(No Model.)

C. H. KOYL.

SEMAPHORE SIGNAL FOR RAILWAYS.

No. 410,598. Patented Sept. 10, 1889.

Fig. 1

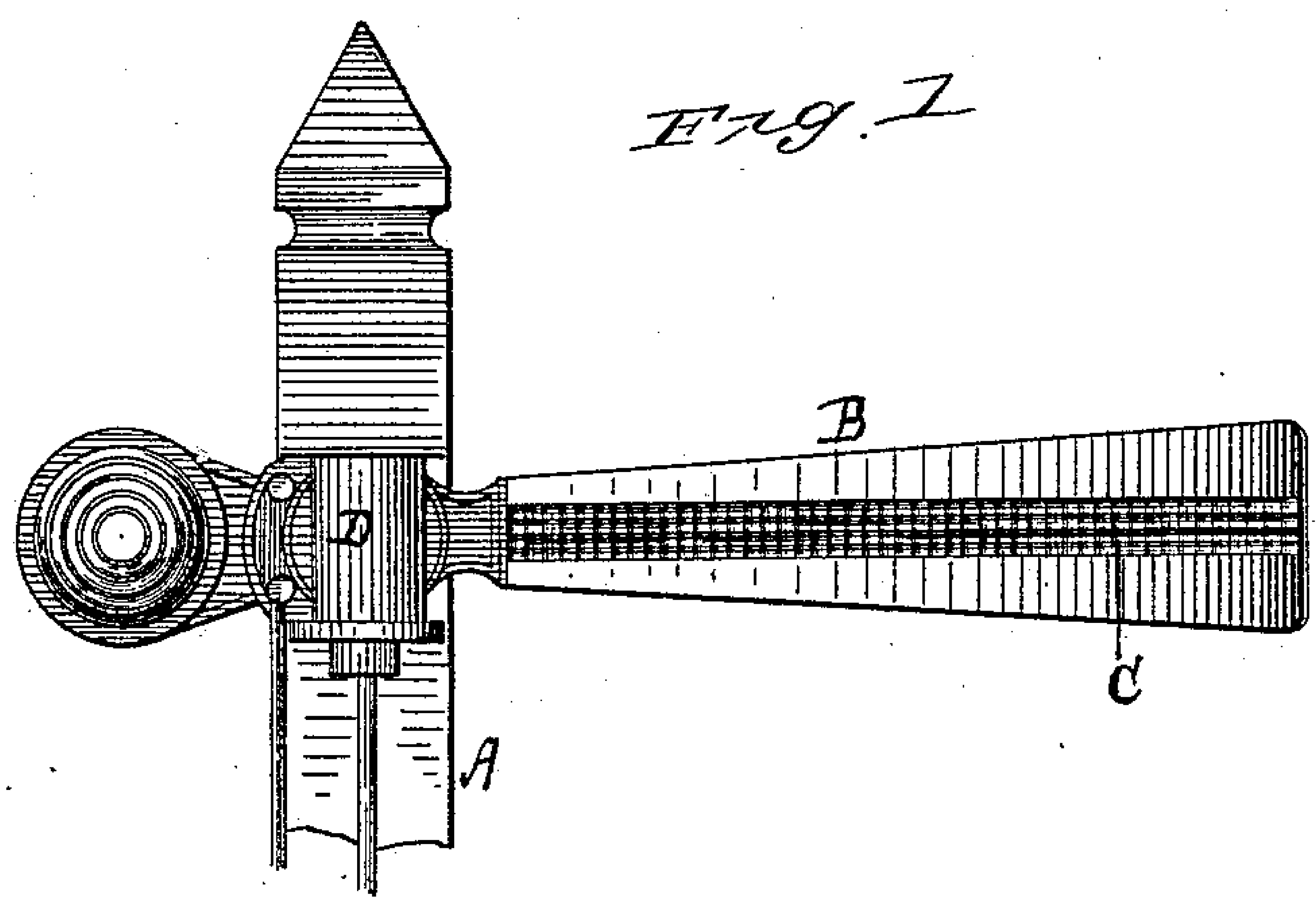
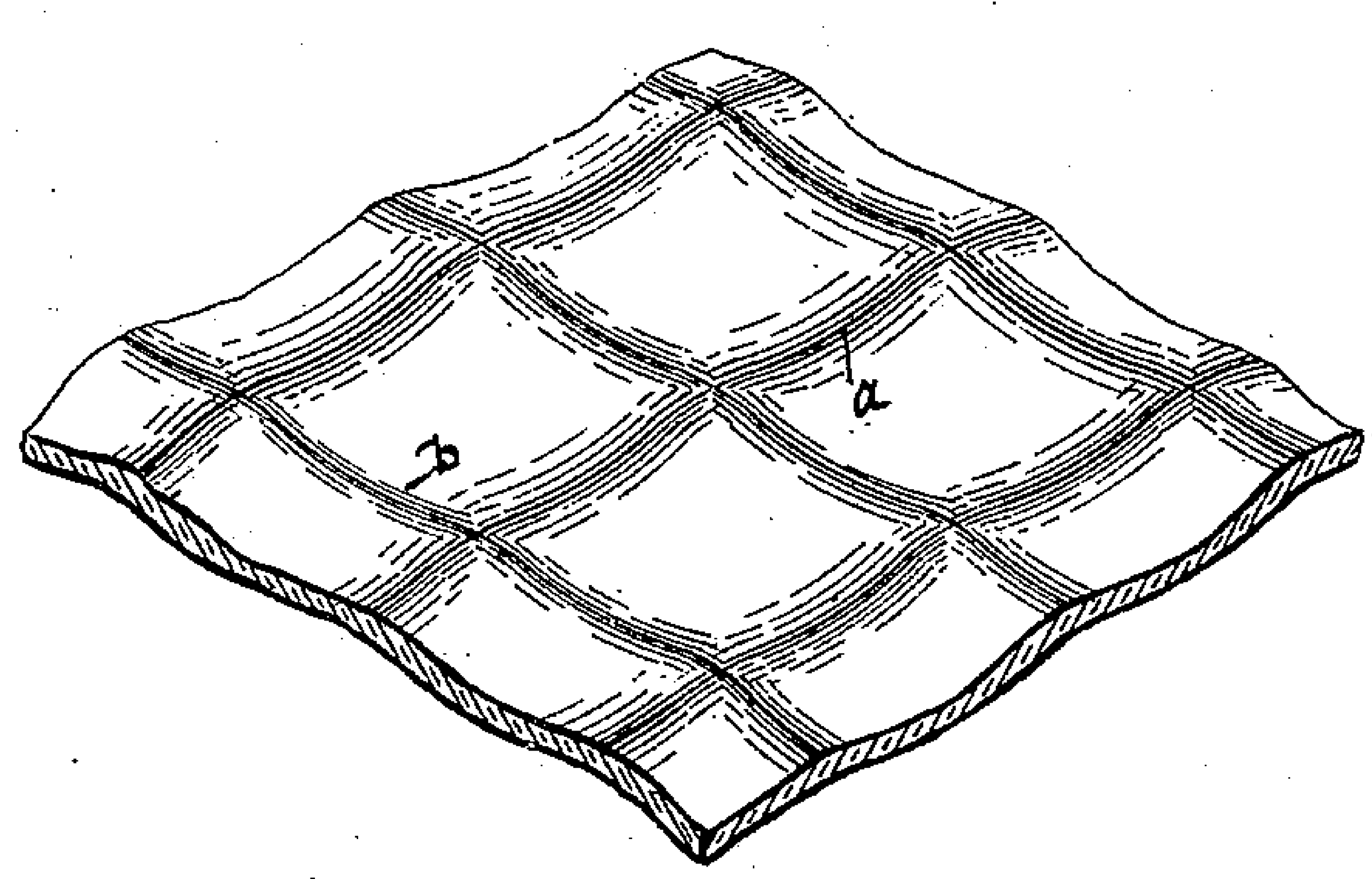



