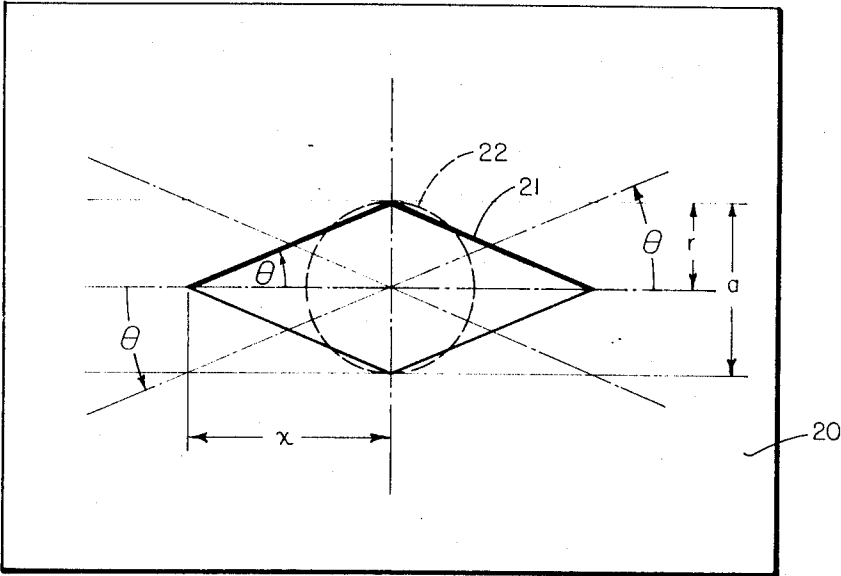


[54] SCANNING APERTURE  
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[73] Assignee: Identicon Corporation, Waltham, Mass.  
[22] Filed: July 9, 1970  
[21] Appl. No.: 53,499  
[52] U.S. Cl. ....235/61.11 E, 250/219 D  
[51] Int. Cl. ....G06r 7/10  
[58] Field of Search.....340/146.3, 146.3 K; 250/233, 250/219 D, 219 DC; 235/61.11 F

[56] References Cited  
UNITED STATES PATENTS  
3,243,776 3/1966 Abbott, Jr. et al.....340/146.3  
3,351,765 11/1967 Malone et al.....250/219 D  
Primary Examiner—Thomas A. Robinson  
Attorney—Charles Hieken

[57] ABSTRACT  
An optical label scanning system has a parallelogram-shaped aperture for scanning.

2 Claims, 2 Drawing Figures



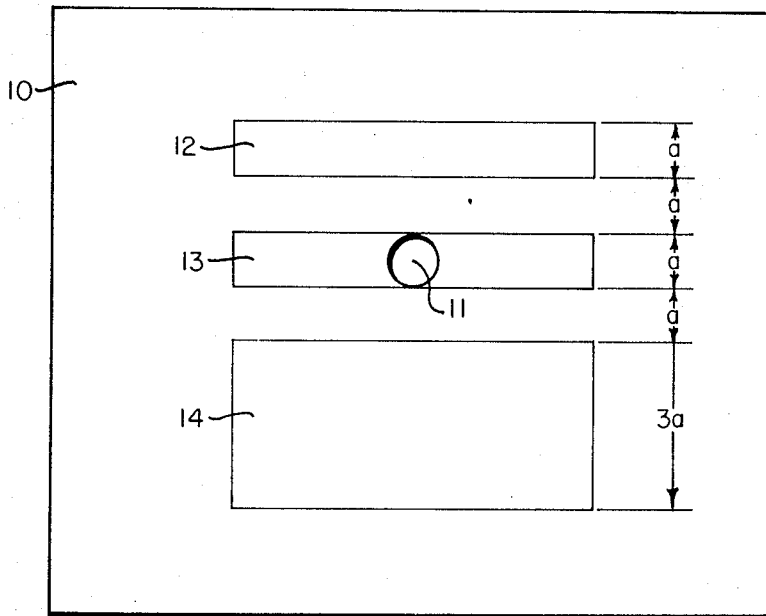


**FIG. 1**

PRIOR ART

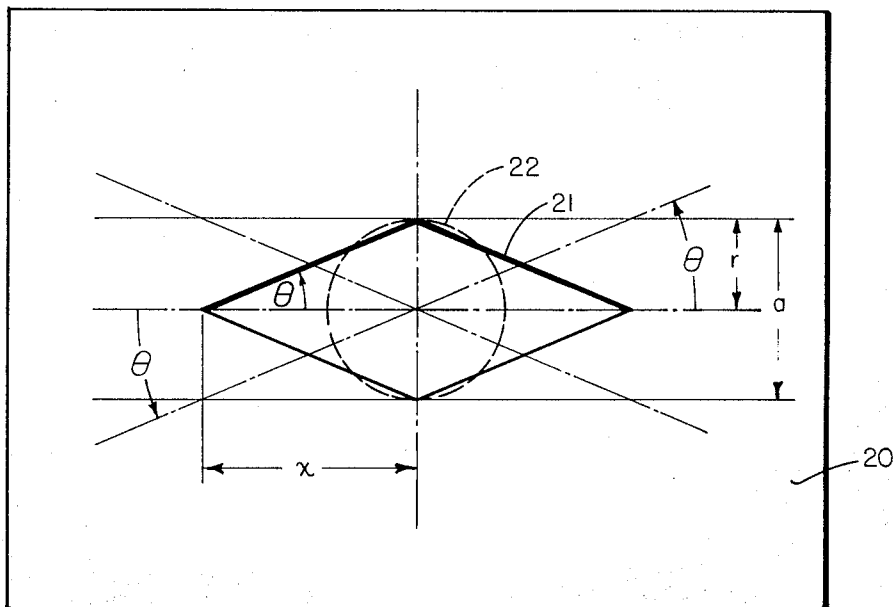


**FIG. 2**

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## SCANNING APERTURE

## BACKGROUND OF THE INVENTION

The present invention relates in general to scanning apertures and more particularly concerns a novel scanning aperture especially useful in scanning labels and coding information in a vertical array of horizontal bars to provide maximum coverage without bar-to-bar overlap while achieving a significant improvement in signal-to-noise ratio. Yet the structure is relatively easy and inexpensive to fabricate.

