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Goodrich

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(54) **LASER PROJECTOR FOR PRODUCING INTERSECTING LINES ON A SURFACE**

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(*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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(52) **U.S. Cl.** **33/286; 33/227; 33/DIG. 21**

(58) **Field of Search** **33/286, 227, 228, 33/276, 277, 282, DIG. 21**

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,218,770 A 6/1993 Toga 33/276

5,367,779 A	*	11/1994	Lee	.....	33/227
5,539,990 A		7/1996	Le	.....	33/286
5,588,216 A	*	12/1996	Rank et al.	.....	33/286
6,005,719 A		12/1999	Rando	.....	33/286
6,065,217 A		5/2000	Dong	.....	33/276
6,195,902 B1	*	3/2001	Jan et al.	.....	33/286
6,202,312 B1		3/2001	Rando	.....	33/227
6,502,319 B1	*	1/2003	Goodrich et al.	33/286

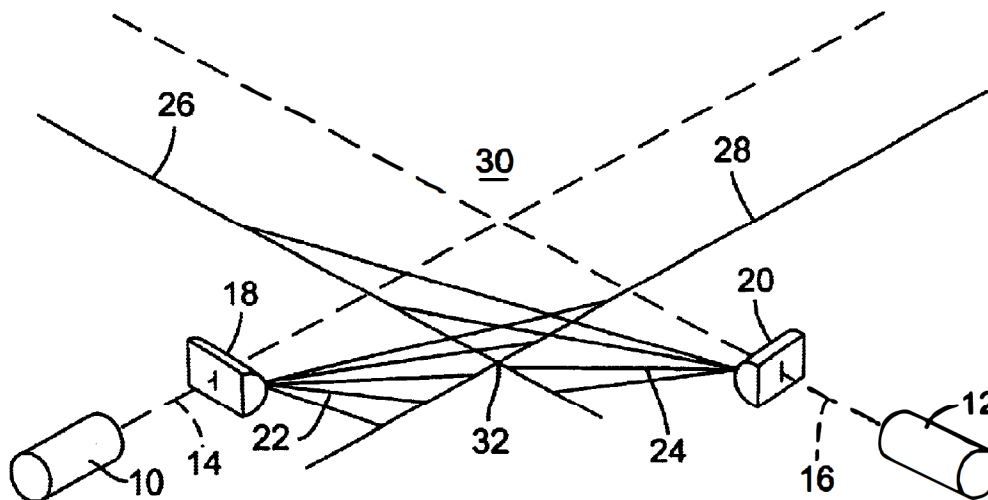
* cited by examiner

Primary Examiner—Christopher W. Fulton
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(57) **ABSTRACT**

A portable construction layout tool generates laser beams in two or more directions related by a specific angle, such as 90°. The instrument emits two fans of light in such a way as to project a pair of lines on the floor, wall or other surface on which the instrument is mounted or placed, with the intersection of the two being visible rather than being a virtual intersection hidden beneath the instrument itself, enabling easier setup. Compared to rotating-beam instruments, the disclosed device is simpler by avoiding moving parts and provides for better visibility. In a preferred embodiment the non-collimated beam from a laser diode is used, and is passed through a cylinder lens to converge the beam on the narrower axis to generate the desired fan of light to be projected as a line.

