

1,374,965.

Patented Apr. 19, 1921.

3 SHEETS—SHEET 1.

Fig. 1

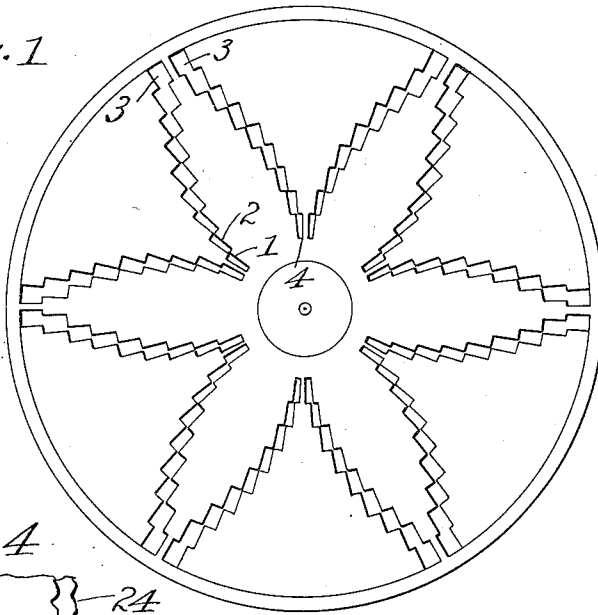


Fig. 4

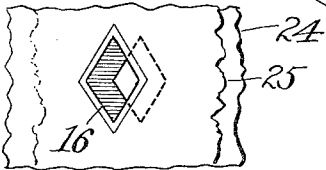


Fig. 2

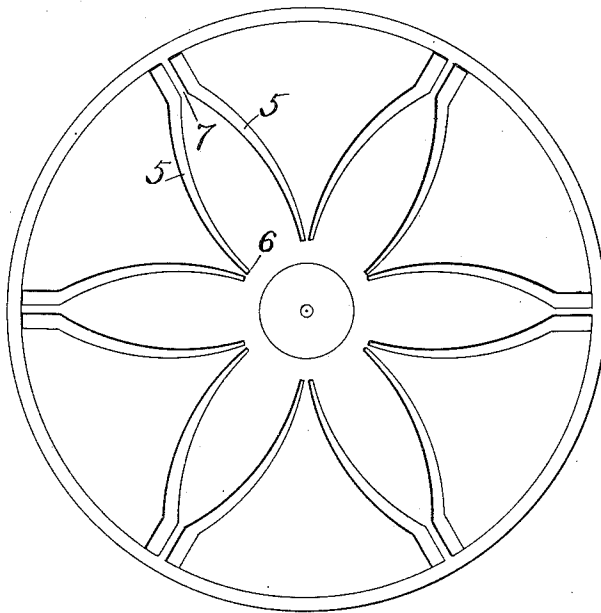
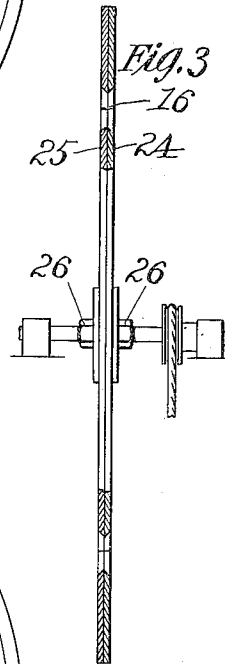


