Nov. 29, 1938. H. P. DORN 2,138,803

LUMINOUS DISPLAY

Filed Oct. 2, 1936

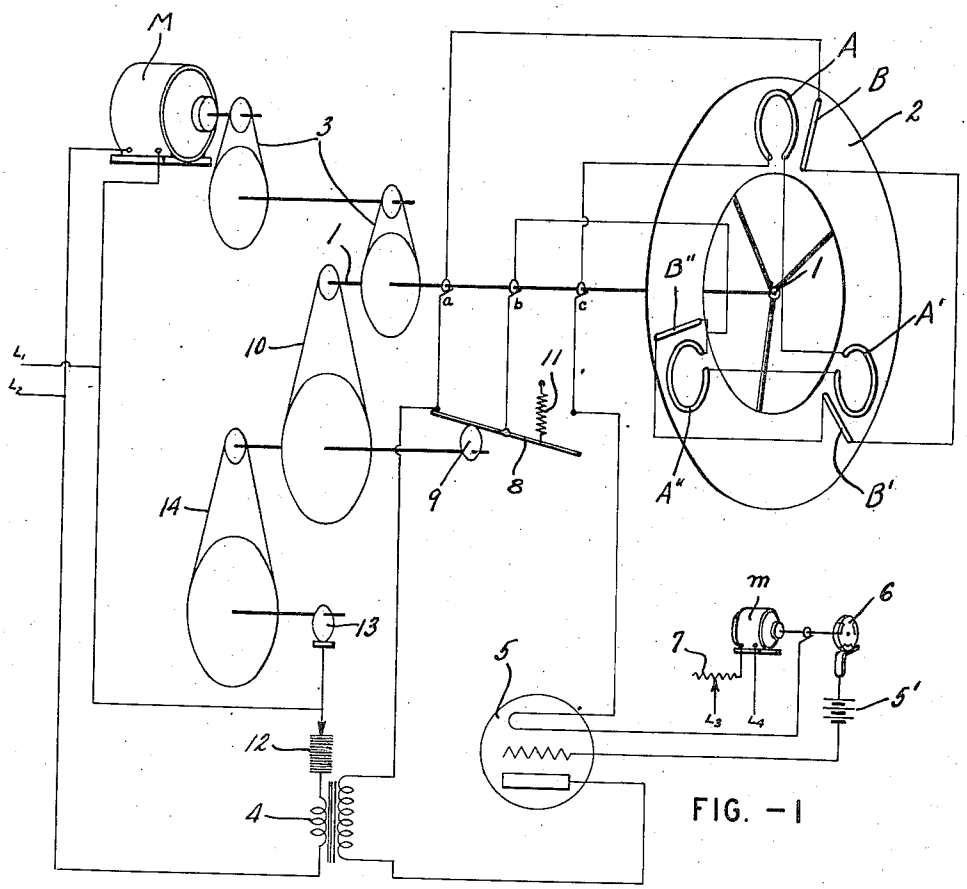


FIG. -1

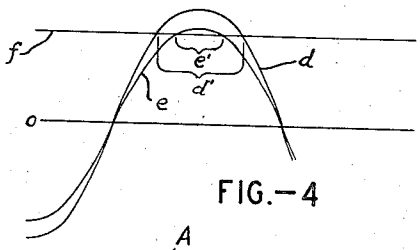


FIG.-4

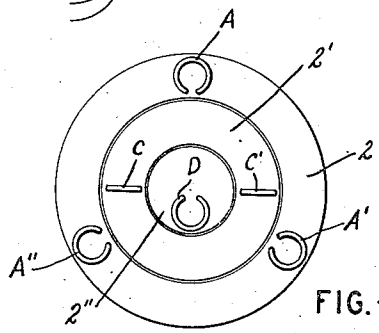


FIG.-3

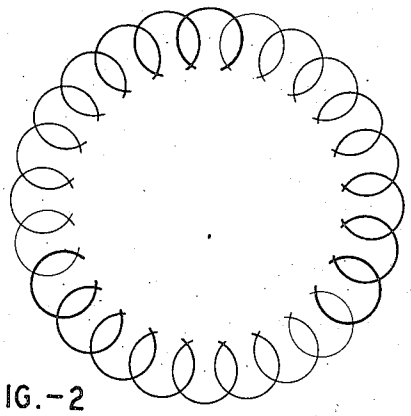


FIG.-2

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LUMINOUS DISPLAY

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7 Claims. (Cl. 40—130)