10 Claims, 3 Drawing Sheets



Parhelion, Inc.
EXHIBIT

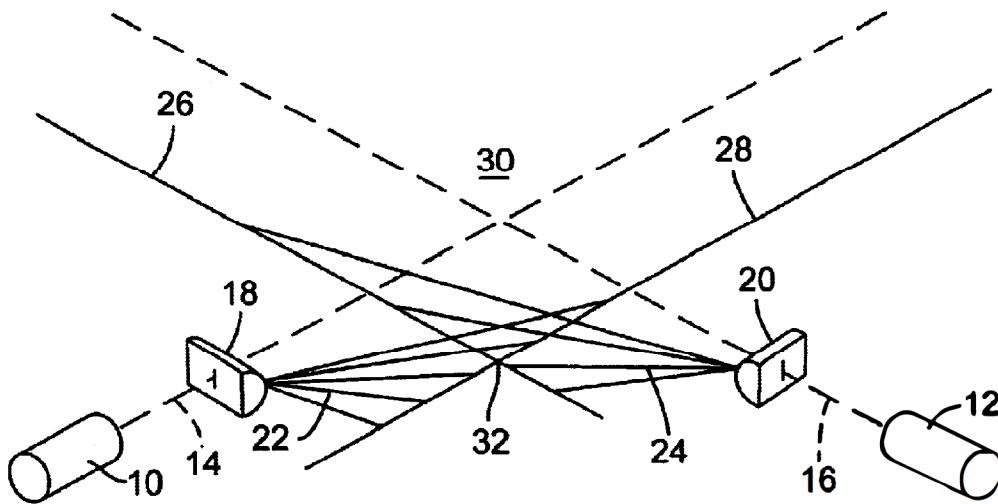


FIG. 1

