

# THE BOY MECHANIC

BOOK I

---

700 THINGS FOR BOYS TO DO

---

Extract:  
"How to Make a Wondergraph"  
By F. E. Tuck

---

COPYRIGHTED, 1913, BY H. H. WINDSOR

---

POPULAR MECHANICS PRESS  
CHICAGO



## How to Make a Wondergraph

By F. E. TUCK

An exceedingly interesting machine is the so-called wondergraph. It is easy and cheap to make and will furnish both entertainment and instruction for young and old. It is a drawing machine, and the variety of designs it will produce, all symmetrical and ornamental and some wonderfully complicated, is almost without limit. Fig. 1 represents diagrammatically the machine shown in the sketch. This is the easiest to make and gives fully as great a variety of results as any other.

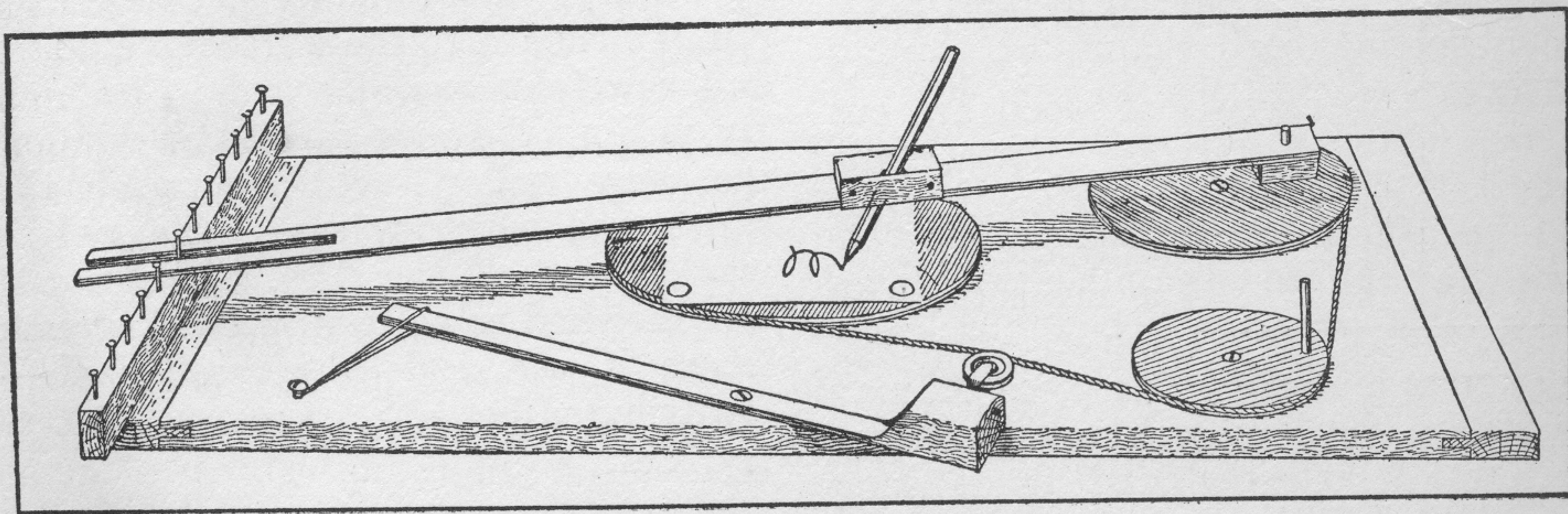
To a piece of wide board or a discarded box bottom, three grooved circular disks are fastened with screws so as to revolve freely about the centers. They may be sawed from pieces of thin board or, better still, three of the plaques so generally used in burnt-wood work may be bought for about 15 cents. Use the largest one for the revolving table T. G is the guide wheel and D the driver with attached handle. Secure a piece of a 36-in. ruler, which can be obtained from any furniture dealer, and nail a small block, about 1 in. thick, to one end and drill a hole through both the ruler and the block, and pivot them by means of a wooden peg to the face of the guide wheel. A fountain pen, or pencil, is placed at P and held securely by rubber bands in

part way into its upper edge. Any one of these nails may be used to hold the other end of the ruler in position, as shown in the sketch. If the wheels are not true, a belt tightener, B, may be attached and held against the belt by a spring or rubber band.

