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(54) **Lighting control apparatus**

(57) Lighting control apparatus 10 comprises a plurality of mirrors 44 positioned so as to each receive at least one beam of light. The mirrors 44 being independently moveable such that the direction of a beam of light 42 reflected therefrom is adjustable. Each of said mir-

rors 44 is mounted on a support structure 48 said support structure 48 is rotatable about a substantially central axis such that the beams of light 42 reflected from each mirror are adapted to simultaneously rotate about said substantially central axis.

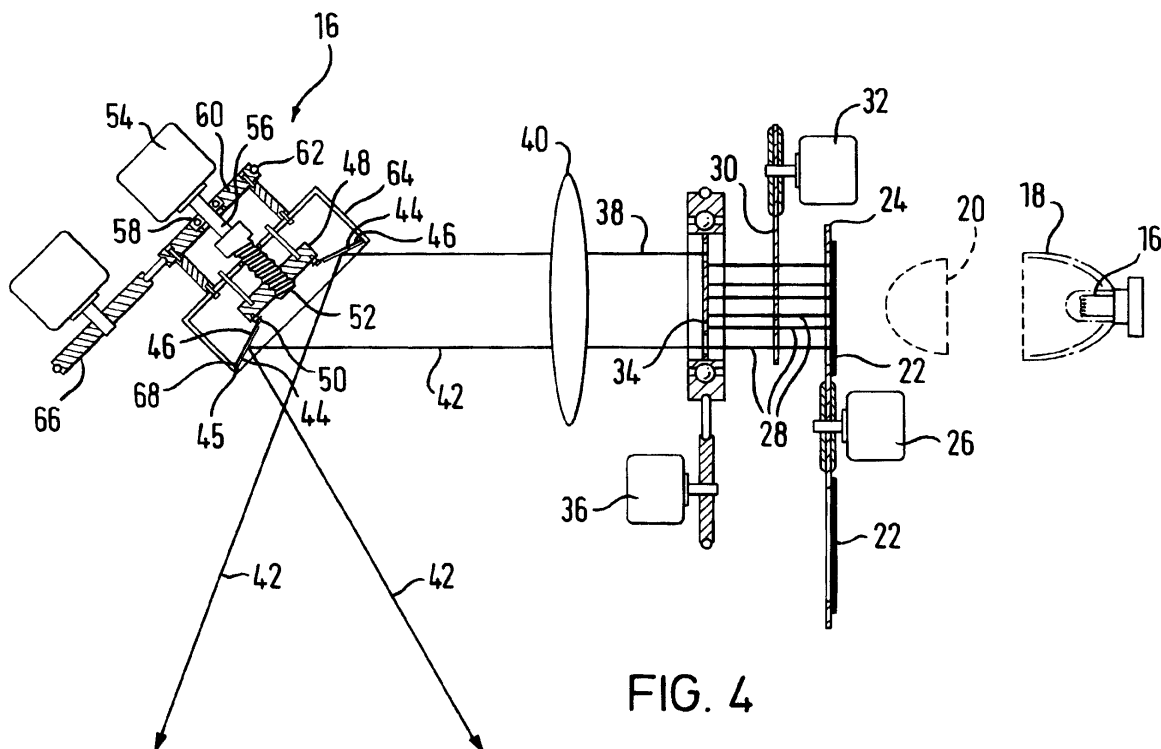


FIG. 4

Description

[0001] This invention relates to lighting control apparatus. More particularly but not exclusively this invention relates to a lighting control system for special effect lighting.

[0002] Special effect lighting is commonly used in discotheques and theatres. In discotheques it is desirable to co-ordinate the movement and colour of light with music. A simple method of producing special effects with light is to shine a light onto a ball coated with a large number of small mirrors. This produces a large number of light beams. It is also known to produce three dimensional lighting effects by directing a beam of light through smoke. This is only possible with a narrow concentrated beam of light i.e. a "pin spot" since ordinary spot lights produce a less concentrated beam.

[0003] Developments in this technical field, over the last 20 years, have been mainly concerned with co-ordinating the movement of light with music. Early proposals included flashing lights to different frequencies of music. This gave a dramatic effect since different lights could be made to react to the various bass beats of the music. The eye could easily follow these changes in light and this effect was commonly known as the Sound Chaser or Sound Sequencer.