Fig. 2.

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CHARLES HERSCHEL KOYL, OF PHILADELPHIA, ASSIGNOR TO THE NATIONAL SWITCH AND SIGNAL COMPANY, OF BETHLEHEM, PENNSYLVANIA.

## SEMAPHORE-SIGNAL FOR RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 410,598, dated September 10, 1889.

Application filed June 6, 1889. Serial No. 313,336. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES HERSCHEL KOYL, of Philadelphia, in the State of Pennsylvania, have invented a new and useful Improvement in Semaphore-Signals for Railway and other Uses, of which the following is a specification.

In Letters Patent of the United States No. 384,170, granted to me June 5, 1888, I have described and illustrated a signaling apparatus comprising, essentially, a reflector having the shape of the segment of a paraboloid rotatable about an axis coincident with the axis of the paraboloid of which the reflector is a segment, and a lamp or other source of light located at the focal point of the said paraboloidal reflecting-segment.

My present invention is an improvement upon this signaling apparatus, and has particular relation to the reflecting-surface.

When the parabolic reflector is of plane glass, the reflected rays of light are almost absolutely parallel, and can be seen only on a straight track—that is to say, a track which is in the line of these parallel rays; but for railroad uses the signal oftentimes is so placed that it is approached around a curve, so that if, for example, the signal is placed at one end of a curve it would not (if made of plane glass, as above supposed) be visible to an approaching train at the other end of a curve, although, obviously, in many instances it is indispensable that it should be thus visible. It becomes necessary, therefore, to diverge sufficient light to meet the requirements of such cases, and to obtain this effect in the best practicable way without detracting from the other advantages attending the use of my patented parabolic reflector is the object of my present improvement. This result I accomplish by retaining the general form of the reflector—that is to say, by still giving it the general shape or contour of the segment of a paraboloid, and in addition to this by corrugating the reflecting-surface of this paraboloidal segment very slightly at right angles to the direction or directions in which the divergence is required. For example, to diverge light laterally sixteen degrees from the direction of the axis of the paraboloid would require the reflecting-surface or series of reflecting-surfaces to make an angle of eight degrees with the parabola. This can be attained for both directions from the axis and for any intermediate degree of divergence by a corrugated or wave surface, (the corrugations being at blending intervals apart, or, in other words, being placed so near together that when the signal is viewed from a distance the rays reflected from the separate corrugations or waves will blend into one line of light,) in which, if the wave length be, say, three-eighths of an inch, (which is a good blending interval,) the amplitude should be, say, $\frac{3}{8}$ in. $\times \frac{1-\cos 8^\circ}{4 \sin 8^\circ} = .006+$ of an inch approximately. These figures, of course, are not absolutely inflexible. The amplitude of the wave or corrugation for the assumed angle of divergence (sixteen degrees) may vary from that stated within small limits, and for an increased angle of divergence the proportion will vary. From the foregoing formula, however, it will be easy to calculate and determine the proportions for any given angle of divergence and wave length. Thus by forming the surface of the paraboloidal reflecting-segment with waves or corrugations at right angles with the length of the section we obtain lateral divergence of rays—that is to say, divergence in the direction of the length of the segment. By forming that surface with waves or corrugations parallel with the length of said segment we obtain divergence of rays in the direction of the width of the segment, and by impressing both sets of waves or corrugations upon the reflecting-surface divergence of rays in both directions is obtained, and all this without materially interfering with or detracting from the capacity of the reflector, as provided in my aforesaid Letters Patent.

Either set of corrugations may be used to the exclusion of the other; but I prefer to impress upon the surface of the paraboloidal segment both sets of corrugations, for the reason that the set of corrugations which will produce lateral divergence when the semaphore-arm is raised to the horizontal will produce vertical divergence when the arm is dropped; but as it is just as desirable that the engineer should see the signal in its "safety" position as in its "danger" position, and as lateral divergence of the rays may be needed for this purpose, then by impressing upon the reflecting-surface of the paraboloidal semaphore-arm two sets of corrugations at right angles with each other, it follows that if the one set will effect lateral divergence when the arm is horizontal the other set will effect the needed lateral divergence when the arm is dropped.

In the accompanying drawings, Figure 1 is a front elevation of a signal embodying my improvement. Fig. 2 is a perspective view, on an enlarged scale, of a portion of the reflecting-surface, showing the corrugations or waves thereon.

In the drawings, A is the support or standard. B is the semaphore-arm having the reflecting-surface C, (usually glass with a silvered back,) formed as a segment of a paraboloid, said arm being pivoted upon an axis coincident with the axis of the said paraboloid; and D is the lamp or other source of light located at the focal point, all as in my aforesaid Letters Patent. Two sets of corrugations impressed upon the glass or reflecting-surface are indicated at *a* and *b*.

The result of impressing the two sets of corrugations upon the paraboloidal reflecting-surface of the semaphore-arm is, that the reflected light is diverged practically in all directions, while at the same time, inasmuch as the general contour of the paraboloidal segment is retained, the improved effect due to that form is unimpaired. I thus obtain a semaphore which is brilliantly illuminated, whether horizontal or dropped, and which can be equally well seen, whether it be approached on a straight or on a curved track. In fact, the general effect of the semaphore is materially improved. Experience has shown that when the reflecting-surface is plain the amount of light reflected down the track is so great as to be dazzling; but by giving the paraboloidal segment-reflector a double wave surface, as described, the light is less concentrated and is spread out over a much greater area, while at the same time the illuminated semaphore is still bright enough to be distinctly seen in ordinary weather at the distance of a mile.

What I claim, and desire to secure by Letters Patent, is—

1. In a signaling apparatus of the kind hereinbefore referred to, a reflector the surface of which has the shape or approximately the shape of the segment of a paraboloid and is corrugated, as described, said reflector being rotatable about an axis coincident with the axis of the paraboloid of which it is a segment, substantially as and for the purposes set forth.

2. In a signaling apparatus of the kind hereinbefore referred to, a reflector the surface of which has the shape or approximately the shape of the segment of a paraboloid and is impressed with two sets of corrugations or waves at right angles to each other, substantially as and for the purposes set forth.

In testimony whereof I have hereunto set my hand this 6th day of June, 1889.

CHARLES HERSCHEL KOYL.

Witnesses:

EWELL A. DICK,
E. D. SMITH.