Fig. 3

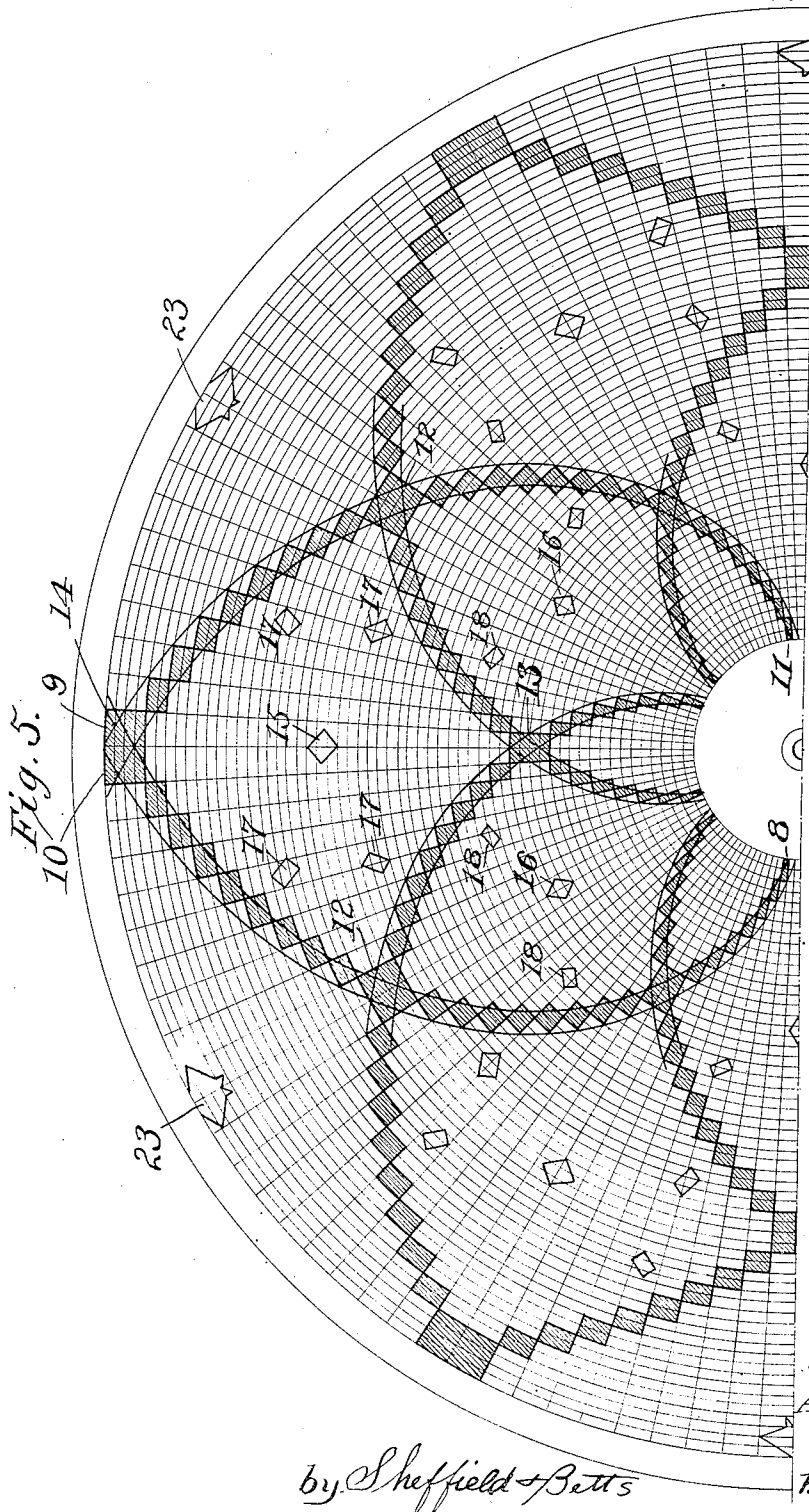


Inventor
Alfred O. Tate
By his Attorneys
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3 SHEETS—SHEET 2.