This invention relates to apparatus for producing luminous display effects by movement of flashing lamp means. Typical of the contemplated lamp means are those of gaseous-electric discharge type operable with periodic luminosity such as neon tubes, and the invention embraces improvements in apparatus wherein such lamp means so operating is caused to move along a predetermined path to produce a sequence of luminous images in displaced relation, whereby persistence of vision of the observer will cause a pattern to appear.

Such apparatus has heretofore been constructed providing a cyclic motion of a neon tube about a center at such speed and luminous frequency that the generated pattern is a complete circular one. This, however, is not entirely satisfactory as the pattern necessarily is unbalanced as to brilliance, and consequently appears eccentric. An object of the present invention is to provide apparent balance or uniform intensity of pattern.

To produce a pattern of large size, such as would be desirable in the outdoor advertising field, has been heretofore impossible because of mechanical limitations such as difficulties of balance, the inability of neon tubes to withstand high speed motion and particularly centrifugal forces, and because sufficient brilliance has been unobtainable. An object of the present invention is to improve the brilliance of the pattern. Briefly, this is accomplished providing a plurality of generating tube elements of similar form and similarly disposed in spaced relation along an endless path such as a circular one, and coincidentally progressing the elements along the path at a relatively low speed, during their simultaneous operation, so that each element produces a similar sequence of luminous images in displaced relation, and persistence of vision of the observer will cause coincident sequences of the images to appear as a complete endless pattern, of brilliance greater than could be produced by a single element.

In the larger sizes and particularly where generating elements of different colors are employed to produce a composite pattern, the invention includes low frequency operation of the elements whereby the generated images will have substantial area, and images of one color may be superimposed upon those of another color to produce a substantial color mixing effect.

Another object is to produce variance in the appearance of the pattern by altering the luminous proportions of its components as will appear.

The exact nature of this invention together with further objects and advantages thereof will be apparent from the following description taken in connection with the accompanying drawing, in which Fig. 1 is a diagrammatic and conventionalized view illustrating apparatus constructed in accordance with the invention; Fig. 2 illustrates a simple luminous pattern which may be produced by the apparatus of Fig. 1; Fig. 3 is a conventionalized view indicating a modification of the apparatus shown in Fig. 1; and Fig. 4 is a diagrammatic view illustrative of one of the features of the invention.

With reference now to the drawing and first to Fig. 1 thereof, A, A', and A'' are similarly formed neon tubes each generally of circular form, mounted for cyclic displacement of simple circular character about an axis 1, as by securement to an annular disk 2 concentric of the axis, the disk being say 9 feet in diameter.

For rotation of the disk and hence of the tubes A, a motor M is provided and arranged to drive the shaft 1 which forms the described axis, through gearing as by belts or chains 3 running over the suitable pulleys or sprockets indicated. The motor may be energized by a source of alternating current L_1, L_2, and the speed reduction provided by the described gearing is such that the disk 2 is driven at about 100 revolutions per minute. The tubes A are substantially identical with each other as to size as well as form, are equally spaced about the axis 1 both radially and circumferentially, and are similarly disposed with respect to the axis. They are interconnected for operation in unison, during rotation of the disk 2 as in parallel relation with each other, by suitable electrical connections leading to the collectors *b* and *c*.

In the embodiment here shown a second set of three tubes B, B', B'', is provided on the disk 2, these tubes being radial and otherwise symmetrically disposed about the axis 1, and have suitable associated connections as indicated for their operation in unison in series relation with each other through the collectors *a* and *b*.

Means are supplied for supplying operating current from the tubes, to the collectors *a* and *c*. Such means as here shown, include a transformer 4, the primary winding of which is connected to the line L_1, L_2, and the secondary winding of which has one side connected to the collector *a* and the other side to the collector *c*. In order that the tubes A and B may be operated at low

frequency, an electronic tube 5 such as a Thyratron, is located in the connection to the collector *c*, and to control the frequency independent of the line L_1, L_2, a commutating device 6 driven by a motor *m* is associated with the grid of the tube 5, with an associated bias battery 5', as indicated, the speed of the motor *m* being adjustable as by the resistance 7 in one of its supply lines L_3, L_4.

