

United States District Court,  
W.D. New York.

**LASER DIODE ARRAY, INC.,**

Plaintiff.

v.

**PARADIGM LASERS, INC., et al,**

Defendants.

No. 96-CV-6581L

**Sept. 12, 2000.**

Owner of patents for laser diode arrays sued competitor for infringement. Construing disputed claim terms, the District Court, Larimer, Chief Judge, held that: (1) nonconductive "lower" substrate and conductive layer formed "over" it meant that one layer was applied or formed onto surface of the other; (2) requirement that diodes be disposed "substantially vertically" in formed grooves meant that diodes had to be perpendicular to horizon when array was lying on flat surface; and (3) requirement that emission face of diodes be "parallel to major surface" of conductive layer meant that surface of conductive layer had to be substantially planar and that plane of emission face of diodes had to be parallel to that surface.

Claims construed.

5,128,951, 5,521,936, 5,627,850. Cited.

Mark H. Fandrich, Karpinski, Stapleton & Fandrich, P.C., Auburn, NY, for Laser Diode Array, Inc.

Paul J. Yesawich, III, Harris, Beach & Wilcox, Rochester, NY, Ronald J. Kisicki, Harris, Beach & Wilcox, Syracuse, NY, Robert J. Bird, Robert J. Bird Law Firm, Penfield, NY, Neal L. Slifkin, Harris, Beach & Wilcox, Syracuse, NY, for Paradigm Lasers, Inc.

***DECISION AND ORDER***

**LARIMER, Chief Judge.**

**INTRODUCTION**

Laser Diode Array, Inc. ("LDAI"), the plaintiff in this patent infringement case, is the holder of United States Patent No. 5,128,951 ("the '951 patent"), which was issued on July 7, 1992 and is entitled, "Laser Diode Array and Method of Fabrication Thereof." LDAI alleges that defendant Paradigm Lasers, Inc. ("Paradigm") has infringed the '951 patent by virtue of its manufacture, use, sale, and offer for sale of laser diode arrays that infringe one or more claims of the '951 patent. LDAI seeks damages, injunctive and other

equitable relief, declaratory relief, and attorney's fees and costs.

The parties jointly requested that the court conduct a *Markman* hearing, *see* *Markman v. Westview Instruments, Inc.*, 517 U.S. 370, 116 S.Ct. 1384, 134 L.Ed.2d 577 (1996), in order to aid the court in construing the claims of the '951 patent. The court held that hearing on May 16, 2000. This Decision and Order constitutes my rulings on the disputed claims.

## **FACTUAL BACKGROUND**

The '951 patent relates to a laser diode array, which is a device that emits light in a laser beam. A laser diode array is formed by mounting together several laser diodes, which are small bars that, when energized, emit laser light into a lasing medium. The lasing medium absorbs the light and emits it in a laser beam. Laser diode arrays have various uses, including military and medical applications.

Several methods for constructing laser diode arrays have been used over the years. In one prior art method, known as "rack and stack," laser diode bars are paired with thermally and electrically conductive material, and the resulting pieces, in the form of a thin rectangular slab or rack, are soldered together in a stack.

In 1991, the United States Patent and Trademark Office ("PTO") issued United States Patent No. 5,040,187. The named inventor was Arthur A. Karpinski, LDAI's president. This patent, for a "monolithic laser diode array," describes a laser diode array in which a single piece of thermally conductive material has grooves cut into it, into which laser diodes are mounted. The claimed invention was said to be an improvement over the rack-and-stack method because, among other things, fewer assembly steps would be required, thus making production more efficient while maintaining a high level of reliability.

The following year, the PTO issued the '951 patent. Karpinski was again the named inventor. With reference to certain prior art, the patent stated that "it would be desirable to have a structure which did not require a separate metallization layer within the grooves into which the laser diodes are placed." Plaintiff's Opening Brief on the Issue of Claim Construction ("POB") Ex. A3, col. 1 lines 61-64. This refers to a process in which metal is applied to the sides of the grooves in order to provide electrical conductivity. One difference between the invention claimed in the '187 patent and that claimed in the '951 patent is that in the latter, a layer of electrically conductive material is provided over an electrically nonconductive substrate, and the grooves are then formed in the conductive material, thus obviating the need for a separate metallization process.

The '951 patent sets forth thirteen separate claims. Claims 1 and 9 are independent claims, and the rest are dependent claims. Claim 1 states:

What is claimed is:

1. A laser diode array comprising: a substantially nonconductive lower substrate; a conductive layer formed over said substantially nonconductive substrate, a plurality of grooves being formed in said conductive layer; and

a plurality of laser diodes disposed in said grooves, wherein said laser diodes are disposed substantially vertically in said grooves, such that an emission face of said diodes is parallel to a major surface of said conductive layer.