[0004] One major development was the introduction of the 'helicopter'. This comprised a number of pin spot lights arranged around a centre piece, as indicated in Figure 1. The separate lamps of the helicopter are manually adjustable to be angled and rotated using a motor until the desired effect is achieved. Typically this is a circular pattern of light pools rotating about the centre axis of the helicopter. The provision of individually adjustable lamp heads allows the helicopter to be used with different ceiling heights. In other words, the angles of the lamp heads may be pre-set to give a desired diameter of the circular light pattern, regardless of the height of the ceiling to which the helicopter is secured. The movement of lighting arrangements such as the helicopter is usually controlled by a lighting engineer or disc jockey ("DJ").

[0005] More recently the pin spot has been replaced by the 'flower effect' light. The principle of the flower effect was to invert the principle of the mirrored ball. A plurality of coloured mirrored pieces are arranged on the concave surface of a dish. When light is directed onto this surface the beams of light from the mirrors converge to a common point which is then passed through a lens. After converging the beams would then continue into a flower pattern. This is indicated in figure 2. As with all modern lighting effects the 'flower effect' light is controllable in terms of sound activation and rotation.

[0006] More recent developments have included 'intelligent lighting'. This principle involves directing a beam of light through a colour filter and a shape commonly known as a GOBO. This beam is then directed onto a mirror which is fixed to two or more motors. Thus

the direction, shape and colour of a beam of light could be controlled remotely.

[0007] One of the problems associated with the recent developments in special effect lighting is the need for a digital language capable of controlling a large number of lights at any given time. This has been addressed by the digital language, DMX. Advantageously DMX dispenses with the need for a large number of wires connecting the various lighting effects. Only one cable is needed from the DMX controller and all the subsequent effects are linked together. This control system is 'intelligent' since it is capable of assigning the correct information to the correct lighting effect.

[0008] One of the most recent advances includes the ability to project a large number of beams from one source in the colour and shape of a DJ's choice and move them in time to music. This advance uses a combination of the 'flower effect' dish and the separately selectable colours and shapes described above. It is achieved by fitting a plurality of silver mirrored pieces to the concave surface of a dish and the passing the reflected beams of light through a selection of colours and GOBO's mounted on a motorised wheel. The motors are controlled by the above mentioned DMX control system.

[0009] Various problems are associated with the above advances in special effect lighting.

[0010] The 'helicopter' effect employs a brush gear which tends to wear quickly. Also it is extremely difficult to change the colours of each individual lamp of the helicopter whilst in operation. Such changes in colour had to be provided during non-operation of the helicopter.

[0011] The standard helicopter was capable of little control (i.e. of lighting colour and shapes) once in operation, other than turning it off and on. However, the helicopter is the only system which produces a 'carousel' lighting effect which is capable of beam angle adjustment, albeit manual adjustment. The "carousel" effect is the rotation of all the lights around a centrepiece.

[0012] It was also not possible to use the helicopter in combination with GOBO's and colours for each light since the wiring involved was prohibitive of free movement of the individual pin spot lamps of the helicopter. Also even the limited tilting movement of the lamps required adjustment before operation or installation. Additionally the light output of the helicopter was somewhat low, since the helicopter only employs comparatively low output "PAR 36" lamps. As a result of such drawbacks the helicopter has recently become less popular.

[0013] Thus it is desirable to have the helicopter 'carousel lighting' effect combined with control over shape and colour of the individual beams, whilst the lighting apparatus is in operation. More recent centrepiece lighting effects have used a multiplicity of pivoting mirrors fixed around a common light source, this light source being capable of colour change. A number of these more recent centrepiece lighting effects employ spinning dishes to the outside of a casing, in an attempt to add some rotary movement. However none have repro-

duced the 360° rotary carousel effect of the helicopter with variable pitch.

[0014] According to the invention there is provided lighting control apparatus comprising a plurality of mirrors positioned so as to receive at least one beam of light said mirrors being independently moveable such that the angle of a beam of light reflected from each mirror is adjustable wherein each of said mirrors is mounted on a support structure said support structure being rotatable about a substantially central axis such that the beams of light reflected from the mirrors are adapted to simultaneously rotate about said substantially central axis.

[0015] Advantageously a beam of light from a light source is rotated and formed into a desired shape, then split into a number of beams by the mirrors thus producing a carousel effect of lights spinning in unison.

