

ferent conditions than is a displacement boat. For instance, the boat has but little lateral area, and when traveling fast with a beam wind, it is easily blown off its course unless designed to resist the force of the wind.

Another condition realized is when the boat is running at full speed, at which time the downward pressure between the bottom of the boat and the surface of the water is shifted aft toward the stern.

Any slight force acting on the forebody at right angles to the direction of motion of the boat will then easily cause her to steer off.

When the boat is running very slowly, the action is reversed, or the downward pressure between the bottom of the boat and surface of water is shifted forward, which causes the stern to be swung easily when a force is applied. In this boat the rudder is placed on the forward plane, so as to take advantage of the foregoing conditions.

Gliding boats when at speed are practically on the surface, which causes the shaft line to come near the surface.

If the propeller is situated under the aft plane and not far below it, the engine will race as the plane nears the surface.

The cause, apparently, is as follows: The water line at full speed is very short on each plane; therefore the propeller draws a mixture of water and air from under the plane. This mass of water and air, since it has a less density than water, allows the engine to speed up, and the propeller shows very great slip.

By running the propeller a little aft of the stern in deeper water, this trouble is eliminated. Twelve to 14 horse-power is the smallest motor which should be used in a boat of this size to get good results. The weight of the motor should not be greater than 300 to 350 pounds complete. The dimensions of the propeller used on this boat with the 14-horse-power engine are 18 inches diameter and 30 inches pitch. The blades are oval shaped and  $4\frac{1}{2}$  inches wide.

For the benefit of those of our readers who would like to build a fast boat of this type, we print in the current SUPPLEMENT the drawings and full directions furnished by the Messrs. Stearns, who are the first Americans we know of to build a really successful hydroplane glider.

#### A MECHANICAL TOY WHICH DRAWS GEOMETRICAL DESIGNS.

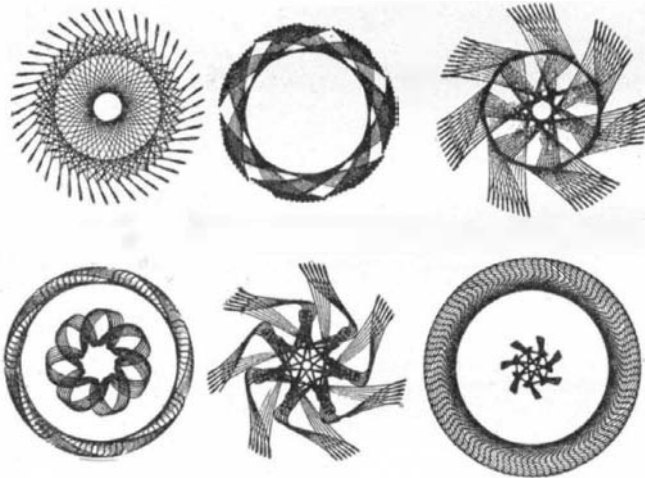
A notable feature of the Advertisers' Show, recently held in Madison Square Garden, was the exhibition of a rose engine or geometric lathe, at work engraving the intricate tracery of geometric curves by which our paper currency is protected against fraudulent imitation. It was interesting to watch this complicated and expensive machine slowly cutting out with absolute perfection a most beautiful pattern, impossible of exact reproduction on any other machine, or even on the same machine, should the combination of gearing by which the design was produced be lost or forgotten.

Turning away from this exhibition with profound respect for the genius who devised this masterpiece of mechanism, the spectator was confronted with a small toy, extremely simple, and almost crude in design, on which patterns fully as intricate as those of the geometrical lathe were traced in ink with wonderful perfection and celerity. A photograph of this toy with facsimiles of some of the work done by it are reproduced herewith. The device resembles, in a measure, the "Cycloid-trope," which was described about twenty years ago in the SCIENTIFIC AMERICAN (Vol. 53, No. 25); but the construction of the "wondergraph," as the new toy is called, is much simpler and it is capable of tracing a greater variety of patterns.