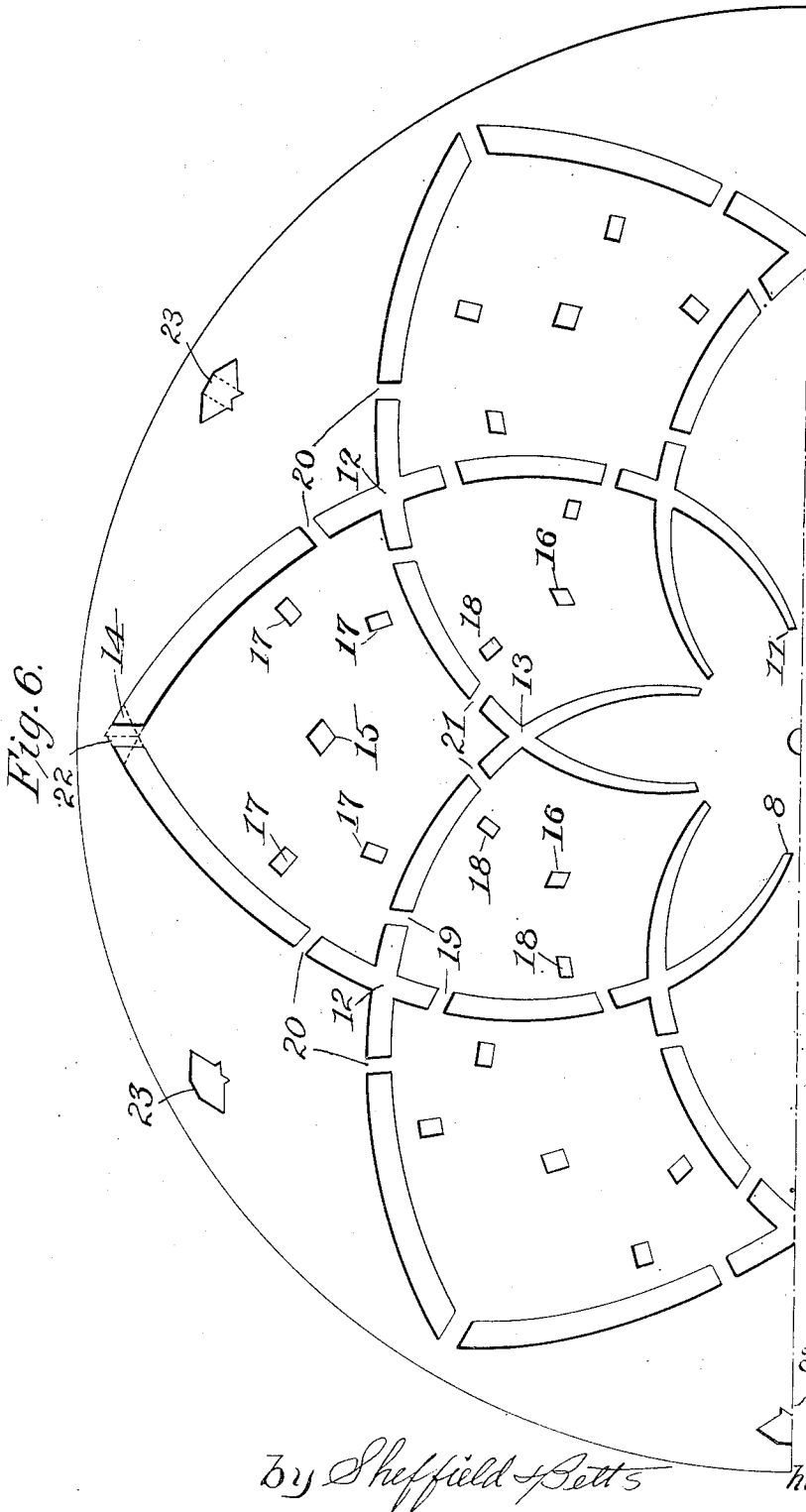
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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

ALFRED O. TATE, OF NEW YORK, N. Y.

APPARATUS FOR TREATING LIGHT AND SIMILAR RAYS.

1,374,965.

Specification of Letters Patent.

Patented Apr. 19, 1921.

Application filed January 24, 1920. Serial No. 353,902.

To all whom it may concern:

Be it known that I, ALFRED O. TATE, a subject of the King of Great Britain, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Apparatus for Treating Light and Similar Rays, of which the following is a full, clear, and complete description.

Briefly stated, my invention relates to rotary disks having therein openings arranged in certain predetermined forms or having certain stripes or figures painted or otherwise applied thereto in similar forms. These disks are for use either in cutting off or reducing the number of light, heat or other rays which reach the eye from a particular object being viewed therethrough, or in the case of the figures of contrasting colors being applied to the surface of the disk, for blending or mixing certain proportions of such colors to ascertain the resulting shades or tones.

One object of my invention is to provide such a rotating disk with openings arranged along such lines or paths as shall produce wave-like or undulating transmission of the light extending from the center of the disk toward its circumference and vice versa.

A further object of my invention is to design such openings so that the percentage of the light admitted through or blended by the disk shall be uniform over the entire surface of the disk, and at the same time shall produce the undulatory effect above referred to.

A further object of my invention is to produce a rotary disk having openings therein which may be covered with transparent material through which different colors of light may be admitted, or having respective colors painted on or otherwise applied to the surface of the disk and arranged in designs similar to those in which the openings are arranged, for the purpose of blending such colors.

A further object of my invention is to provide such disks with openings which may be varied in effective area so that the amount of light admitted through the disks may be adjusted without entirely remaking or redesigning the same.

