Correspondence.

Trans-Neptunian Planets.

To the Editor of the Scientific American:

In these days of large telescopes and modern astronomical methods, it seems strange that no vigorous efforts are being made to discover planets beyond the orbit of Neptune, which is now considered the outermost limit of the solar system. It has been noticed that seven comets have their aphelia at a point that would correspond to the orbit of a planet revolving around the sun at a distance of about 100 astronomical units (9,300,000,000 miles).

Now several have suggested that such a planet exists, and has captured the comets by attraction. This is probable, as Jupiter and others also mark the aphelia of many celestial wanderers. The writer has noticed that a great many comets cluster around a point 50 units out, where a large body might revolve. If the great mathematicians of the day should try to compute orbits from these aphelia, it is doubtful if they could succeed; but if all the observatories that possess celestial cameras should band together and minutely photograph the ecliptic, as is done in asteroid hunting, the bodies might be revealed on their plates. Even if no discoveries were made, the accurate star photographs would almost be worth the time and trouble.

H. P. Lovecraft.

Providence, R. I., July 16, 1906.

Block Signal Systems Should be Automatic.

To the Editor of the Scientific American:

I have read with some interest your editorial commenting upon the joint resolution of Congress instructing the Interstate Commerce Commission to investigate the various safety devices for the prevention of railroad wrecks.

Might I be permitted to suggest that you in common with others have fallen into the error of using the term "block signal system" in a specific sense, whereas the Esch bill introduced in the House of Representatives uses the term generically, distinctly stating in the last paragraph that such term shall be taken to mean any system, whether non-automatic or automatic, that provides a way whereby certain distances may be established between trains.

Any signal system is an absolute preventive of collision if all the parts that go to effect the desired result are in accord, but in all the non-automatic signaling systems, the ingenuity, wakefulness, and watchfulness of man is depended upon, and thus *ipso facto* the whole system is no stronger than its weakest part; some one must see that the batteries are in proper shape, that signals are well oiled; and no matter how dark or stormy the night, the engineer *must* see the signal by the side of the track. So, though these non-automatic systems are a step forward in the right direction, yet expediency would seem to demand that an absolute automatic system be adopted, one that after installation does not depend on any man's watchfulness. This would be the ideal signal system, and would indeed mark an epoch in railroading.

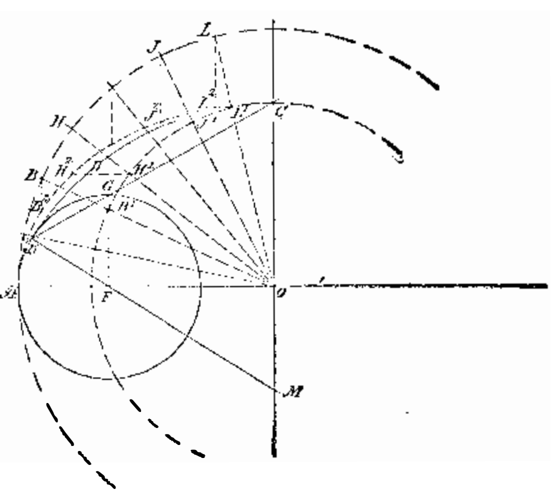
James LeRoy Smith.

Kansas City, Mo., August 9, 1906.

An Argument That the Kuka Ellipse Is Not an Ellipse.

To the Editor of the Scientific American:

In reference to the letter of Mr. M. N. Kuka on "How to Draw an Ellipse," published in your issue of



July 14, I beg leave to say that the figure submitted is not an ellipse at all, but merely a curve composed of the arcs of two pairs of circles.

In his figure he has a curve of constant radius from C to K of MK and from K to B of FK, reference being made to one quadrant only. In the true ellipse, in any one quadrant there are no two points of the curve having the same radius.

I inclose a figure comparing the curve given by Mr. Kuka with the true ellipse, the curve, according to Mr. Kuka's method, being shown by the solid line, $AKDC$, and the true ellipse by the dotted line $AB''H''J''L''C$.