After the apparatus is adjusted so it will run smoothly, fasten a piece of drawing paper to the table with a couple of thumb tacks, adjust the pen so that it rests lightly on the paper and turn the drive wheel. The results will be surprising and delightful. The accompanying designs were made with a very crude combination of pulleys and belts, such as described.

The machine should have a speed that will cause the pen to move over the paper at the same rate as in ordinary writing. The ink should flow freely from the pen as it passes over the paper. A very fine pen may be necessary to prevent the lines from running together.

The dimensions of the wondergraph may vary. The larger designs in the illustration were made on a table, 8 in. in diameter, which was driven by a guide wheel, 6 in. in diameter. The size of the driver has no effect on the form or dimensions of the design, but a change in almost any other part of

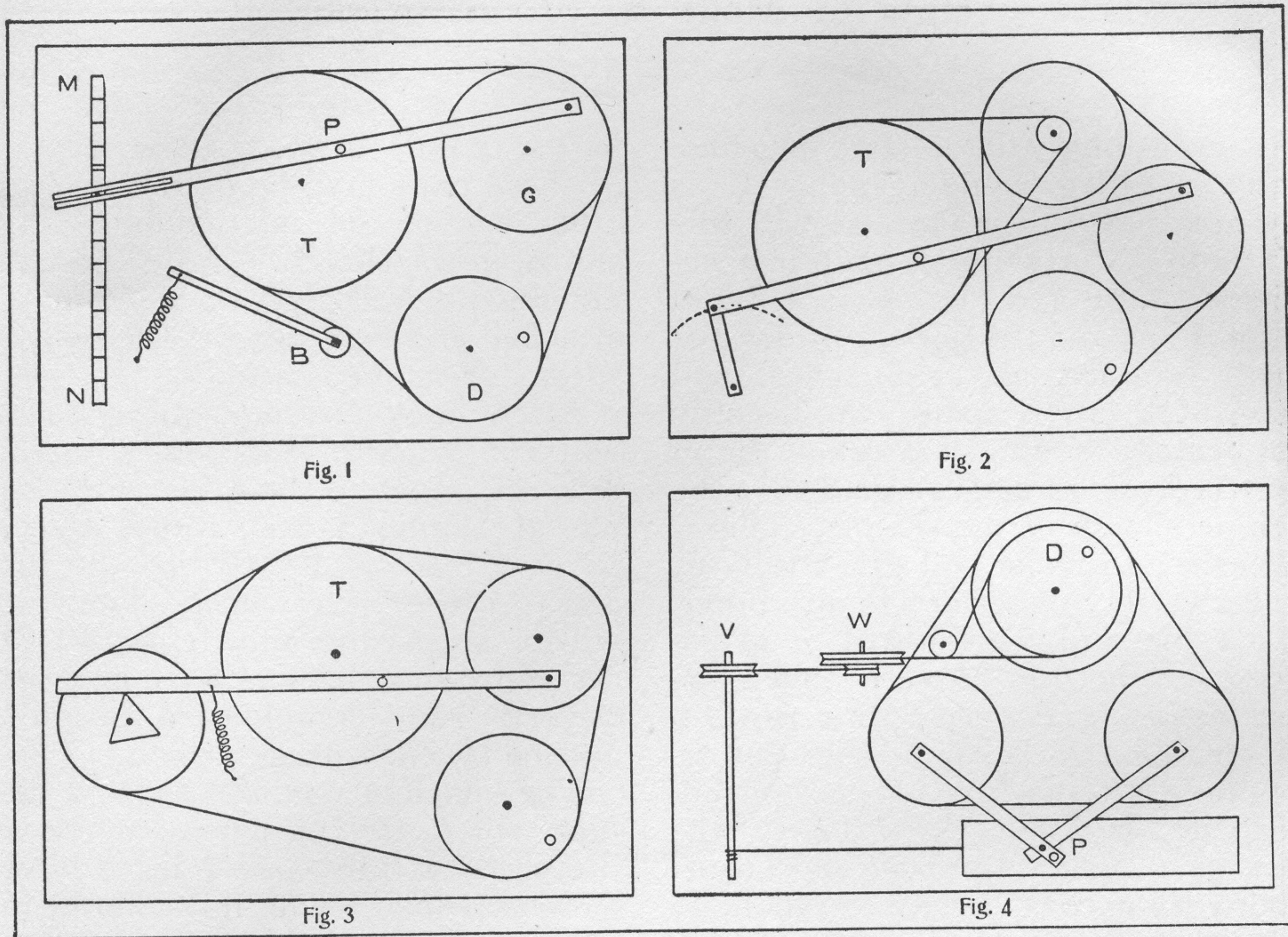


An Easily Made Wondergraph

a grooved block attached to the ruler. A strip of wood, MN, is fastened to one end of the board. This strip is made just high enough to keep the ruler parallel with the face of the table, and a row of small nails are driven

the machine has a marked effect on the results obtained. If the penholder is made so that it may be fastened at various positions along the ruler, and the guide wheel has holes drilled through it at different distances from the center