[0016] Also according to the invention there is provided lighting control apparatus comprising a plurality of mirrors positioned to receive at least one beam of light, said mirrors being mounted on a support structure, said support structure being rotatable; and means for providing rotation to said at least one beam of light wherein said beam of light is dividable into a plurality of beams of light upon reflection by said mirrors each of said reflected beams being adapted to simultaneously rotate about a common axis.

[0017] Advantageously the mirrors are individually adjustable in terms of angle and also capable of rotating around a common axis thus producing a carousel effect of lights which are adjustable in terms of beam pitch.

[0018] The invention will now be described by way of non-limiting example with reference to the accompanying drawings, in which

Figure 1 is an illustration of a prior art 'helicopter' lighting effect;

Figure 2 is a diagrammatic illustration of beams of light reflected from the concave surface of a prior art mirrored dish;

Figure 3 is a diagrammatic illustration of lighting apparatus according to an embodiment of the present invention;

Figure 4 is a sectional view of the lighting apparatus according to an embodiment of the present invention, omitting the outer housing visible in Figure 3; and

Figure 5 is a perspective view on X-X of figure 4.

Description of Preferred Embodiments

[0019] Referring to figures 3 5 lighting control apparatus shown generally at 10 produces a plurality of beams 12. Each beam produces a spotlight 14 that may

comprise any shape, design or colour.

[0020] A light source 16 (Figure 4) such as a metal halide lamp is positioned within a reflector 18 which directs light onto a condenser lens 20. The condenser lens aligns the rays of light forming the beam produced from the light source. However the condenser may not be required if the beam of light produced from the light source is of a high quality in terms of focus. This light is then directed through a colour filter 22 mounted on a colour wheel 24. The colour wheel comprises a number of different colour filters and is rotatable so as to provide a predetermined colour through which the light is directed. Rotation of colour wheel 24 occurs through use of motor 26. The rotary output shaft of motor 26 is secured to the centre of colour wheel 22.

[0021] A beam of light 28, having passed through the filter 22 of the colour wheel 24 is then directed through a shutter 30 which may be operated at various speeds to provide a flashing light effect. The shutter is operated by motor 32. The rotary output shaft of motor 32 is secured to a shutter plate that may, as a result of operation of motor 32, be repeatedly interposed into the light beam. The speed of rotation of motor 32 dictates the rate of flashing

[0022] The beam of light 28 is then directed through a GOBO plate 34 or any suitable means such as a photographic slide for providing the beam of light with a desired shape. A preferred form of GOBO is a shape cut out of a plate through which light is then directed, the emerging beam of light then being formed in the shape of the GOBO. The GOBO plate is also operable through use of rotary motor 36 so as to rotate the pattern thus defined in the beam of light 28.

[0023] The emerging beam of light 38 is then directed through a focus lens 40.

[0024] The beam of light 42 is then directed onto mirrors 44 arranged in the manner of flower petals about a centre axis. In the embodiment shown each mirror has the shape of a triangle truncated adjacent its apex (Figure 5). Other mirror shapes are possible. Each mirror 44 is mounted on an adjustable plate 46 which is itself mounted on a central support member 48. The mirrors are arranged to be generally adjacent one another such that a substantially concave or convex formation of mirrors is provided. The formation is adjustable between convex and concave shapes. A concave shape is clearly shown in Figure 5.

[0025] The beam of light is split by the mirrors into a number of beams of light, corresponding to the number of mirrors 44 reflecting light. Each mirror reflects an individual beam of light corresponding to the shape and colour previously selected by the gobo and colour filter.

[0026] The plates 46 are flexibly mounted at their radially inner ends on the central support member 48 through springs 50. This flexible mounting arrangement allows the mirrors to be individually adjusted to alter the angle of the beam reflected. This flexible mounting allows the mirrors to be tilted about one of their ends thus

producing a concave (as shown), flat or convex array of mirrors. Thus if the lighting apparatus was to be ceiling mounted different heights of ceiling could be accommodated without impairing the lighting effect produced.

[0027] The support member 48 includes a central, threaded bore mounted on a screw 52. A rotary motor 54 is selectively operable to rotate the screw 52. Rotation of the screw 52 is enabled by its attachment to a spindle 56 mounted within a journal bearing 58 and attached to motor 54. Through operation of the motor 54 to rotate the screw 52 the angle of the mirrors may be remotely adjusted.