Claim 9 states that what is claimed is:

9. A monolithic laser diode array comprising:

a monolithic substrate having upper and lower portions, said lower portion of said substrate being substantially undoped and electrically nonconductive, and said upper portion being highly doped and electrically conductive, a plurality of grooves being formed in said upper portion; and

a plurality of laser diodes disposed in said grooves, wherein said laser diodes are disposed substantially vertically in said grooves, such that an emission face of said diodes is parallel to a major surface of said upper portion.

Id., col. 4 line 64-col. 5 line 7.

The patent contains several drawings illustrating laser diode arrays, either in three-dimensional representations or cross-sections. In each drawing, the array is shown as having flat surfaces that are parallel to or at right angles with each other, like a rectangle or six-sided polygon. *See Fig. 1.*

In May 1996, the PTO issued United States Patent No. 5,521,936 ("the "6 patent"), entitled "Radial Laser Diode Array." Timothy L. Irwin was listed as the inventor, and Paradigm as the Assignee. In this formulation, the array consists of a cylindrical diode array containing a laser rod surrounding by a segmented conductive ring with laser diodes between adjacent ring segments. *See Fig. 2.* FN1 Light is emitted from the diodes to the crystal laser rod, which then emits the light in a laser beam. It is that patent that LDAI alleges infringes the '951 patent. FN2

FN1. Figure 2 is taken from Defendant's Exhibit E from the *Markman* hearing.

FN2. On May 6, 1997, the PTO issued another patent owned by Paradigm, United States Patent No. 5,627,850 ("the '850 patent"). LDAI alleges that this patent also infringes on the '951 patent. For purposes of this Decision and Order, however, it is not necessary to give separate consideration to the '850 patent, since (1) the only issue presently before the court is the meaning of certain terms in the '951 patent, and (2) to the extent that the design of Paradigm's arrays is relevant to that issue, the inventions claimed in the "6 patent and the '850 patent are sufficiently similar that separate consideration need not be given to each of them.

## DISCUSSION

### I. Claim Construction-General Standards

[4] [5] "[S]econd, it is always necessary to review the specification to determine whether the inventor has used any terms in a manner inconsistent with their ordinary meaning. The specification acts as a dictionary when it expressly defines terms used in the claims or when it defines terms by implication." Vitronics, 90 F.3d at 1582; *Markman*, 52 F.3d at 979. Because the specification contains a written description of the

invention which must be clear and complete enough to enable those of ordinary skill in the art to practice the invention, the specification "is the single best guide to the meaning of a disputed term." Vitronics, 90 F.3d at 1582.

"Third, the court may also consider the prosecution history of the patent, if in evidence." *Id.* The Court of Appeals for the Federal Circuit has described the prosecution history as "often of critical significance in determining the meaning of the claims." *Id.* (citing Markman, 52 F.3d at 980).

[6] [7] [8] If this "intrinsic" evidence, *i.e.* the claims, the specification, and the prosecution history, is unambiguous, the court may not look to other, extrinsic evidence. Elkay Mfg. Co. v. Ebco Mfg. Co., 192 F.3d 973, 976-77 (Fed.Cir.1999); Pitney Bowes, Inc. v. Hewlett-Packard Co., 182 F.3d 1298, 1308-9 (Fed.Cir.1999); Vitronics, 90 F.3d at 1583. Extrinsic evidence is that evidence which is external to the patent and file history, such as expert testimony, inventor testimony, dictionaries, and technical treatises and articles. Vitronics, 90 F.3d at 1584. The court may receive extrinsic evidence to educate itself about the invention and the relevant technology, but it may not use extrinsic evidence to arrive at a claim construction that is clearly at odds with the construction mandated by the intrinsic evidence. *See Key Pharm. v. Hercon Labs. Corp.*, 161 F.3d 709, 716 (Fed.Cir.1998). Extrinsic evidence, then, may be used only to help the court come to the proper understanding of the claims; it may not be used to vary or contradict the claim language.

## **II. Disputed Terms in the Case at Bar**

After exchanging expert reports on the issue of claim construction, plaintiff and defendant were able to agree on which particular claim terms are in dispute here and are to be construed by the court. Those terms (in *italics*) are:

A laser diode array comprising: a substantially nonconductive *lower* substrate; a conductive layer formed *over* said substantially nonconductive substrate, a plurality of grooves being formed in said conductive layer; and a plurality of laser diodes disposed in said grooves, wherein said laser diodes are disposed *substantially vertically* in said grooves, such that an emission face of said diodes is *parallel to a major surface* of said conductive layer. FN3

FN3. Although some other terms in the claim were initially identified as disputed (*e.g.* "grooves"), there was no expert testimony concerning these claims presented at the hearing, at which the parties focused on the three sets of claim language construed in this Decision and Order, and those other terms no longer appear to be at issue in this case.

### **A. "Lower Substrate" and "Conductive Layer Formed Over Said ... Substrate"**

[9] The disputes concerning these two terms are closely connected because a determination of the meaning of one term will almost automatically yield a determination of the meaning of the other. Paradigm contends that these terms connote a horizontal, planar surface only, so that the conductive layer is literally over, or on top of, the nonconductive substrate. In Paradigm's view, the conductive layer in its cylindrical array is not formed "over" the nonconductive layer, but *inside* it. Paradigm asserts that the nonconductive layer in its array is not "lower" than the conductive layer, but rather is an outer ring.