Diagrams Showing Construction of Wondergraphs

to hold the peg attaching the ruler, these two adjustments, together with the one for changing the other end of the ruler by the rows of nails, will make a very great number of combinations possible. Even a slight change will greatly modify a figure or give an entirely new one. Designs may be changed by simply twisting the belt, thus reversing the direction of the table.

If an arm be fastened to the ruler at right angles to it, containing three or four grooves to hold the pen, still different figures will be obtained. A novel effect is made by fastening two pens to this arm at the same time, one filled with red ink and the other with black ink. The designs will be quite dissimilar and may be one traced over the other or one within the other according to the relative position of the pens.

Again change the size of the guide wheel and note the effect. If the diameter of the table is a multiple of that of the guide wheel, a complete figure of few lobes will result as shown by the one design in the lower right-hand corner of the illustration. With

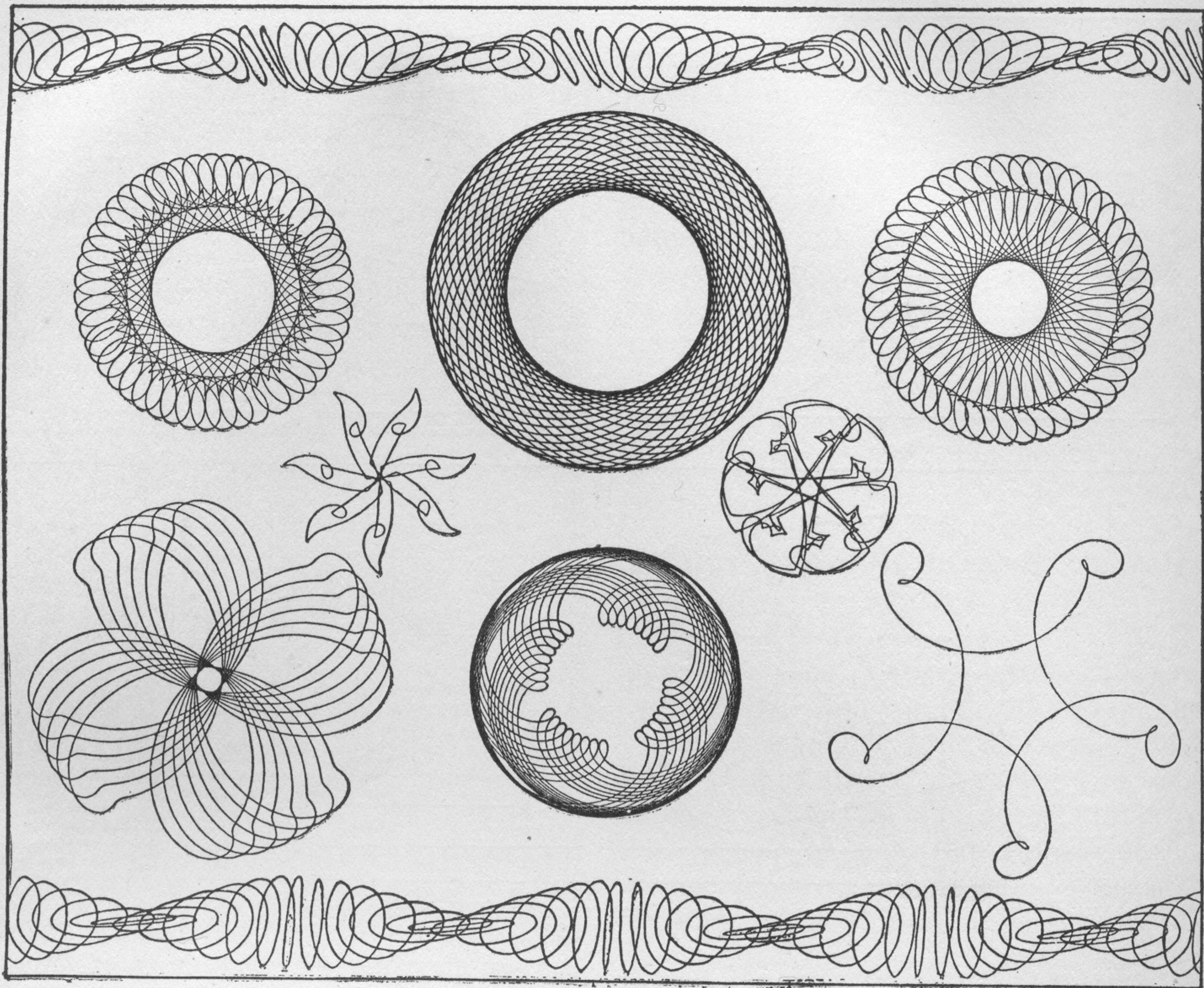
a very flexible belt tightener an elliptical guide wheel may be used. The axis may be taken at one of the foci or at the intersection of the axis of the ellipse.