[0028] The mirrors 44 and associated mounting apparatus are housed within a casing in the form of a dish or cup 64. As shown in Figure 5, cup 64 is in a preferred embodiment octagonal in plan view, although other shapes are of course possible. One end 45 of each mirror plate 46 is mounted within a sliding joint 68 formed in the cup 64. Each sliding joint takes the form of an aperture in the upstanding wall 64' of cup 64. A flat tab 46' protrudes from the radially outer edge of each plate 46 and is slidably received in the aperture, providing a radially slideable mounting for the plate 46.

[0029] This sliding joint ensures that the mirrors 44 are located in a desired position and the adjustment of their mounting angle via rotation of the screw 52 is smoothly effected.

[0030] Pulleys 60 and 60' and associated drive belt 62 are provided to allow rotary movement of the entire cup 64 and hence the beams reflected from the mirrors 44.

[0031] A further rotary motor 66, whose output shaft is secured to the centre of pulley 60' provides rotating movement to the carousel cup 64 as also shown in Figure 5.

[0032] Advantageously this lighting arrangement provides the circular carousel movement of the prior art 'helicopter' without the need for individually adjustable lamps. The rotatable gobo wheel 34 and the rotatable colour wheel 24 also provide the beam of light 38 with a choice of colour and shape. The beams 42 reflected by the mirrors 44 therefore also have colours and shapes corresponding to the colour and shape of beam 38. They are also rotatable around both their own axis as shown in Figure 3 by arrow A and also about a common axis as indicated by arrow B.

[0033] The angle at which the beams 42 are reflected from mirrors 44 is also adjustable to allow for different ceiling heights thus providing variable beam pitch and an added lighting effect of varying the pitch of the beams whilst in operation. This variation in pitch angle is shown in Figure 3 by arrows C.

[0034] The apparatus of the invention may be controlled e.g. by an electronic controller that sends control pulses to each of the motors, using the above-mentioned DMX language. Each motor may be permanently connected to a current source, and the DMX control pulses may be used to switch the motors on and off in-

dividually, according to encoded information contained within the DMX pulses.

Claims

1. Lighting control apparatus comprising a plurality of mirrors positioned so as to receive at least one beam of light said mirrors being independently moveable such that the angle of a beam of light reflected therefrom is adjustable wherein each of said mirrors is mounted on a support, said support being rotatable about a substantially central axis such that the beams of light reflected from each mirror are simultaneously rotatable about said substantially central axis.
2. Lighting control apparatus according to Claim 1 wherein the position of each mirror relative to the support is independently adjustable.
3. Lighting control apparatus according to Claim 2 wherein each mirror is flexibly mounted on said support structure adjacent another mirror in a substantially circular arrangement.
4. Lighting control apparatus according to Claim 2 or Claim 3 wherein each mirror is secured, at one end, to the support structure such that movement of each of said mirrors is convergent or divergent with respect to the substantially central axis of said support structure.
5. Lighting control apparatus according to any one of the preceding claims including a light source remote from the mirrors and a plate in the light path between said light source and said mirrors, said plate comprising one or more colour filters and being rotatable so as to provide at least one beam of light from the source filtered to a predetermined colour.
6. Lighting control apparatus according to any one of the preceding claims including a light source remote from the mirrors; and a plate in the light path between said light source and said mirrors, said plate comprising at least one cut out portion such that at least one beam of light from the source passes through said cut out portion and includes said cut out shape when projected, via the mirrors, onto a target.
7. Lighting control apparatus according to any one of the preceding claims wherein said support is moveable in the direction of its central axis upon rotation of a threaded screw drivingly received in a correspondingly threaded aperture generally concentric with the support.