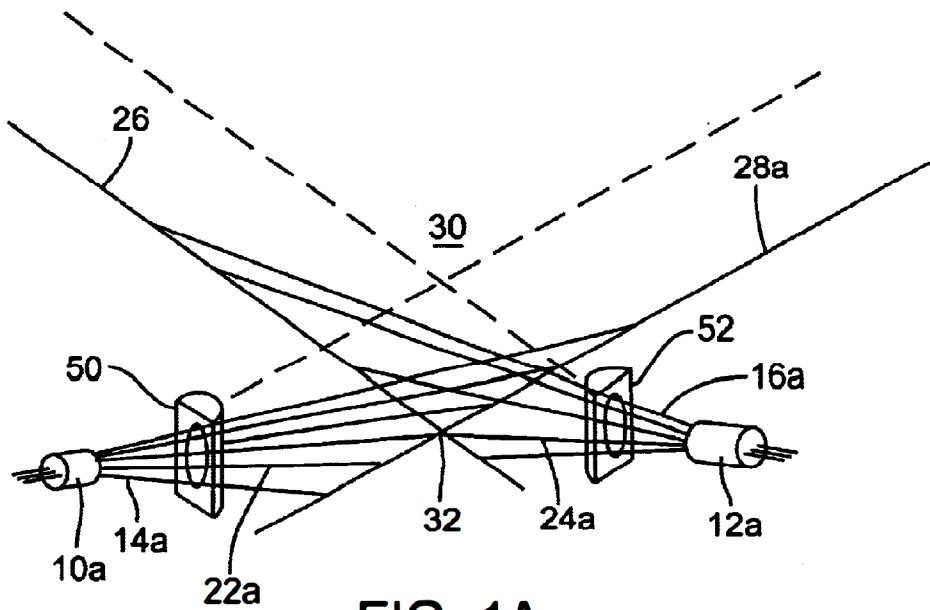
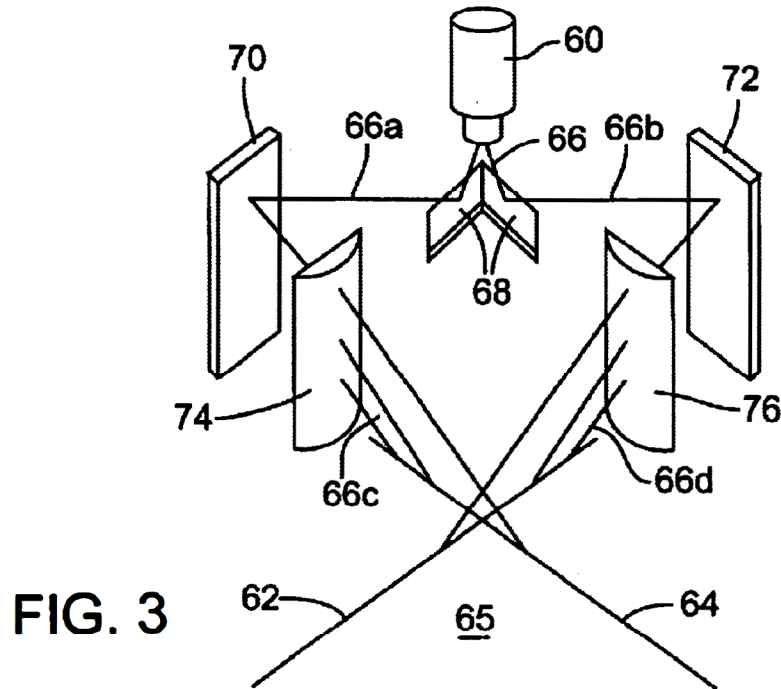
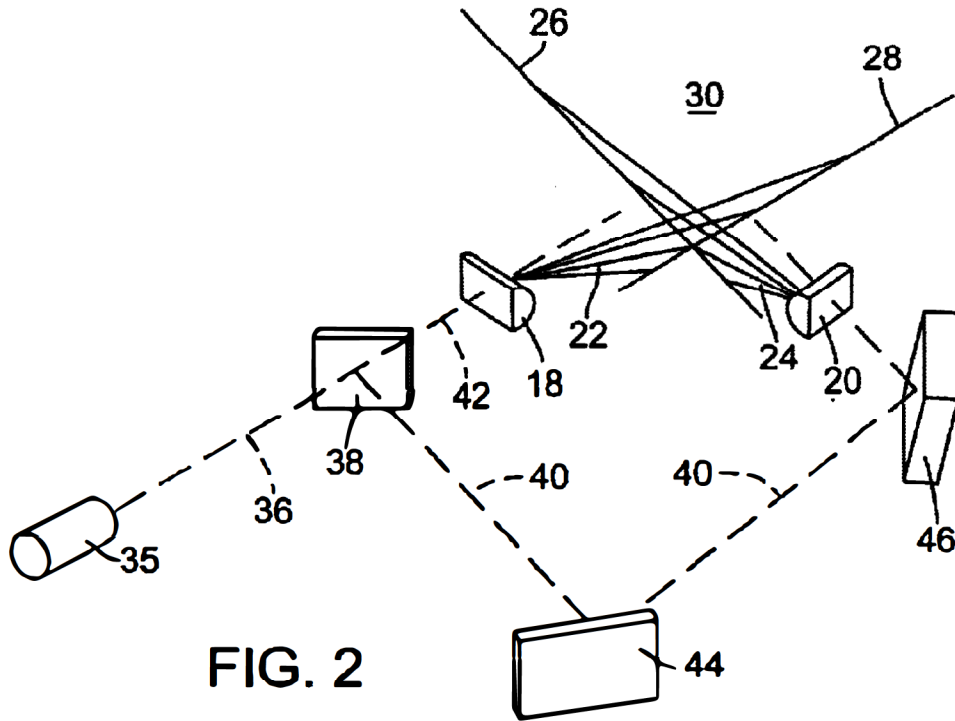