For a detailed description of several

forms of my invention reference may be had to the following specification and to the accompanying drawing forming a part thereof, in which—

Figure 1 shows the surface of one of my improved disks provided with approximately rectangular openings or figures and indicating the manner in which the final form of the stripes or slots is arrived at;

Fig. 2 is a similar view showing one form of the disk having its openings or radial stripes arranged as when completed;

Fig. 3 is an edge view, partly in section, of two disks mounted upon a shaft for rotating the same;

Fig. 4 is an elevation of a portion of two superposed disks, showing the effect of adjusting one disk relative to the other to vary the amount of light admitted therethrough.

Fig. 5 is a view of one half of one of the disks showing the method of plotting or laying out the curves which form the slots or stripes formed in or on the surface; and

Fig. 6 is a similar view showing one half of one of the completed disks having its slots or stripes arranged in the manner which I at present deem preferable.

It will be appreciated that heretofore in the art relating to optical devices, including such a device as kinetoscopes which were the predecessors of the present so-called cinematographs or moving picture cameras, rotary cylinders or disks were provided with axial or radial slots, respectively, through which successive figures on the opposite sides of the disks or cylinders were viewed as the same were rotated, thereby producing the effect of motion. In the case of the use of a disk with radial sectorial slots through which the figures were seen, the slots caused the figures or other objects to be viewed successively by discontinuous and entirely separated groups of rays or bursts of light, since the entire length of the slot passed the particular vertical or horizontal portion of the object at one and the same instant. These bursts or flashes of light were very tiring to one's eyes and affected the optic nerves, causing a sensation of fatigue and weakness. To obviate this, and to distribute the transmission of the light so that the same is practically continuous at every point of the disk in successive sectors, I have designed the

openings so that they may be arranged in such a manner as to give an undulating effect to the light rays, approximating the sinusoidal vibration of light or sound itself.

5 Referring now to Fig. 5, it will be noted that the entire surface of the disk is divided up by radial lines into small sectors and by parallel circles into narrow zones which form small figures by intersection with the
10 radial lines, there figures being approximately rectangular.

Referring now to Fig. 1, the approximate rectangles therein shown were formed by dividing the circle into 108 radial lines and
15 10 equally spaced circles. Starting at any given rectangle formed between two of the 108 radial lines which are nearest the center of the disk, such as indicated by 1, the next adjacent rectangle above and at one side
20 thereof, indicated by 2, is selected for the next opening or area and so on successively until the outer circle of the disk at 3 is reached, from which point the same method is pursued inward toward the center or inner
25 circle terminating at the point 4. This is continued until the point of starting is reached, and will form a design having six lobes or six pairs of reversely curved series of adjacent, approximately rectangular figures, spots or openings. The slight overlapping of the inner and outer rectangles is necessary on account of the fact that should these openings be cut in a disk, there must
30 be a narrow strip to hold the free ends of the intervening material in position such as is necessary in making stencils.

Now, the arrangement just described, where the openings are in the form of approximate rectangles, tends to produce, when
40 the disk is rotated, a series of circular dark spaces or lines where the outer and inner ends of the adjacent openings come into alignment. To obviate this, I do away with the zigzag edges of these openings and make
45 them curved and continuous, but retain the same progressive radial increase in size, thereby forming slots or stripes of gradually increasing width. This results in the construction illustrated in Fig. 2. The inner
50 ends of the stripes 5 start at the same relative positions at 6, as illustrated in Fig. 1 at 1, and continue outward between curved lines until the point 7 is reached, where the lines become substantially radial. This is
55 for the purpose above referred to, of forming a radial support 7 between the two slots where they would otherwise meet. It will now be appreciated that owing to the method of laying out these slots, the lines
60 which bound them are true spirals of very short pitch, and it will also be appreciated that as such a disk as that shown in Fig. 2 is rotated, the light will be admitted in a series of undulatory practically connected
65 series of rays, the undulations moving from

the center toward the circumference and then from the circumference toward the center successively.

Referring now to Fig. 5, the manner of laying out a similar series of slots is illustrated. However, in this case the six pairs of reversely curved or relatively concave and convex slots or stripes are made of longer pitch so that they overlap and form the petal-shaped figures indicated. In this
7 case the complete disk is divided up into 120 radial sectors which are further divided by concentric circles into 29 circular zones.