As may be seen in the illustration, the wondergraph comprises three wooden pulleys, about which an endless cord serves as a driving belt. The face of the larger pulley is used as a revolving table over which the pen operates, and is provided with a pair of spring catches that serve to clamp a piece of paper smoothly on the table. The driving pulley is fitted with a small crank handle, by means of which it may be easily turned. The third pulley is carried on an arm which is pivoted to the baseboard, so that the belt may be readily tightened by swinging the arm. A series of holes are formed in the face of this pulley to receive the downwardly-bent end of a rod, whose opposite end rests in one of the notches of a guide rack. The rod carries a pen, the point of which rests on the paper clamped on the revolving table. Now, when the crank is turned the paper is rotated under the pen, and at the same time the pen is oscillated by the small pulley, and this combination of movements results in the drawing of a novel design

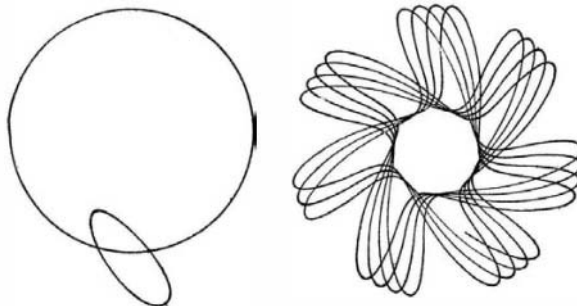
on the paper. The holes in the pen-oscillating pulley are arranged in a spiral series running from the center to the periphery. If the point of the rod is moved from one hole to another, the design will be changed to a very remarkable extent. Further variation is provided by setting the rod in different guide notches in the rack.

The exact curve described by the pen may be observed by holding the table stationary while turning the pen pulley. It will be noticed that the pen traces a loop or ovoid figure, which is the resultant of the revolving motion of the point of the rod and the sliding motion of the rod in the guide rack. In one of our



Some Patterns Produced by the Geometrical Toy, Showing the Wide Scope of Its Work.

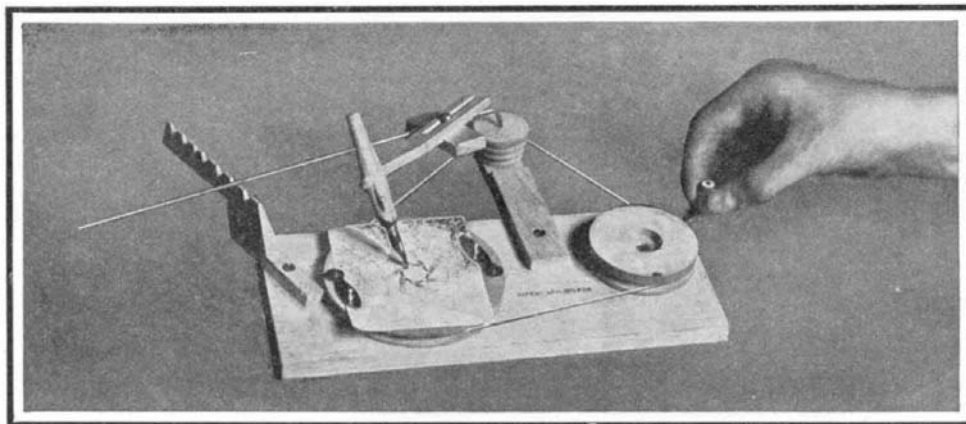
illustrations we show a typical ovoid curve drawn in this manner. The motion of the paper under the pen is, of course, rotary, and is here represented by a circle. Adjacent to this illustration is a pattern drawn with the pen at the same adjustment, but without holding the table stationary, and represents the resultant of the ovoid curve superposed on the revolving circle.



Ovoid Shows Path of Pen. Design Produced by Combination of the Curves. Circle Shows Rotation of Paper.

#### Analysis of a Design.

It will be evident that the size of the pen pulley with relation to that of the table bears an important influence on the form of the design. That is, if the two pulleys are geared three to one, the figure will be a three-sided or three-lobed design. In order to permit varying the character of the figure, the peripheral face of the pen-oscillating pulley is tapered, and is formed with three grooves of different diameters.



A MECHANICAL TOY WHICH DRAWS GEOMETRICAL DESIGNS.