A typical prior art scanning aperture is a circle having a diameter chosen to provide maximum coverage without bar-to-bar overlap. For example, if the narrowest bar is of width  $a$  and the separation between bars is also of width  $a$ , the diameter of a typical circular aperture is also  $a$ .

It is an important object of this invention to provide an optical scanning system having an improved scanning aperture.

It is another object of the invention to achieve the preceding object while increasing signal-to-noise ratio.

It is a further object of the invention to achieve one or more of the preceding objects with essentially no increase in cost.

## SUMMARY OF THE INVENTION

According to the invention, means define a generally parallelogram-shaped aperture.

Numerous other features, objects and advantages of the invention will become apparent from the following specification when read in connection with the accompanying drawing in which:

## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a diagrammatic view of the image of label stripes super-imposed upon a mask having a circular aperture according to the prior art; and

FIG. 2 is a plan view of a mask according to the invention having a parallelogram-shaped aperture with the outline of a circular aperture superimposed by broken lines to illustrate the increased aperture area available with a parallelogram-shaped aperture while still retaining wide latitude for angular disorientation.

## DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

With reference now to the drawing and more particularly FIG. 1 thereof, there is shown a mask 10 formed with a circular aperture 11 of diameter  $a$  corresponding to the width of the narrow stripes and the separation  $a$  therebetween with the image of narrow stripes 12 and 13 and broad stripe 14 superimposed upon mask 10.

Referring to FIG. 2, there is shown a mask 20 formed with a parallelogram-shaped aperture 21 with a circle designated by the broken lines 22 to facilitate comparison between the two openings. The parallelogram-shaped aperture 21 has a height  $x$  corresponding to the diameter  $a$  of circle 22, this height being the minor diagonal of the parallelogram illustrated. The major diagonal is perpendicular to the scanning direction. The sides are parallel to the maximum axes of rotation and form an angle of  $\theta$ . The area of the parallelogram may be larger, equal to or less than the circle 22 of

diameter corresponding to the height of the parallelogram, depending upon the value of  $\theta$ .

It can be shown that a parallelogram-shaped aperture will scan a larger portion of each bar than a circular aperture without bar-to-bar overlap by increasing its area without sacrificing resolution and still providing good latitude for angular misorientation of the label.

The critical value of  $\theta$  where the areas of parallelogram and circle of the same height are equal may be derived as follows:

$$2rx = \pi r^2.$$

$$x = \pi r/2.$$

$$\theta = \tan^{-1}(r/x) = \tan^{-1}(r/\pi r/2) = \tan^{-1}(2/\pi) = 32.5^\circ.$$

Thus, for allowable misalignment angles of less than  $32.5^\circ$  from the horizontal, a parallelogram-shaped aperture according to the invention will scan a larger portion of each bar than a circular aperture without bar-to-bar overlap. At the same time it will allow considerably more latitude in angular misalignment of the bars than a horizontal slit aperture.

The particular scanning system in which the mask is used is known in the art and not described herein so as not to obscure the principles of the invention. For a description of a suitable scanning system, reference is made to U.S. Pat. No. 3,225,177 entitled MARK SENSING granted Dec. 21, 1965, to Stites et al. A mask according to the invention would be substituted for the mask 50 with a slit aperture there shown.

There has been described novel apparatus and techniques for developing a significant improvement in signal-to-noise ratio while still retaining acceptably wide latitude in optical misalignment of stripes being scanned. For example, the increase in scanning area over a circular aperture is of the order of 75 percent for  $\theta=20^\circ$ . Since the noise is frequently limited by the type of detector rather than non-bar return and signal strength is directly proportional to aperture area, a significant signal-to-noise ratio improvement is realizable through the use of a parallelogram-shaped aperture according to the invention.

It is evident that those skilled in the art may now make numerous uses and modifications of and departures from the specific embodiments and techniques disclosed herein without departing from the inventive concepts. Consequently, the invention is to be construed as embracing each and every novel feature and novel combination of features present in or possessed by the apparatus and techniques herein disclosed.

What is claimed is:

1. In an optical scanning system for scanning stripes having lengths and widths normally respectively perpendicular and parallel to the scanning direction and separated by a separation  $a$ , said system having masking means formed with an aperture for restricting the cross sectional area of light rays that may impinge upon a photo-detector masked by said masking means, the improvement comprising, means defining an aperture in said mask that is parallelogram-shaped with the major diagonal thereof perpendicular to said scanning direction and the minor diagonal corresponding to said separation  $a$  between stripes, said aperture defining an area

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greater than that of a circle having diameter a, whereby said apparatus scans through said aperture a larger portion of each bar than a circular aperture of the same area without bar-to-bar overlap while allowing considerably more latitude in angular misalignment of the bars than a horizontal

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slit aperture.  
2. The improvement according to claim 1 wherein the angle subtended by the minor diagonal is less than substantially 65°.

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