Starting now with any one of the inner rectangles such as at 8, successive adjacent
8 rectangles offset by one in the next radial sector in the direction of the hands of a clock are taken successively until the outer circumference is reached, as at 9. From that point, starting with the next rectangle in
9 the rear, as at 10, the same process is followed advancing toward the center of the disk, whence the inner circle is ultimately reached, as at 11. The other lobes or loops of these successive lines of openings or spots
9 are laid out in the same way, their number being increased or diminished according to the amount of light it is desired to have pass through the disks or blended.

It should be noted, furthermore, that if the size of the radial sectors be doubled, and also the width of the circular zones be doubled, twice as much light would be admitted through a given slot as in the case above described. Thus, the percentage of
1 light admitted may be very easily determined by selecting the proper width of the radial sectors and the proper width of the circumferential zones.

It will be noted that at the points 12, 13
1 and 14 larger approximate rectangles are formed which are combinations of those associated with each of the spiral groups of figures. This feature is significant for the following reason: In eliminating the zigzag
1 edges of these openings, as referred to in connection with Fig. 1, the spiral figures, as arranged in Fig. 5, cross each other at the points 12, 13 and 14. This obviously cuts
1 down the area of the spaces through which light is admitted at the crossing points, where the stripes or slots are superposed, and should the disks be used without compensation for these crossing points, only
1 one-half of the rays of light required at these points would be permitted to pass, and dark bands or shadows would be formed before the eye, corresponding to these crossing points. It therefore becomes necessary to admit more light to the disk at other
1 points in the same circular zone. This is provided by auxiliary openings 15, 16 and 23, respectively, which should be exactly equal in area to the diamond-shaped figure outlined by the edges of the slots where they
1

cross, as at 12, 13 and 14. The other series of openings 17 and 18 will be described in connection with Fig. 6, to which attention is now directed.

5 In this figure the same crossing points 12, 13 and 14 are indicated, and their respective compensating openings or spots 15, 16 and 23. However, in this figure there is indicated, in addition, certain connecting
10 strips or bridges, as at 19, 20, 21 and 22. These are for the purpose above referred to of holding the otherwise free inner portions of the disks in position, preventing the
15 movement of loose flexible ends, as in the case of stencils. In these cases, where the continuity of the spiral slots is interrupted, it also becomes necessary to compensate for the same by additional auxiliary openings. These are the approximately rectangular
20 openings 17 and 18 and the central portion of the openings 23 previously referred to, which it will be noted are placed in the same circumferential zones or circles as the corresponding bridges for which they compensate. In the case of the outer compensating
25 openings 23, the area covered thereby must be not only sufficient to compensate for the crossing of the two spiral slots or stripes, but also for the addition of the connecting strip or bridge 22. This accounts
30 for the peculiar shape given to these openings 23, since it is necessary to separate the two halves of the diamond-shaped figure formed at the crossing point so that they
35 shall be outside of the area representing the bridge 22, as indicated in dotted lines at 23. In using metallic disks having the openings described cut therein, it is preferable to bevel the margins of the slots and other
40 openings to produce sharp edges so as to eliminate shadows, variation in the size, and reflections which otherwise tend to be produced by the thicker edges. This is indicated in Fig. 3, in which two such disks,
45 24 and 25, are shown mounted on the same shaft, and the opening indicated at 16 corresponding to the similar opening previously referred to. In the case of the use of two disks superposed on the same shaft,
50 the adjusting nuts 26 or other suitable clamping devices may be used to fix the two disks in their relative positions. When such disks are used, they may be rotated slightly relative to each other, and then fixed
55 in position, thereby enlarging or decreasing the area of the overlapping openings through which the light is permitted to pass. Since all of such openings are moved simultaneously and proportionately, the adjustment referred to provides means for
60 varying the percentage of light admitted through the disks, in addition to the variation of the light by increasing or diminishing the width and number of the spiral
65 slots, it being possible to vary the amount

of light admitted substantially from zero up to the maximum for which the disk was designed, which, in the case of the disk shown in Fig. 6, is 10% of the total light emanating from the object viewed.

70 It should also be noted that the method, above described, of laying out the figures, results in an absolutely uniform distribution of the areas of the slots or stripes over the whole useful surface of the disk, because the
75 circumferential widths of the figures are primarily dependent upon and are proportional to the spaces between corresponding radii. This is because these radii, according to which these spirals are laid out, include
80 equally proportionate areas between them, thereby giving equal light values, in the successive radial zones from the center to the circumference of the disk, when rotating. These areas may be varied between
85 wide limits and may be made to correspond to definite percentages of light to be transmitted or blended, according to different requirements. By use of the word "figures", I desire to indicate spots or holes of any
90 shape, as well as stripes or slots.

