral spacing of the characters is uniform, and is determined by the printing operation. The platen frame, in falling back, rotates a screw which carries the type wheel and ink roller. The spacing between the lines and the return of the type wheel to the starting point are effected at the same time by pressing a key which corresponds to a position on the commutator and the type wheel which is not occupied by a letter. A pin projecting from the type axis at this point causes the intervention of a block which acts as a fulcrum to a lever connected to and worked by the platen, but which only comes into operation to release the type wheel when thus provided with a fulcrum, and consequently only when the act of printing takes place with the type wheel in this position. A spring returns the type wheel to zero.

Synchronizing between the receiving and transmitting apparatus is secured by means of a lever, which is geared to a type axis by friction, and is carried by the revolution of the latter into the path of a projecting pin. Upon a print being made, this lever is reset at its starting point, but should three revolutions of the type wheel be made without a print, the wheel will be arrested at zero. By commencing a message always upon the zero or spacing key of the transmitter, the apparatus will be in unison.

Ink is supplied from an inking wheel in the usual manner.—*The Electrician.*



A A A. Type Wheel Axle and Ink Loller. B B B. Type Propelling Pallet and Armature Magnet. C. Printing Magnet. D. Screw for Returning Type to Zero.

THE ELECTRICAL TYPE WRITER

Making Pig Iron with Gas.

The *American Manufacturer* says that Mr. Jacob T. Wainright, a well known metallurgical engineer of Pittsburg, Pa., has succeeded in making pig iron with natural gas as fuel. His furnace differs from the ordinary blast furnace in this, that, while dispensing with coke, it has overcome the great difficulty noted in connection with other experiments in gas furnaces by a mechanical device for supporting the burden. This device consists of a series of pipes covered with fire clay tiles, and at the same time ventilating the pipes with a current of air. A combustion chamber is also connected with the furnace, which reduces the amount of gas needed to produce the required heat, and also prevents the chilling of the furnace, which has been a great obstacle to the success of other experiments.

In the new furnace the ordinary cupola blower is used, and the gas and air are introduced in a very simple manner into the combustion chamber in a separate pipe. The current for cooling the tubes, already mentioned, is supplied from the same air blast, and from thence may be utilized in the furnace. Ordinary cupolas may be easily altered, so as to do the required work, by adding the combustion chamber and the protected tubes for supporting the burden.

The tests were made at the iron and lead works of William G. Price, on Price Street, where the inventor had the hearty co-operation of the manager, Mr. David Carlin. Mr. Carlin says that the furnace worked rapidly, and that its success is no longer an experiment.

Transfer Paper.

Brackelsberg's multiplying paper consists of sheets of paper, each one supplied with a coloring layer, whose principal element is a violet aniline methyl. An oiled leaf serves as a hard, smooth under layer. Place a sheet of the copy paper on this, then a sheet of writing paper, and write with a hard lead pencil. The back of the writing paper will give a negative of the writing in high color. Wet the copy sheet thoroughly, and from it twenty or more copies can be made, which will not roll nor show a gelatinous coating. Embroidery and compass-sawing patterns are finely rendered in this way.