It will be apparent that both sets of neon tubes on the disk 2 may be operated in unison by the described supply of energy to the collectors *a* and *c*, the sets being in series relation with each other. In order that at times one set only shall operate, a switch 8 is arranged to alternately short circuit the collectors *a* and *b*, and the collectors *b* and *c*. A cam 9 driven at reduced speed from the motor M as by a belt 10, is arranged to periodically throw the switch 8 to the former position which is that illustrated and a spring 11 is arranged to throw the switch to the latter position when permitted by the cam 9.

In operation of what has thus far been described, and first with reference only to the first set of luminous elements A, it will be apparent that each will generate a sequence of luminous images in displaced relation about the axis 1. Coincident sequences of these images, one sequence for each generating element, will appear as a pattern having distribution about the axis 1. Preferably the speed of the disk 2 is such that persistence of vision of the observer will cause each image sequence to extend substantially from its generating element to the next succeeding one, so that the pattern appears as a complete annular one, generally as in Fig. 2.

If the drive of the disk be constant, as where the motor *m* is a synchronous one and the gearing connecting it with the disk is positive, and the frequency of operation of of the tubes is properly adjusted to the speed of the disk, the images produced by all of the tubes A may be located in registry with each other as in Fig. 2. But such synchronization is not necessary, since without it any displacement between the images of the tubes will be unnoticeable.

Obviously for a given disk speed, the lower the tube operating frequency, the fewer will be the number of images appearing coincidentally within the observer's persistence of vision—and also the greater dimension such images will have in the direction of tube travel. Consequently the slower the rotation of the disk the lower should be the tube frequency, on the assumption that the larger the disk the greater the distance from which the pattern is to be observed.

In the operation of the apparatus indicated in Fig. 1, the second set of tubes B will operate occasionally producing of course a circular pattern but differing from that produced by the set of A tubes. Also both sets of tubes will at times operate simultaneously in which event if one set of tubes has a different color from the other, images from one set will have areas overlying those of the other set, and such areas will appear to be of a hue compounded from the two colors emitted by the tubes, which may preferably be primary colors. Also, the complementary color of each tube color will appear in the pattern, and the pattern as a whole will appear to include many colors although actually it is produced merely by the two colors of the tubes.

In Fig. 1 is shown a resistance 12 in the primary circuit of the transformer 4, arranged to be periodically varied as by the cam 13 and belting 14, the purpose of which resistance is to vary the pattern as follows:

A tube of the character described, receiving alternating current having the usual harmonic voltage fluctuation of sine wave form, will be energized and luminous only during those periods when the instantaneous voltage is at or above the minimum required to operate the tube. Thus with reference to Fig. 4, if the curve *d* represents the fluctuating voltage impressed upon the tube, whereas the line *f* represents that required for energization of the tube, the tube will be luminous through periods indicated by the line *d'*, and these luminous periods may be of greater duration than the non-luminous periods therebetween. Under these conditions the luminous images forming the visible pattern will be of substantially greater length in the direction of tube progress than are the spaces therebetween; and the pattern as a whole may have greater luminous area than non-luminous, and greater total luminosity, with an appearance suggesting dark lines upon a luminous background of substantial intensity.

Supposing now the voltage to be cut down as by the resistance 12, to that indicated by the line *e* in Fig. 4. The tube will now be luminous only during the periods indicated by the line *e'* and the pattern will present the delicate appearance of fine luminous lines interlaced upon a dark background—something in the nature of a negative in relation to the positive effect of its previous appearance. Obviously by varying the voltage between these two values the proportions of light and dark of the pattern may be correspondingly varied. Obviously also, the pattern will have greater overall luminosity, the more the voltage impressed upon it approaches that indicated by the curve *d*.