LDAI disagrees. According to LDAI, when the conductive layer is formed onto the surface of the nonconductive layer, it is formed "over" the nonconductive layer, regardless of whether the structure is

planar or cylindrical.

After reviewing the evidence, and in particular the claims of the '951 patent itself, as well as the expert testimony concerning how these terms would be understood by a person of ordinary skill in the art, I agree with LDAI's interpretation of these terms. I believe that the words "lower" and "over," as used in the patent, do not mean that one layer is physically above, or higher than the other, but simply that one layer is applied or formed onto the surface of the other.

The word "over" has many different meanings. When used to describe the relative position of two objects, it can mean that one object is physically higher than the other, *e.g.*, "the lamp hangs over the table." It can also be used, however, to connote that a surface is covered with some substance. If one were to say, for example, "the ceiling was stained, so I painted over it," that would not mean that the person painted *above* the ceiling, but only that he covered its surface with paint. In that example, the paint would, strictly speaking, physically be *beneath* the ceiling.

In my view, that is a more logical interpretation of the terms at issue here. The patent indicates that one begins with a nonconductive layer, and then forms a conductive layer "over" it. That simply means that one surface of the nonconductive layer is covered with a conductive layer. The fact that the nonconductive layer may be cylindrical does not mean that it cannot be covered "over" in this manner.

Likewise, the nonconductive layer can be described as "lower" than the conductive layer for the same reason: the conductive layer has been formed "over" it. Again using the analogy of a painted ceiling, one could speak in terms of what lies "beneath" the surface of the paint, even though the ceiling itself is physically higher off the ground than the paint that covers it.

Paradigm's interpretation of these terms is not persuasive, because according to Paradigm's logic, one could theoretically construct a laser diode array exactly like those made by LDAI, flip it upside down, and claim that it does not infringe the '951 patent because the conductive layer is physically lower than the nonconductive layer. Such a result is obviously absurd. Clearly, then, these terms are not meant so much to describe the physical position of these layers, but rather the *order* in which they are formed. The nonconductive layer is formed first, and then the conductive layer is formed "over" it, *i.e.*, on the surface of the nonconductive layer.FN4 I conclude, therefore, that as used in Claim 1 of the '951 patent, "lower substrate" refers to the base or foundation on which the rest of the structure is built, and "conductive layer formed over" the substrate means that the conductive layer covers the surface of the substrate.

FN4. I also note that, as pointed out by LDAI, Paradigm's arrays are actually constructed of two identical pieces, each of which is shaped roughly like a half-cube with a semicylindrical concavity running along one side. Those pieces are made of a nonconductive material, and the concave surface is covered with a conductive layer. The two pieces are then joined together, with the concavities facing each other, to make the final product. See Fig. 3 (taken from the drawing sheets of the '850 patent). Even using Paradigm's own interpretation of these claim terms, then, the two halves, considered individually, could arguably be considered to have a conductive layer "over" the "lower" nonconductive layer.

## B. "Disposed Substantially Vertically in Said Grooves"

[10] The parties also dispute what the word "vertically" means in the context of this claim language.

Paradigm contends that "vertically" is an absolute term that means that the diodes are vertical in relation to the horizon, *i.e.* that they are perpendicular to the horizon when the array is lying on a flat surface. In Paradigm's view, anything that is "vertical" runs along an imaginary axis running through the center of the earth.

LDAI, on the other hand, takes the position that "vertically," as used in the '951 patent, is a relative term that refers to the position of the diodes with respect to the grooves themselves. In other words, "disposed substantially vertically in said grooves" means that the bars do not "tilt" very much within the grooves. LDAI also contends that the diodes in Paradigm's arrays are "vertical" with respect to the point at which they meet the surface of the conductive layer, since they are directed toward the center of the cylinder.

With respect to this language, I find Paradigm's interpretation more persuasive. For one thing, I believe that the common-sense understanding of "vertical" or "vertically" is that those words convey a sense of perpendicularity with respect to the surface of the earth. Those words are commonly understood to refer to an object's orientation with respect to the earth itself, not to individual objects on the earth. Thus, if a person, standing erect, were to aim a laser beam directly away from himself, *i.e.* at a right angle to his body, one would not describe the beam as traveling vertically, but horizontally. If one wanted to describe the path of the beam relative to the person aiming it, one would describe it as traveling perpendicularly to that person.