FIG. 1A



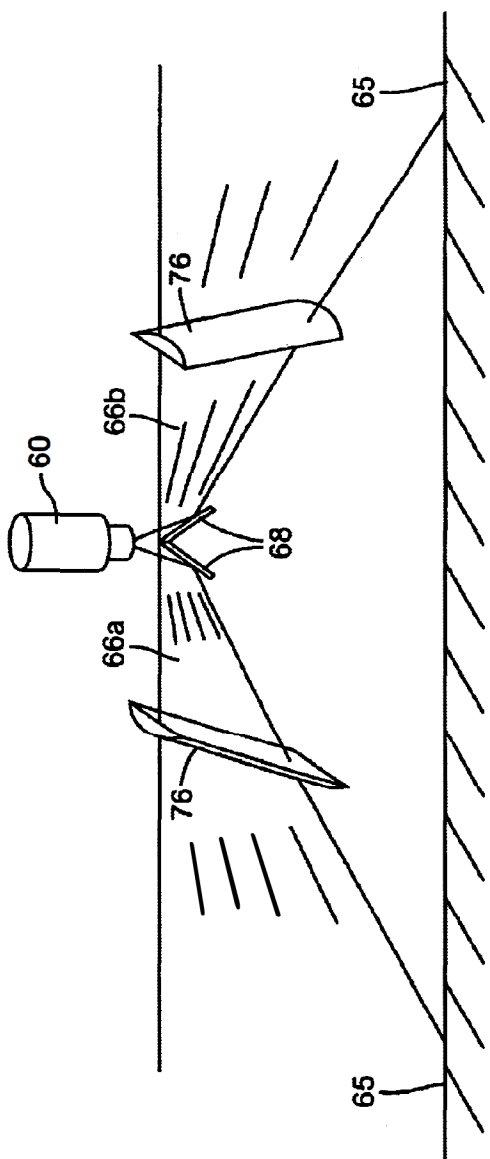


FIG. 3A

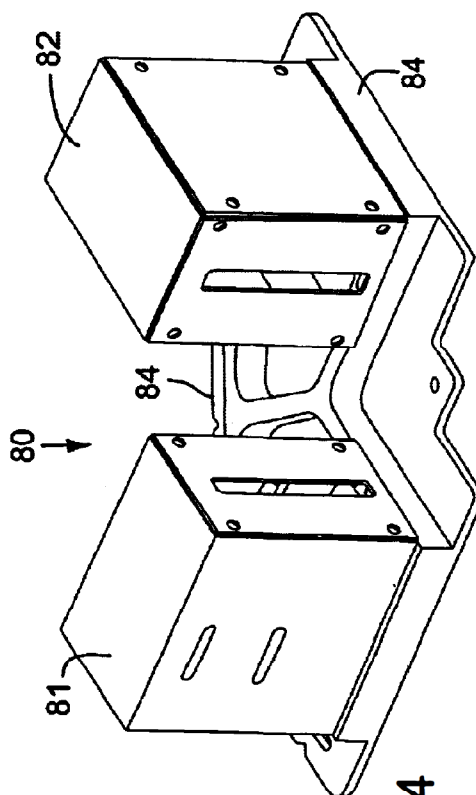


FIG. 4

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LASER PROJECTOR FOR PRODUCING INTERSECTING LINES ON A SURFACE

BACKGROUND OF THE INVENTION

The invention concerns optical layout or measuring equipment, and in particular encompasses a laser projector tool mounted on or placed against a surface, that produces intersecting lines on that surface without moving parts to project the lines, and with a visible line intersection displaced from the instrument housing, for more convenient use.

Laser-projecting instruments are well known in the field of surveying and construction layout and as measuring devices. Prior patents show several examples of such tools that project lines, primarily by rotating a beam to make an apparently solid line on a surface. Some such instruments have included two rotating projected beams to produce intersecting lines at right angles to each other. See, for example, U.S. Pat. Nos. 5,218,770 and 6,202,312 in which such devices are shown as prior art. See also U.S. Pat. No. 6,065,217.

It has also been known to form lines on a surface by placing a cylindrical lens in the path of a collimated laser beam, thus spreading a narrow beam of light into a planar fan of light that forms a line on a surface. Again, see U.S. Pat. No. 6,202,312 showing such instruments, and the disclosure of that patent is incorporated herein by reference, particularly as to discussion of prior art.

There have been laser tools that produce two lines with a visible intersection, such as described in U.S. Pat. No. 5,539,990, but with an important difference from the device of this invention. The prior tools produced the intersecting lines on a surface that is generally perpendicular to the surface on which the instrument rests.