I have found that most neon tubes have a slight rectifying effect during their operation, so that it is possible to adjust the voltage of an impressed alternating current to a critical point wherein the tube will be energized when the instant potential is in one direction but not when it is in the other, opposite, direction. Thus, when the voltage is so adjusted, alternate of the images described will disappear and the pattern will be of radically changed appearance. Of course such operation is practically possible only where the pattern has the character of bright lines upon a dark background, which, however, is where the omission of half the images produces the most noticeable change. Thus, in the arrangement of Fig. 1 the images of the B tubes may be caused to be finer during operation of the A tubes than when they are operating alone, and vice versa.

Obviously the tube operating frequency might be altered periodically by varying the resistance 7 controlling the motor *m* in a manner similar to that described for varying the resistance 12.

The number of neon tubes or other image-generating elements for producing a single pattern, as well as their proper speed of advancement along their path, will depend upon the length of the path. Where the path is circular this dependence will be upon the radial distance of the tubes from the axis. Thus as in Fig. 3 where the three tubes A, A', A'', are necessary on a diameter in the neighborhood of 9 feet, but two tubes C, C', may be necessary where the diameter is say 6 feet, these tubes C, C' being mounted upon a disk 2' whose speed is in the neighborhood of 200 revolutions per minute.

Similarly a single tube D only may be employed on a disk 2'' whose diameter is but 2 or 3 feet and which operates at say 300 revolutions per minute. As indicated in Fig. 3 all three disks may be concentrically arranged to operate at their various speeds on a common axis to produce a triple pattern having three concentric components but having substantially uniform luminosity throughout the entire general area.

It will be obvious that the patterns may have innumerable variations depending upon the shapes of the generating tubes employed, those shown being merely for illustrative purpose.

Where a plurality of tubes are arranged in series relation and arranged to be severally temporarily cut out of operation during operation of the remainder, the resultant variations in pattern appearance may be greater provided the tubes are disposed with similar polarity, that is, so that their rectifying effect is cumulative. Under such conditions short-circuiting of one set of tubes to terminate its operation, will increase the voltage upon the remainder and as already set forth in connection with Fig. 4, this will alter the appearance of the pattern produced by such remaining tubes which are still operating; and vice versa.

What I claim is:

1. Apparatus of the character described comprising a pair of gaseous electric discharge elements, means for operating said elements with periodic luminosity, said elements being mounted for movement during their operation, cyclically about a center from which one element is located farther than the other, and means for moving the far element at less angular speed than the near element.

2. Apparatus of the character described comprising a pair of gaseous electric discharge elements, means for operating said elements with periodic luminosity, and means for moving said elements during their operation, at substantially equal linear speeds, cyclically about a center from which one element is farther than the other.

3. Apparatus of the class described, comprising lamp means of gaseous electric discharge type arranged to operate with periodic luminosity, means for displacing said lamp means, during its said operation, and means for varying the duration of its individual luminous periods during said operation.

4. Apparatus of the class described, comprising gaseous electric discharge means, periodically fluctuating current means for operating said discharge means with periodic luminosity, means for displacing said discharge means during its operation, and means for varying the maximum instantaneous operating voltage of said current means, during said operation, to substantially vary the appearance of the visual pattern produced by said discharge means.

5. The method of operating gaseous electric discharge means for the purpose described, comprising displacing said means cyclically about a center while causing periodic luminosity of said means by a current having harmonic potential fluctuation above and below the voltage necessary to energize said means, whereby the resultant succession of luminous images will be caused, by persistence of vision of the observer, to present a pattern disposed about said center, and varying the maximum voltage of said current to vary the appearance of said pattern.

6. Apparatus of the class described, comprising a plurality of elements of gaseous electric discharge type, each adapted to have some rectifying effect during its operation, said elements being arranged in series relation with unidirectional polarity, alternating current means for operating said elements in said series circuit, means for short-circuiting one of said elements, and means for cyclically displacing another of said elements during its operation.

7. The method of producing a luminous pattern of apparently uniform luminous intensity, from a plurality of elements of similar form similarly disposed in uniformly spaced relation along an endless path of substantial length in relation to the size of said elements, said elements having associated means for their simultaneous operation with the same periodic luminosity, said method comprising moving said elements with similar progression along said path, to thereby generate by each a similar sequence of luminous images with similar distribution in a common pattern, at such a speed that, in persistence of vision of the observer, one sequence extends substantially from its generating element to its succeeding element.

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