In essence, then, LDAI's interpretation of this language seeks to equate verticality with perpendicularity. Under the terms of the '951 patent, however, the grooves themselves are vertical, *i.e.* perpendicular to the horizon, when the array is at rest on a flat surface, and the clear implication of "disposed substantially vertically" is that the bars are likewise vertical; in other words, the bars are not placed in the grooves crosswise or horizontally, but vertically, like the grooves themselves. In a device like Paradigm's, LDAI's interpretation would mean that the bars are all vertical at once, even though none of them is parallel to the bars adjacent to it. That simply makes no sense. Even assuming that an object can have its own verticality independent of reference to the earth's horizon (*e.g.* a piece of graph paper may have a "vertical" y axis drawn on it even though that paper is lying flat on a table, so that the y axis is actually horizontal with respect to the earth), it is difficult to see how it can have multiple verticalities, which is essentially what LDAI contends.

In short, LDAI's interpretation is not supported by the claim language, and nowhere do the specifications suggest that the word "vertically" is being used in a manner inconsistent with its ordinary meaning. See Vitronics, 90 F.3d at 1582; *cf. Fireplace Mfrs. v. Hearth Techs.*, No. 4-96-1080, 1997 U.S.Dist. LEXIS 21966 (D.Minn. Dec. 10, 1997) ("The phrase 'horizontal exhaust pipe' must be given its ordinary meaning. Nothing in the claims, specification, or prosecution history suggests otherwise. In short, 'horizontal' means 'horizontal'; it does not mean 'horizontal and vertical,' 'angled,' or even 'substantially horizontal.' "). I conclude that as used in the '951 patent, "vertically" means that the bars are disposed substantially in a vertical direction, *i.e.*, a direction that is perpendicular to the plane of the horizon, or parallel to a plumb line through the center of the earth, when the array is resting on a flat, horizontal surface.

### C. "Parallel to a Major Surface of Said Conductive Layer"

[11] The parties also disagree about the proper construction of the word "parallel" as it is used to describe the position of the emission face of a diode with respect to a "major surface" of the conductive layer. LDAI takes the position that this language covers curved surfaces as well as flat ones. LDAI contends that where a

major surface extends along an axis, and an emission face of a diode bar follows that same axis along the length of the bar, the major surface and the diode bar are both parallel to the axis, and hence to each other. To put it another way, using Paradigm's array as an example, an imaginary line (the "z axis," in Paradigm's words) runs through the center of the cylinder. Any line that runs through the conductive surface, *i.e.* through corresponding points at either end of the cylinder, is parallel to the z axis. Likewise, the emission faces also run parallel to that axis, *i.e.* they remain equidistant from the axis throughout their length. In LDAI's view, that makes the emission faces and the surface of the conductive layer parallel to each other as well.

Paradigm disagrees. Paradigm asserts that under the laws of geometry, a flat surface can never be parallel to a curved surface. According to Paradigm, the whole concept of parallelism is based on linear or planar geometry. Paradigm's expert, Dr. Richard W. Dixon, who testified at the *Markman* hearing stated that, a "curved surface cannot be parallel to a plane." Transcript ("Tr.") at 149. He added that "parallel is defined to be a term that applies to straight lines and planes. So two planes can be parallel.... [B]ut you can't have a spherical surface or a cylindrical surface parallel to a plane." Tr. at 153.

I find Paradigm's position more persuasive. I credit Dr. Dixon's statements that as a simple matter of geometry, a curved surface cannot be parallel to a curved surface. The concept of parallelism implies that two parallel objects are everywhere equidistant. *See, e.g.*, Webster's Third New International Dictionary (Unabridged) (1981) at 1637 (defining "parallel" as, *inter alia*, "extending in the same direction and everywhere equidistant," and "everywhere equally distant"). At different points on a curved surface, however, a neighboring flat surface will be different distances away, even if it runs in the same direction. Even if parallelism does not completely exclude all curved surfaces ( *e.g.* arguably two concentric cylinders might be considered parallel to each other), I do not see how that concept can be applied to both a curved surface and a planar surface.

True, the planar and curved surfaces at issue here—the emission faces and surface of the conductive layer in Paradigm's arrays—run in the same direction. As stated, however, parallelism requires more than that. If a cylinder of infinite length shared a line in common with a plane, one would not describe them as parallel, but as tangent to each other. *Id.* at 2337 (defining "tangent" as "having a common tangent line at a point—used of two curves in a plane, two space curves, or a *surface and a space curve* "). In fact, in his testimony at the hearing, LDAI's own expert, Dr. J. Stanley Whiteley, conceded that in a diagram in his expert report, which uses tangent lines to demonstrate the relative positions of the emission faces and the major surface of the conductive layer, *see* POB Ex. A at 22 (Fig.4), the major curved surface was not parallel to surface of the emission face. Tr. at 115.

LDAI's attempt to reduce this concept to geometric lines running through the respective surfaces distorts the fact that we are *not* in fact dealing with lines, *i.e.* with one-dimensional objects, but with two- and three-dimensional objects: planes and cylinders, or at least planar and cylindrical objects. To focus on the fact that any given line running the length of the cylinder is parallel to any line running the length of the emission face, then, is to sidestep the real question, which is whether the cylinder itself can be considered parallel to the emission faces. After considering all the evidence, including the expert reports and testimony, I do not believe that a person of ordinary skill in the art would understand the word "parallel," as used in the '951 patent, to cover both curved and flat surfaces. I conclude, then, that this claim language requires that the surface of the conductive layer be substantially planar and that the plane of the emission face of the diodes be parallel to that surface.