Other laser reference tools have produced spots of light on a surface, rather than solid lines of light. For example, see U.S. Pat. No. 6,005,719.

See also copending application Ser. No. 09/684,696, now U.S. Pat. No. 6,502,319, owned by the assignee of this invention, showing generation of lines on a surface on which the instrument is placed.

It is among the objects of this invention to produce an efficient portable laser reference tool that generates at least two intersecting lines of laser light on a floor or other surface against which the tool is placed, with the intersection being displaced from the instrument and visible. An accompanying object is to generate such light beams and lines without the use of moving parts, such as spinning lasers or mirrors.

SUMMARY OF THE INVENTION

A portable construction layout tool generates laser beams in two directions related by a specific angle, such as 90°. The instrument emits two fans of light in such a way as to project a pair of lines on a floor, wall or other surface on which the tool is mounted, with the intersection of the two fans being visible rather than being a "virtual" intersection inside or below the instrument, thus enabling easier setup. Compared to rotating-beam instruments, the disclosed device is simpler by avoiding moving parts, and provides for better visibility. In a preferred embodiment the non-collimated beam from a laser diode is used, and is passed through a cylinder lens to converge the beam on the narrower axis to generate the desired fan of light to be projected as a line.

In one embodiment two different laser diodes and lenses are used to generate the two fans of light, and in another

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embodiment a single laser diode is employed, with optics to produce the two fans of light.

It is thus a primary object of the invention to provide a rugged and reliable laser instrument, without moving parts, to produce at least two lines of light on the floor or other surface on which the instrument is mounted or placed, with the intersection of the two lines visible to the user. These and other objects, advantages and features of the invention will be apparent from the following description of a preferred embodiment, considered along with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic perspective view showing an implementation according to one embodiment of the invention.

FIG. 1A is a view similar to FIG. 1 but with different optics.

FIG. 2 is a similar schematic perspective view showing an implementation according to another embodiment of the invention.

FIG. 3 is another schematic perspective view showing a further implementation of the invention involving a single laser diode.

FIG. 3A is a schematic side elevation view showing another embodiment, wherein the lines at 180° are produced.

FIG. 4 is a perspective view showing the exterior of an instrument according to one preferred embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention involves the use of two light beams combined to draw intersecting lines on the surface which the instrument is mounted or placed. The visible lines can be at a 90° angle or any other desired angle.

In FIG. 1, two lasers 10 and 12 produce collimated beams 14 and 16 which are passed through cylinder lenses 18 and 20 to generate fans of light 22 and 24 which produce lines of light 26 and 28 on a surface 30, which is the surface against which the instrument's housing (not shown in FIG. 1) is placed. The lasers and optics are housed in or fixed to a single structure and are mechanically aligned to the desired angle between the fans 22, 24 and the intersecting lines 26, 28. The lines 26, 28 intersect at a point 32 visible to the user, projected outside the instrument. Note that in the implementation of FIG. 1 the beams approaching the cylinder lenses are collimated.

FIG. 2 is an arrangement similar to FIG. 1, again utilizing two cylinder lenses 18, 20 to produce fans of light 22, 24 that project as intersecting lines 26, 28 on the surface 30. However, in this embodiment the fans of light are produced by a single laser 35 producing a single collimated laser beam 36. The beam 36 encounters a beam splitter 38 which partially reflects the beam at 40 and partially transmits the beam at 42. The reflected beam 40 is twice more reflected off mirrors 44 and 46, to pass through the cylinder lens 20 as shown (this could be done with only one reflection beyond the beam splitter by directing the beam 40 directly at the mirror 46, properly directed). In this embodiment, as in FIG. 1, the positions and orientations of the cylinder lenses, 20, can be manipulated relative to the axes of the approaching beams, 40 and 42, so as to optimize the projected lines, 26 and 28, for brightness and general quality on the projection surface, 30, the same surface on which the instrument may rest.

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