8. Lighting control apparatus according to Claim 7 including a motor selectively providing motorised movement of said support member.
9. Lighting control apparatus according to Claim 1 wherein said mirrors are located within a casing, said casing being rotatable about a substantially central axis. 5
10. Lighting control apparatus according to Claim 1 wherein rotation of said casing provides simultaneous rotation of the attached array of mirrors. 10
11. Lighting control apparatus according to Claim 2 or any one of the preceding claims dependent from Claim 2 wherein movement and rotation of said mirrors and support provides corresponding movement of said reflected beams. 15
12. Lighting control apparatus according to Claims 5 and 6 wherein rotation of said plates is motorised. 20
13. Lighting control apparatus according to any preceding claim wherein at least one light source provides a plurality of beams each of said beams being directed onto a corresponding mirror, the colour, shape and movement of each beam being alterable during operation of said lighting control apparatus. 25
14. Lighting control apparatus comprising: a plurality of mirrors positioned to receive at least one beam of light, said mirrors being mounted on a support structure, said support structure being rotatable; and means for providing rotation to said at least one beam of light wherein said beam of light is dividable into a plurality of beams of light upon reflection by said mirrors, each of said reflected beams being adapted to simultaneously rotate about a common axis. 30
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15. Lighting control apparatus according to Claim 1 including a casing enclosing the mirrors, the casing including an aperture permitting projection of a plurality of beams of light reflected by the mirrors. 45
16. Lighting control apparatus according to Claim 1 including a light source remote from the mirrors; and a focussing lens in the light path between the light source and the mirrors. 50
17. Lighting control apparatus according to Claim 1 including a light source remote from the mirrors; and a shutter selectively repeatedly interposable into the light path between the light source and the mirrors. 55