## **CONCLUSION**

For the abovestated reasons, the disputed claim terms of United States Patent No. 5,128,951 are construed as stated in the body of this Decision and Order. At trial, the jury will be instructed on the meaning of those terms consistent with the court's construction of the terms at issue.

IT IS SO ORDERED.

## **FIGURE 1**

FIGURE 1

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FIG. 1A

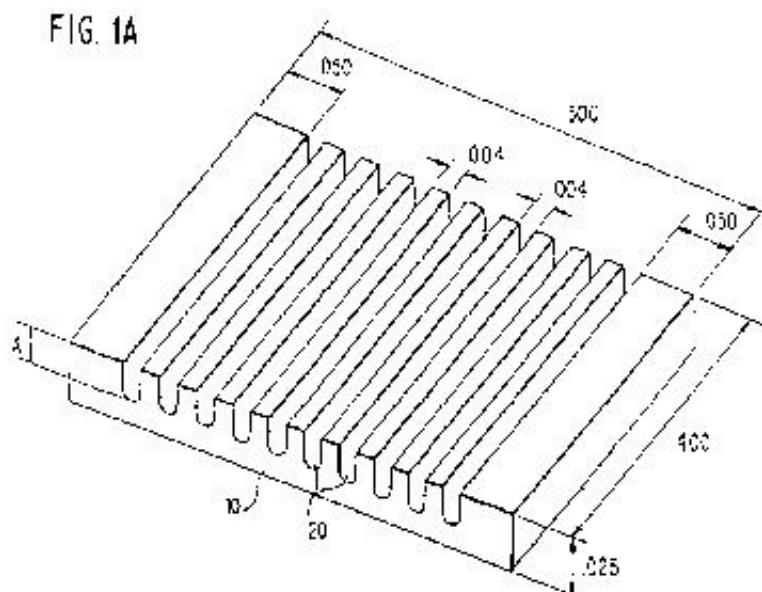


FIG. 1B

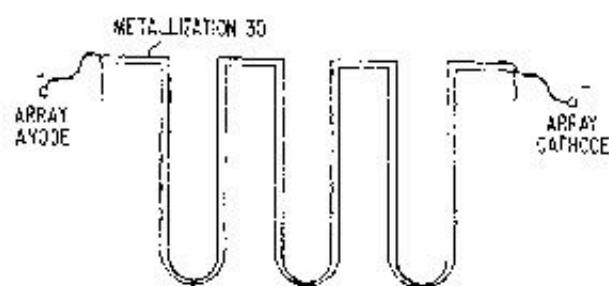


FIG. 1C

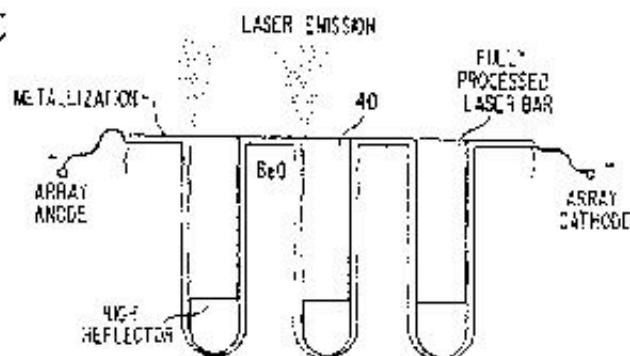


FIG. 2A

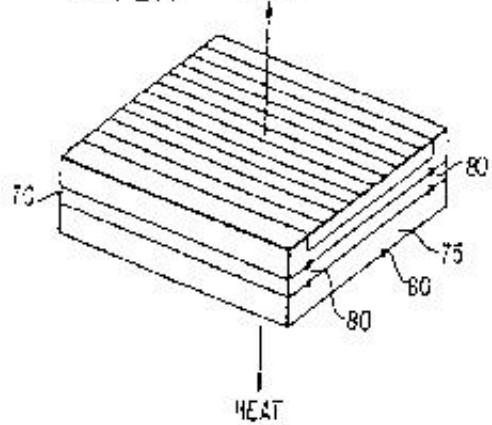


FIG. 2B

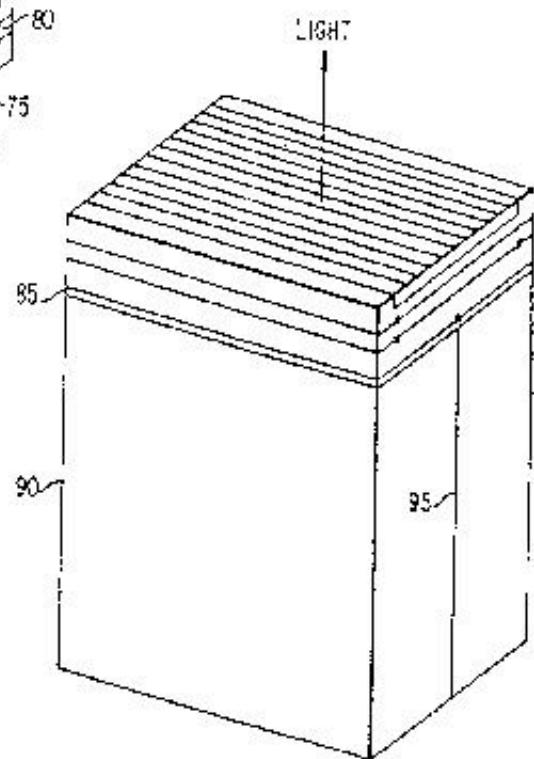


FIG. 3A

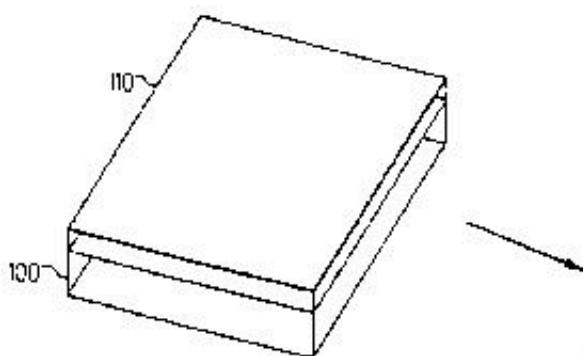


FIG. 3B