The most complicated adjustment is to mount the table on the face of another disc, table and disc revolving in opposite directions. It will go through a long series of changes without completing any figure and then will repeat itself. The diameters may be made to vary from the fraction of an inch to as large a diameter as the size of the table permits. The designs given here were originally traced on drawing paper 6 in. square.

Remarkable and complex as are the curves produced in this manner, yet they are but the results obtained by combining simultaneously two simple motions as may be shown in the following manner: Hold the table stationary and the pen will trace an oval. But if the guide wheel is secured in a fixed position and the table is revolved a circle will be the result.

So much for the machine shown in





Specimen Scrolls Made on the Wondergraph

Fig. 1. The number of the modifications of this simple contrivance is limited only by the ingenuity of the maker. Fig. 2 speaks for itself. One end of the ruler is fastened in such a way as to have a to-and-fro motion over the arc of a circle and the speed of the table is geared down by the addition of another wheel with a small pulley attached. This will give many new designs. In Fig. 3 the end of the ruler is held by a rubber band against the edge of a thin triangular piece of wood which is attached to the face of the fourth wheel. By substituting other plain figures for the triangle, or outlining them with small finishing nails, many curious modifications such as are shown by the two smallest designs in the illustrations may be obtained. It is necessary, if symmetrical designs are to be made, that the fourth wheel and the guide wheel have the same diameter.

In Fig. 4, V and W are vertical wheels which may be successfully con-

nected with the double horizontal drive wheel if the pulley between the two has a wide flange and is set at the proper angle. A long strip of paper is given a uniform rectilinear motion as the string attached to it is wound around the axle, V. The pen, P, has a motion compounded of two simultaneous motions at right angles to each other given by the two guide wheels. Designs such as shown as a border at the top and bottom of the illustration are obtained in this way. If the vertical wheels are disconnected and the paper fastened in place the well known Lissajou's curves are obtained. These curves may be traced by various methods, but this arrangement is about the simplest of them all. The design in this case will change as the ratio of the diameters of the two guide wheels are changed.

These are only a few of the many adjustments that are possible. Frequently some new device will give a figure which is apparently like one ob-



tained in some other way, yet, if you will watch the way in which the two are commenced and developed into the complete design you will find they are formed quite differently.

The average boy will take delight in making a wondergraph and in inventing the many improvements that are sure to suggest themselves to him. At all events it will not be time thrown away, for, simple as the contrivance is, it will arouse latent energies which may develop along more useful lines in maturer years.

---

◆ ◆ ◆

### **How to Make a 110-Volt Transformer**

---