The uses to which these disks may be applied are so varied and numerous that only a few will be mentioned. For the examination
95 of electric arcs, in which case it will cut off the heat as well as the light rays emanating from the incandescent source of light and heat, whether it be electrodes, incandescent gases, or other light and heat
100 radiating substances and objects.

The device is particularly applicable for the examination of molten material in blast furnaces, crucibles, electric furnaces, etc.

The disks may also be used on the wind shield of an automobile in order to intercept
105 the glare from approaching automobiles having bright headlights or where there are other sources of light which cause a blinding effect upon drivers of motor vehicles.

Another use to which this device may be
110 applied is that referred to above, or for the blending of colors, it being obvious that this use may be one in which some of the light is of different colors transmitted through the openings alone or may be allowed to mix
115 with light reflected from the surface of the disk, or the two colors to be mixed or blended may be directly applied to the surface of the disk, in which case the spiral stripes may be arranged as previously described but
120 without the connecting bridges referred to, it being only necessary to compensate at the points where the spiral stripes cross each other.

The disks may also be adapted for use in
125 connection with moving picture cameras and projectors, in place of the disks now employed for covering the lenses during the advances of the films between the successive impressions or pictures.

Generally, my invention may be utilized in any device in which a desired intermingling of contrasting characteristics of light or other rays is to be produced by the motion of the various figures or designs with which a disk is provided, and may include the intermingling of characteristics due to absorption, reflection, refraction, direct transmission, and partial or complete interception of the rays.

I do not wish to be understood as being limited to the details of form or arrangement of parts herein set forth, for various changes may be made by those skilled in the art without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim and desire to protect by Letters Patent is:

1. Rotary disks for treating light and similar rays provided with series of figures having characteristics as concerns the effect on said rays, different from those of the main body of the disk and arranged along lines which form substantially continuous undulations between the center and circumference of the disk, and having the same intermingling effect in successive circumferential zones when the disk is rotated.
2. Rotary disks for treating light and similar rays, provided with series of figures having characteristics, as concerns the effect on said rays, different from those of the main body of the disk, and arranged along successive spiral lines between the center and circumference of the disk and having widths which provide the same intermingling effect in successive circumferential zones when the disk is rotated.
3. Rotary disks for treating light and similar rays, provided with series of figures having characteristics, as concerns the effect on said rays, different from those of the main body of the disk and arranged in the form of successive spiral stripes between the center and circumference of the disk, and having the same intermingling effect in successive circumferential zones when the disk is rotated.
4. Rotary disks for treating light and similar rays, provided with series of figures having characteristics, as concerns the effect

on said rays, different from those of the main body of the disk and arranged in the form of successive spiral stripes forming substantially continuous undulations between the center and the circumference of the disk, and having successive convex and concave outlines.

5. Rotary disks for treating light and similar rays, provided with series of figures having characteristics, as concerns the effect on said rays, different from those of the main body of the disk and arranged in the form of successive intersecting spiral stripes, comprising one or more substantially continuous series of undulations between the center and circumference of the disk, and similar auxiliary figures thereon to compensate for the reduction of the area of the stripes at their crossing points.

6. Rotary disks for treating light and similar rays, provided with series of openings arranged in the form of successive mathematically true spirals between the center and circumference thereof.

7. Rotary disks for treating light and similar rays, provided with series of openings arranged in the form of successive mathematically true spirals forming substantially continuous undulations between the center and circumference thereof.

8. Rotary disks for treating light and similar rays, provided with series of slots, arranged in the form of successive spirals forming substantially continuous intersecting undulations between the center and circumference thereof, and provided with auxiliary openings to compensate for the reduced areas at the crossing points of said slots.

9. Rotary disks for treating light and similar rays, provided with series of slots arranged in the form of successive spirals, forming substantially continuous undulations between the center and circumference thereof, strengthening bridges or strips crossing said slots, and auxiliary openings to compensate for the reduced areas at the points where said bridges cross said slots.

Signed at New York, N. Y., this 23d day of January, 1920.

ALFRED O. TATE.