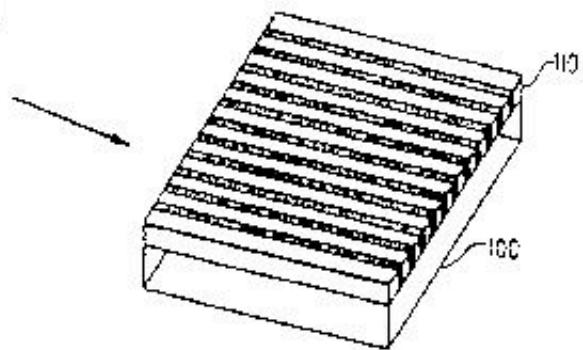


FIG. 4

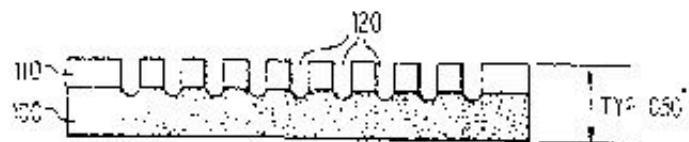


FIG. 5

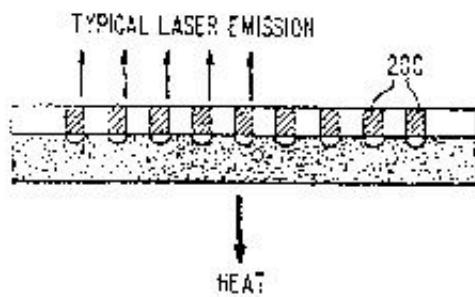


FIG. 6

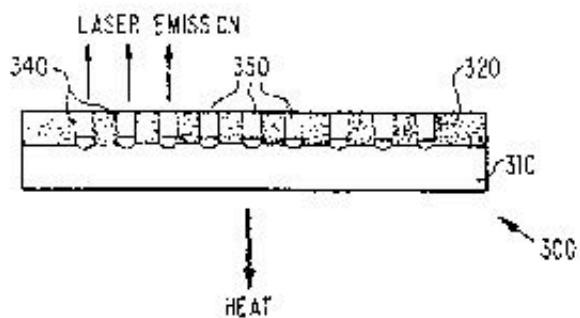


FIG. 7A

FIG. 7A

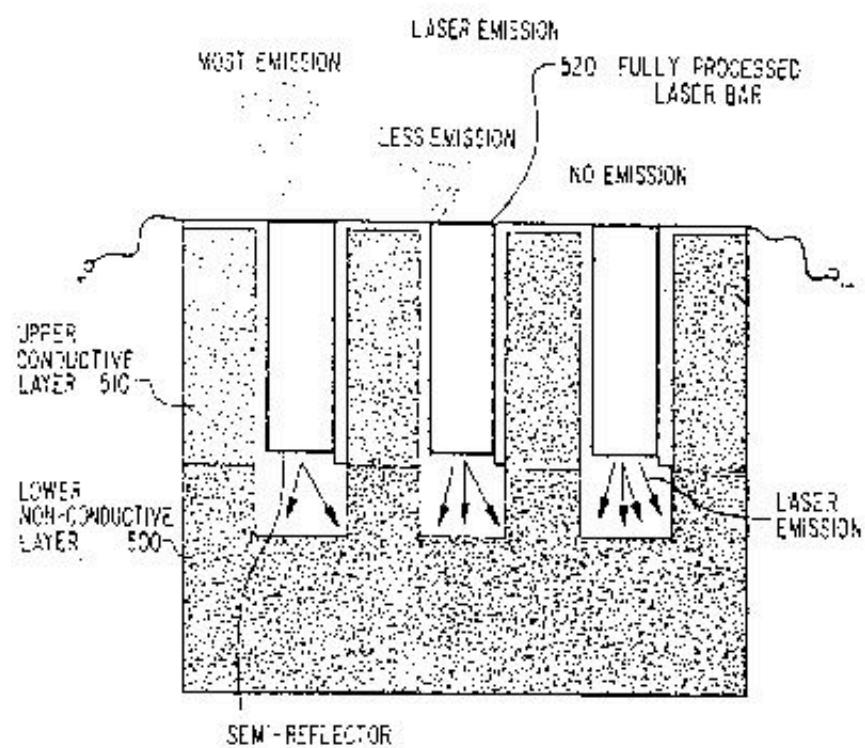


FIG. 7B

FIG. 7B

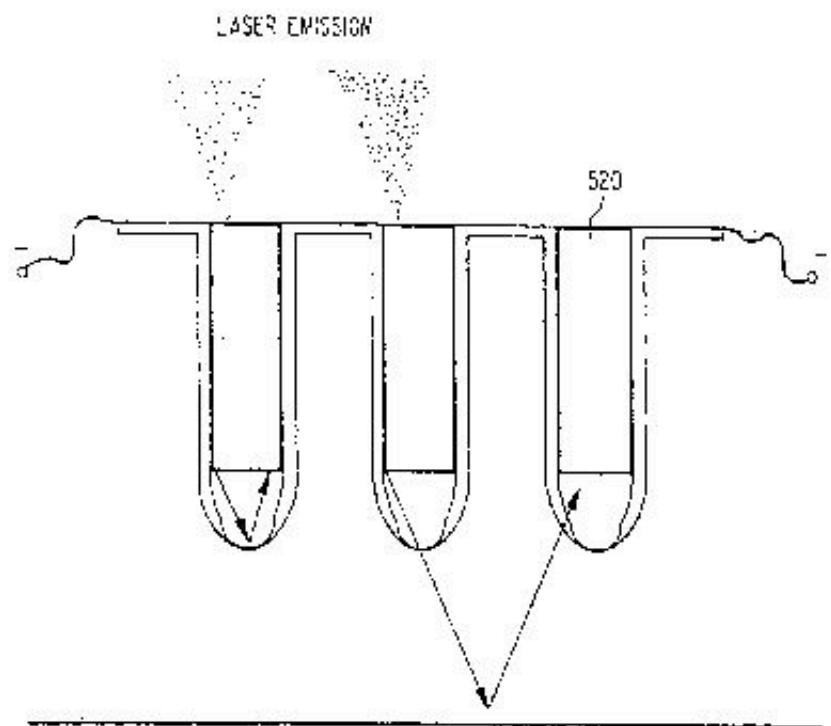


FIGURE 2

FIGURE 2

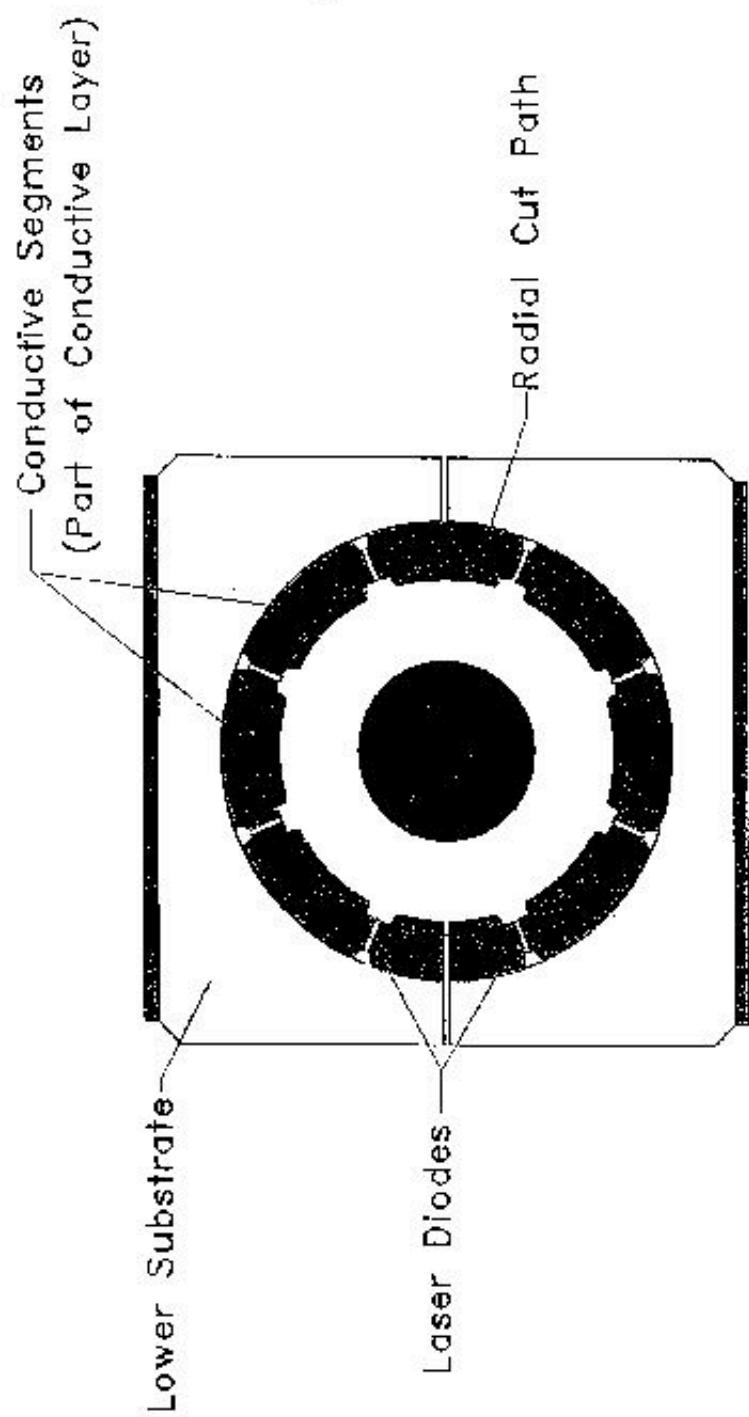