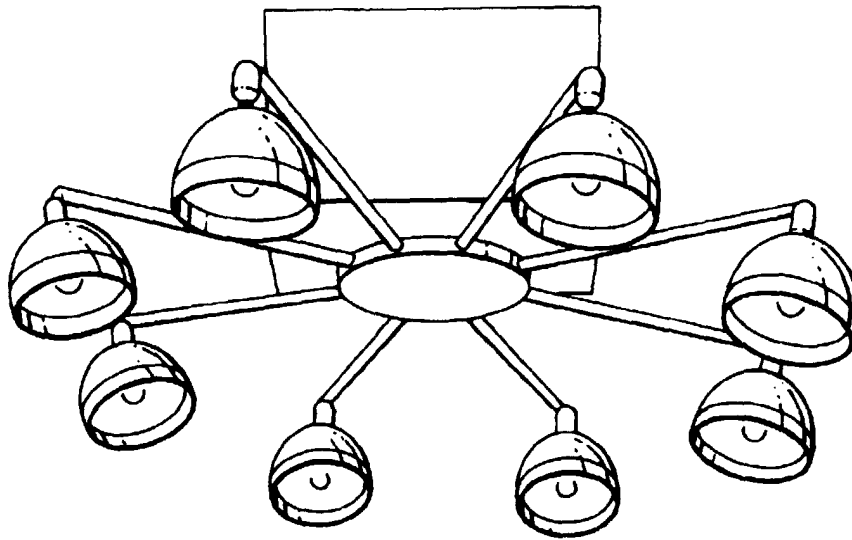


FIG. 1
PRIOR ART

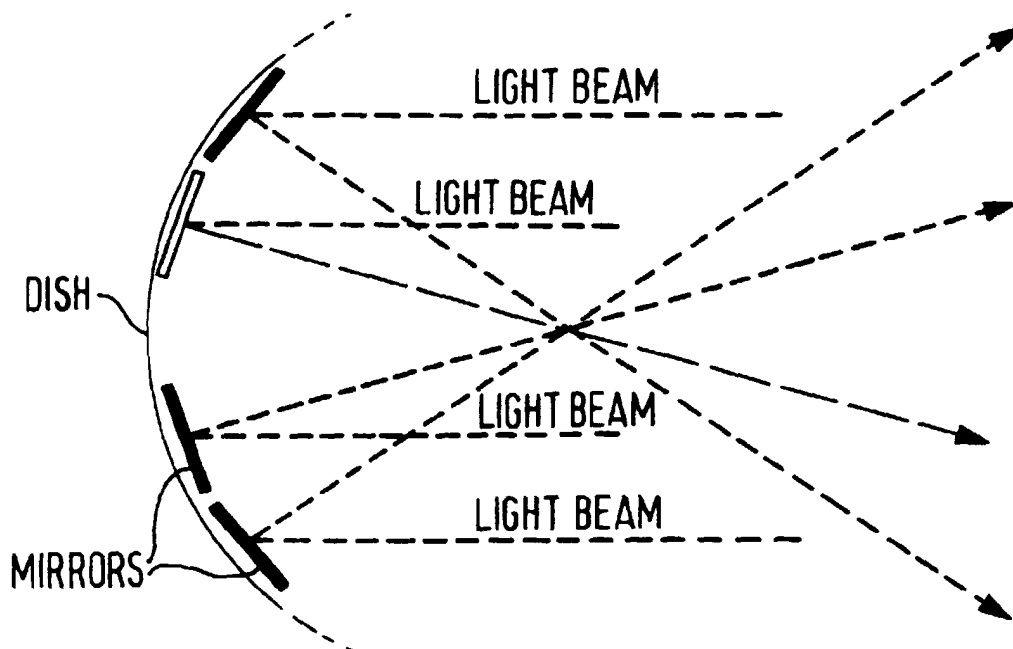


FIG. 2