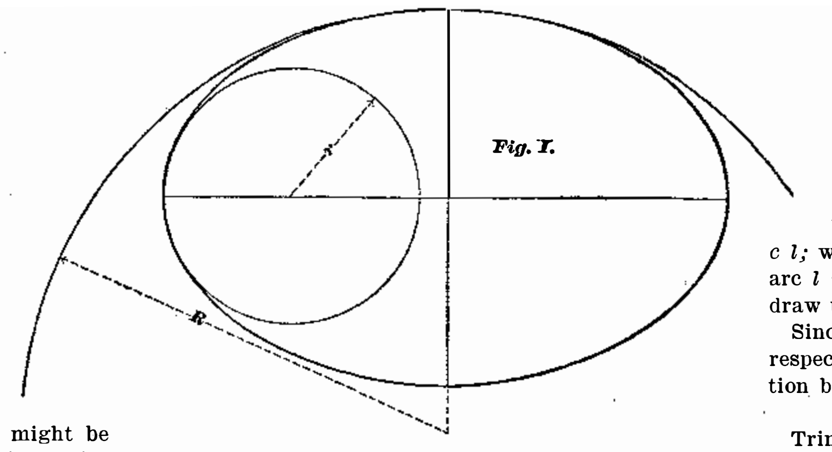
J. F. B.

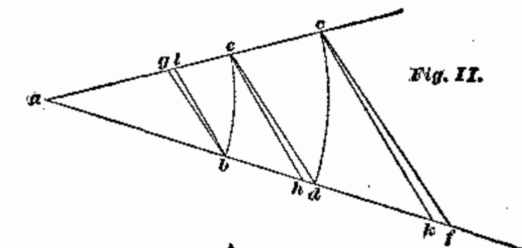
Portsmouth, Va.

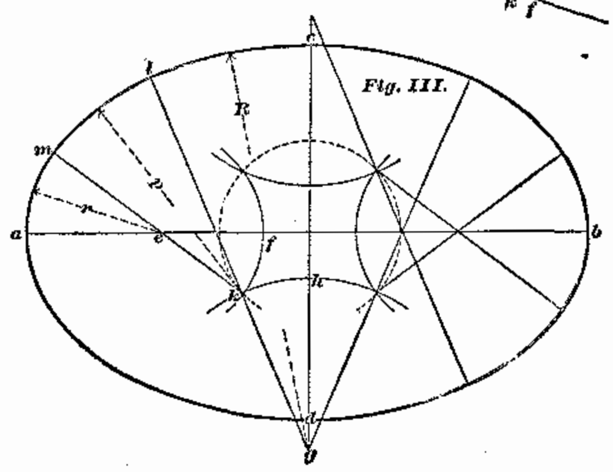
How to Construct an Ellipse: Two Interesting Letters.

To the Editor of the Scientific American:

The article on the construction of an ellipse, published in your columns of July 14, tempts me to call to the attention of your readers a method of drawing the eight-centered oval and ellipse, which method I devised some years ago, and which I have successfully used in classroom work:







THE EIGHT-CENTERED ELLIPSE.

By a careful selection of radii, an eight-centered oval may be drawn which will very nearly coincide with the ellipse constructed on the same axes, and may, within wide limits, be accepted as a representation of it. By this method the use of the curve ruler is avoided, and symmetry with respect to the axes is maintained. The construction given below is the result of an extended series of observations upon eight-centered ovals constructed on axes of various proportions, and a comparison of these curves with the corresponding ellipses.

In drawing an eight-centered oval, three radii are employed. With the shortest radius we describe the two arcs which pass through the vertices of the major axis; with the longest the two arcs which pass through the vertices of the minor axis; and with the third radius the four arcs which connect the former; i. e., the figure is an assemblage of eight arcs of circles.

Fig. 1 represents an ellipse with the osculating circles—or circles of curvature—at the vertices of the minor and major axes. A simple method of determining the radii of curvature is illustrated in Fig. 2. Draw the straight lines af and ac forming any angle at a. With a as a center, and with radii ab and ad respectively equal to the semi-minor and semi-major axes, draw the arcs be and dc. Join ed and through b and c respectively draw bg and cf parallel to ed intersecting ac at g, and af at f; af is the radius of curvature at the vertex of the minor axis; and ag the radius of curvature at the vertex of the major axis.

From the similarity of the triangles acf, aed, and agb, the student will see that this construction is in conformity with a demonstration in the calculus, viz., that the radius of curvature at the vertex of an axis is a third proportional to the semi-axes. With these radii (R and r) the osculating circles in Fig. 1 are described.

One of these circles falls wholly *without* the ellipse, while the other falls wholly *within* the curve. It is evident, then, that in order to represent an ellipse approximately by arcs of circles the longest radius should be less than R, and the shortest radius greater than r.