Since the pulley is mounted on a pivoted arm, it may be moved to loosen the belt, and the latter may then be shifted from one groove to another, thus changing the gear or the ratio of rotation between the pulley and the revolving table. The best results are obtained when the diameter of the table is not a perfect multiple of the diameter of the pulley, for then the pen, after describing, say, a seven-lobed figure, will not come back to the starting point, but will continue the design at a slight displacement with respect to the original figure. If the operation is sufficiently prolonged, a continuous circular pattern may be formed, as shown in most of the designs here reproduced. The scope of

the device is increased by providing a means for adjusting the pen to any angle with the rod, or extending it to any desired distance from the rod; and still another variation is afforded by pivoting the guide rack to the baseboard, so that by swinging the rack to various angles the designs may be further modified. It will be evident that the toy, crude as it may seem, embodies sufficient elements to produce a countless number of combinations, and hence it should prove of endless amusement to children, as the changes produced by slight variations of adjustment are kaleidoscopic in character. Furthermore, a toy of this kind is bound to be instructive to any one.

#### The Portland Cement Industry.

In the United States the cement industry has prospered to a degree that would seem to justify indulgence in the alleged American propensity to boast. Taking into consideration the brief period that has elapsed since America was entitled to be called a cement-producing country, the record of the industry stands without a parallel. One has merely to recall the fact that 82,000 barrels of Portland cement comprised the output in 1880, and to be told that the estimate for 1906 has been placed at the enormous total of 42,000,000 barrels or more, to be convinced that the development of the industry in this country has been truly marvelous. Certain it is that both the production and use of cement are constantly increasing, and not solely because of great enterprises like the construction of the Panama Canal, the reclamation of deserts, and the rebuilding of cities, but because there is growing appreciation and understanding of the value of cement. The last has operated to give the cement trade a tremendous impetus in the United States. Not only does America easily take first place among the cement-producing and using countries in the world, but so unprecedented is the demand for cement and so thoroughly established is the industry, that no one can safely predict its future magnitude. A potent factor in all this has been the gradual decline in the cost of manufacture and the selling price as compared with the situation of the early nineties. The wide distribution of the industry has been another important consideration. It has afforded the people generally an opportunity to become familiar with the many virtues of cement and concrete construction, and it is now extensively used in communities in which a barrel of cement would have been a novelty a short time ago.

To reflect upon the development of the past few years is to become convinced that, after all, this country has merely crossed the threshold in the evolution of the cement industry. Cement in factory construction may be said to have fairly begun. In the matter of dwellings and kindred structures the field has scarcely been touched. Granting that there can be no further saving effected in the cost of production, no increased competition in manufacture, and that progress in structural methods is about to cease, even so, under present conditions, the use of cement must increase far beyond the present output.

To sum up the situation briefly, America has first and foremost a large home demand. Cement is sold at a reasonable price within the reach of all classes of consumers, but at a price which allows a fair profit to the manufacturer. The consumption of cement is constantly expanding, but the establishment of new factories precludes the probability of exorbitant prices. Viewed from every standpoint the cement industry in this country appears to be on a substantial and wholesome basis.—Robert W. Lesley in the Engineering and Mining Journal.

#### Platinum \$34 an Ounce.

The year 1905 saw a phenomenal rise in the price of platinum and a greatly increased production in the United States. The annual report of the United States Geological Survey on the production of platinum, prepared this year by Mr. F. W. Horton, contains details of exceptional interest. It shows that early in March, 1905, the price of ingot platinum advanced from \$19.50 an ounce to \$21 an ounce, surpassing gold in value. On April 1, 1905, the price fell to \$20.50 and remained firm at this quotation until February 1, 1906, when it jumped to \$25 an ounce, where it remained until September 1, 1906, when it leaped to the unprecedented value of \$34 an ounce. Mr. Horton's report also shows that the production of platinum in the United States increased from 200 ounces in 1904 to 318 ounces in 1905. This report is published as an advance chapter of the annual volume, "Mineral Resources of the United States, 1905," and is distributed free of charge, on application to the United States Geological Survey.