PRIOR ART

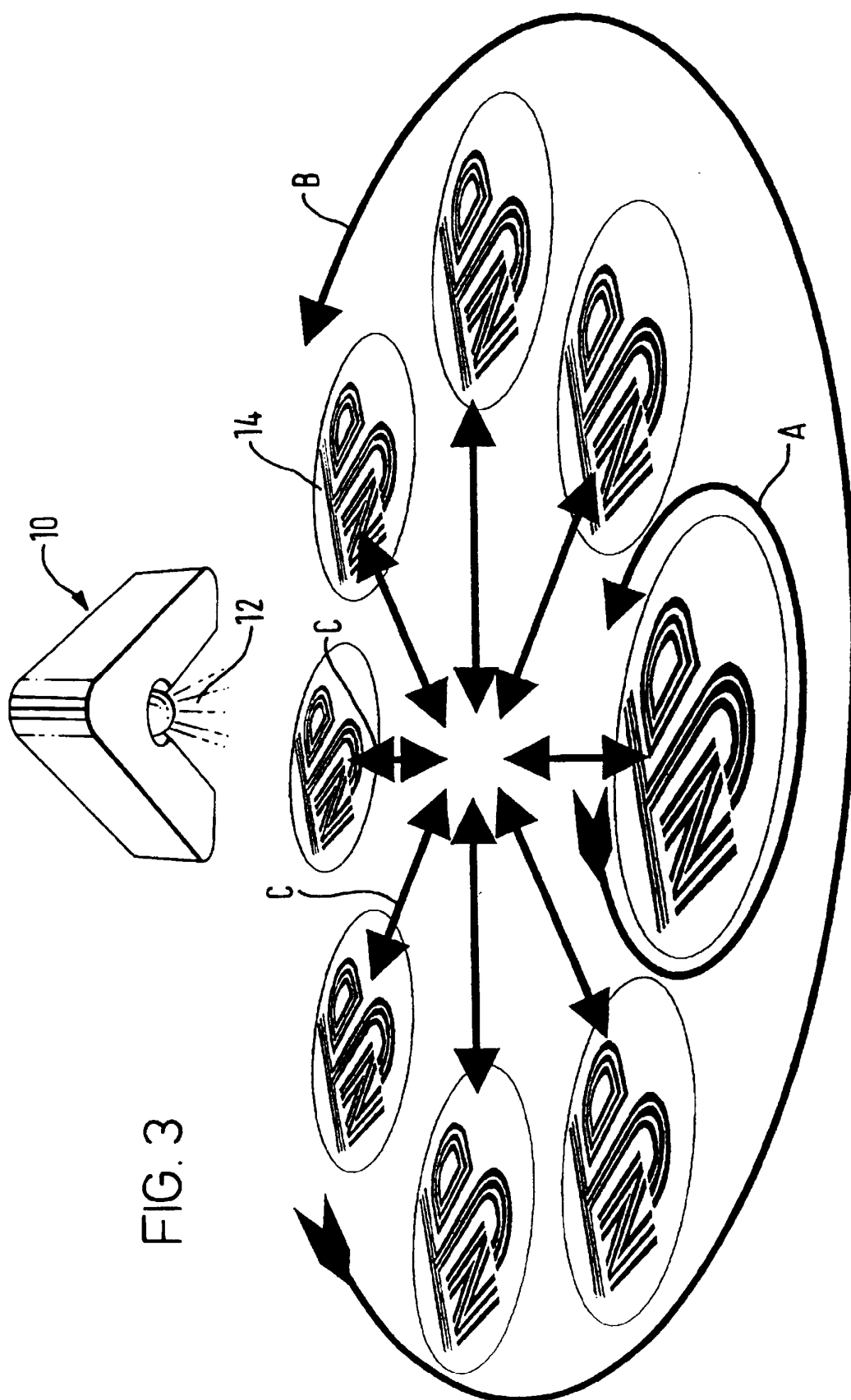


FIG. 3

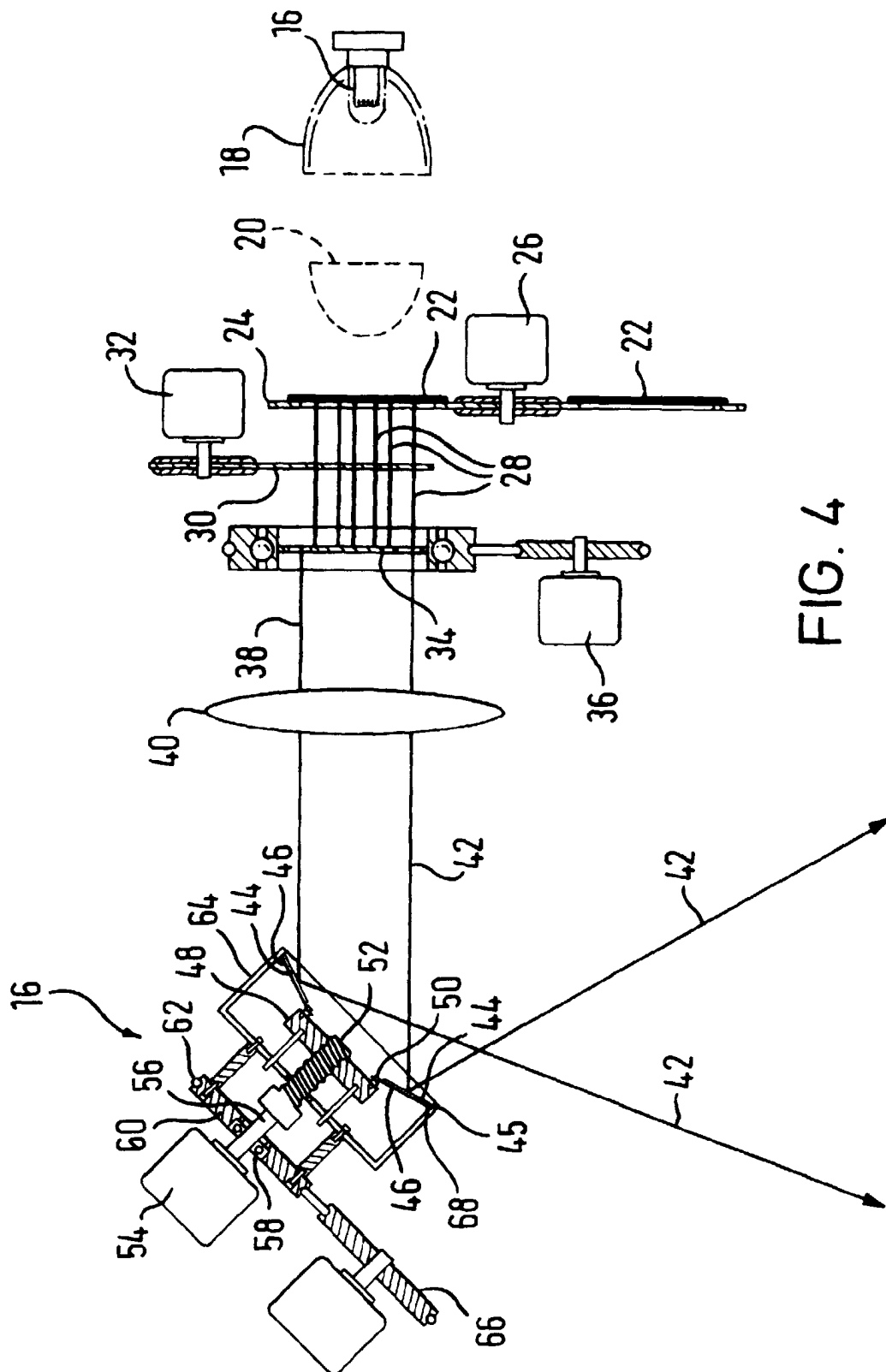


FIG. 4