The following empirical construction gives the best result: Lay off dh (Fig. 2) equal to one-eighth of bd. Join eh, and draw ck and bl parallel to eh. Take ak for the longest radius $(=R)$ al for the shortest radius $(=r)$ and the arithmetical mean, or one-half the sum of the semi-axes, for the third radius $(=p)$ and employ these radii in the well-known construction for the eight-centered oval.

In case the student may not be familiar with this figure it is illustrated. Let ab and cd (Fig. 3) be the major and minor axes. Lay off ae equal to r, and af equal to p; also lay off cg equal to R, and ch equal to p. With g as a center and gh as a radius, draw the arc hk; with the center e and radius eg draw the arc fk intersecting the former at k. Draw the line gk and produce it, making gl equal to R. Draw ke and produce it, making km equal to p. With the center g and radius gc $(=R)$ draw the arc cl; with the center k and radius kl $(=p)$ draw the arc lm; and with the center e and radius em $(=r)$ draw the arc ma.

Since the remainder of the work is symmetrical with respect to the axes, the student will need no explanation beyond that which is afforded by the drawing.

Frederic R. Honey.

Trinity College, Hartford, Conn.

To the Editor of the Scientific American:

I noticed in the issue of July 14 an article written by M. N. Kuka on how to construct an ellipse. He requests the readers of your paper to endeavor to find a proof for its being an ellipse. I was unable to do this, but I think that I have established the contrary fact—that it is not an ellipse.

Referring to Mr. Kuka's first figure, let $OB=a$, and $OC=b$. There can be only one ellipse having the axes AB and CD. Its equation is: $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$. The equation of the circle having its center at the point F and a radius FB is: $4(x-a+\tfrac{1}{2}b)^2+4y^2=b^2$.

According to Mr. Kuka's construction, all points on the arc BK of this circle lie also on the ellipse having the axes AB and CD.

In order to obtain the co-ordinates of the points common to the ellipse and the circle, their equations must be solved simultaneously.

In this way it is found that the circle and the ellipse have only two points in common at the very most. The abscissa of the first point is a, and its ordinate is O; the abscissa of the second point is:

$$\frac{a(a^2-ab+b^2)}{(a^2-b^2)}$$

and its ordinate is:

$$\frac{b}{(a^2-b^2)}\sqrt{(a^2-b^2)^2-(a^2-ab+b^2)^2}$$

Sometimes this second point is imaginary, according to the values of a and b.

Thus it is seen that the circle and the ellipse cannot possibly have more than two points in common, whereas in Mr. Kuka's figure the entire arc BK is common to both. This shows that his figure is not an ellipse, although it looks very much like one.

K is one of the points of intersection of the circle with the line CG. It can be proven that the point K does not lie upon the ellipse unless: $a^6-6a^5b+14a^4b^2-18a^3b^3+14a^2b^4-6ab^5+b^6=O$.

It is also very doubtful whether $MK=CM$, although I have not investigated that.

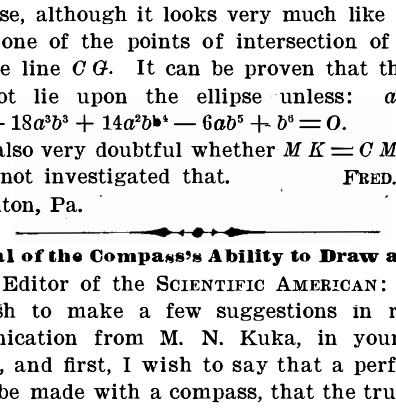
Fred. Eaton.

Scranton, Pa.

A Denial of the Compass's Ability to Draw an Ellipse.

To the Editor of the Scientific American:

I wish to make a few suggestions in reply to a communication from M. N. Kuka, in your issue of July 14, and first, I wish to say that a perfect ellipse cannot be made with a compass, that the true and perfect figure must decrease in curve from the center of the end to the center of the side; in the examples he gives, two-thirds are of the same curve. A perfect el-



lipse can be made by the instrument called the ellipsograph, and by the "string," also by the following process: Square the length and width you desire your ellipse to be. Divide the sides and ends in thirteen equal parts, and draw lines as in the figure. By this process a perfect ellipse may be obtained of any size and shape.

J. B. G.

Brooklyn.