FIGURE 3

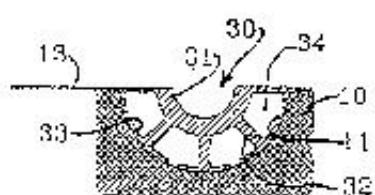


FIGURE 6.

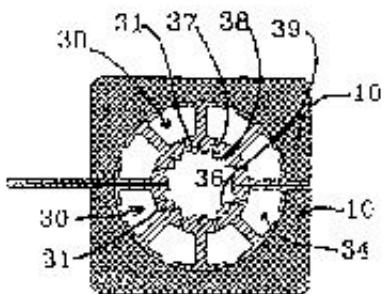


FIGURE 7.

FIG. 4. FIG. 5(a)

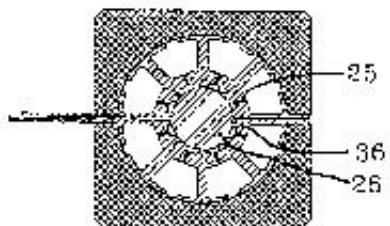


FIGURE 8.

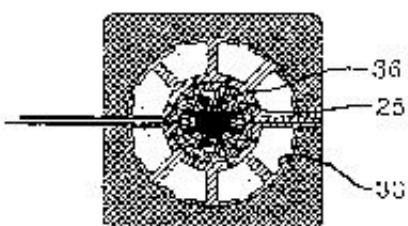
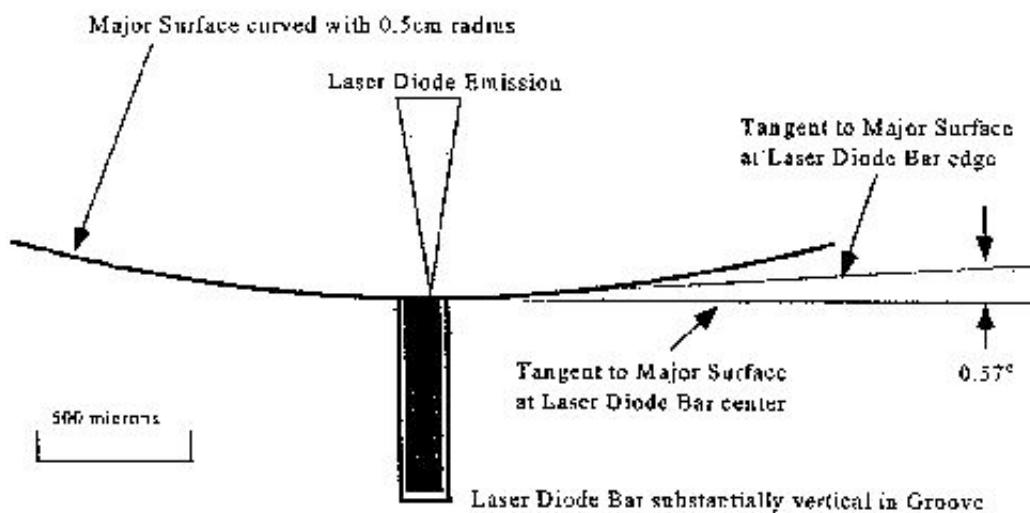


FIGURE 9.

FIGURE 4

FIGURE 4



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