THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

Paper No. 22

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte STEVEN P. SLINKER,
RICHARD F. HUBBARD,
MARTIN LAMPE,
and GLENN JOYCE

Appeal No. 97-0866
Application 07/801,248[1]

ON BRIEF

Before BARRETT, TORCZON, and LALL, Administrative Patent Judges.

BARRETT, Administrative Patent Judge.

---

[1] Application for patent filed December 3, 1991, entitled "Method And Apparatus For Transporting An Intense Ion Beam."

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the final rejection of claims 1-10.

We reverse.

BACKGROUND

The disclosed invention is directed to a method and apparatus for transporting an intense positive ion beam to a distant target.

Claim 1 is reproduced below.

> 1. An apparatus for transporting an intense ion beam comprising:
>
> means for creating a plasma channel in a gas;
>
> means for injecting a positive ion beam into said channel at a mildly-relativistic mean velocity;
>
> wherein the magnitude and direction of current caused by propagation of said beam in said channel, the magnitude of charge density in said beam, the magnitude of charge density in said plasma channel, and said mean velocity of ions in said ion beam are effective to create net currents within said beam sufficient to pinch said ion beam.

The examiner relies on the following prior art:

Ashkin	3,808,432	April 30, 1974
Linlor	4,246,067	January 20, 1981

Winterberg, Focusing of an Intense Relativistic Electron Beam by a Hollow Conical Laser Beam, Z. Naturforsch, 30a, 1975, pages 976-980 (hereinafter Winterberg (1975)).

Winterberg, Super-ion-beam accelerator for the ignition of thermonuclear reactions, J. Plasma Physics, 1980, vol. 24, part 1, pages 1-14 (hereinafter Winterberg (1980)).

Miller et al. (Miller), Observation of Plasma Wake-Field Effects during High-Current Relativistic Electron Beam Transport, Physical Review Letters, September 23, 1991, vol. 67, no. 13, pages 1747-1750.

Claims 1-10 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which appellants regard as their invention. The examiner states that it is unclear what constitutes a "mildly-relativistic beam" or an "intense ion beam" (Examiner's Answer, page 3).

Claims 1-4 and 6-9 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Linlor or, in the alternative, under § 103 as being unpatentable over Linlor and Ashkin.

Claims 1-10 stand rejected under 35 U.S.C. § 103 as being unpatentable over Linlor, Ashkin, and Miller. Miller is applied only for the specific limitations of claims 5 and 10.

Claims 1-10 stand rejected under 35 U.S.C. § 103 as being unpatentable over Winterberg (1975) and Winterberg (1980).

We refer to the Examiner's Answer (Paper No. 19) (pages referred to as "EA__") for a statement of the examiner's position and to the Brief (Paper No. 18) (pages referred to as "Br__") and the Reply Brief (Paper No. 20) for a statement of appellants' position.

OPINION

35 U.S.C. § 112, second paragraph

Appellants argue that "[t]he definition of 'mildly relativistic' appears in Appellants' specification at p. 5, and indicates speeds sufficiently below the speed of light that the electric field generated by the charge will precede the ion beam and pull oppositely charged particles from the surrounding plasma axially along the direction the [sic] of the ion beam" (Br4). This sets a top speed for $=v/c, the ratio of the velocity to the speed of light, i.e., "[t]he term $ must not be so close to the speed of light that the electric field from beam 26 cannot significantly outrun the beam itself" (specification, page 9). The examiner's remarks that the specification is vague and indefinite (EA5) do not try to explain why the result, the electric field must be able to precede the ion beam, is not sufficiently definite to define the term. In addition, appellants state that pinching will occur at least within the range of $=0.3 to 0.8 (specification, page 9), which is another indication of what is meant by "mildly relativistic." Accordingly, this reason for the § 112, second paragraph, rejection is reversed.

Appellants argue that the term "intense ion beam" is art recognized and means a beam in which self-induced fields are significant (Br4). Appellants note that both Winterberg references use the term "intense" in connection with electron and ion beams without further explanation, indicating that the term is intrinsically clear to readers of particle beam literature (Br4). The examiner does not address this reasoning, but maintains that appellants have not provided a definition. Patent disclosures are addressed to those of ordinary skill in the art. We are persuaded by the fact that the Winterberg references disclose "intense" beams, that one of ordinary skill in the particle beam art would have known what was meant without a numerical definition. This reason for the § 112, second paragraph, rejection is reversed.

35 U.S.C. § 102(b)

Linlor discloses an apparatus and method to produce nuclear fusion. High energy beams of neutral deuterium atoms ($^{2}_{1}H$ or D) and tritium atoms ($^{3}_{1}H$ or T) or high energy beams of molecular ions, D^{2+} and T^{2+}, are injected along the axis of the machine and are irradiated by laser beams so that a change in charge state occurs (e.g., col. 8, lines 43-48; col. 22, lines 37-41). The deuterium atoms are ionized into deuterons (D^{+}) and the tritium atoms are ionized into tritons (T^{+}). When injecting molecular ions, the molecular ion D^{2+} is ionized into the neutral atom D and D^{+} ion and the neutral atom D is subsequently ionized into a D^{+} ion and an electron (col. 19, lines 29-39); a similar ionization reaction occurs for T^{2+}. The deuterium atom or deuteron velocity is sufficiently great to overtake the tritium atom or triton at a relative velocity which produces a high fusion reaction cross section. The fusible ion beams of deuterons and tritons, together with electrons for space-charge neutralization, constitute a "moving-plasma" (col. 8, lines 19-22). Thus, it appears that positive ion beams are injected into a plasma channel created along the machine axis. Linlor states (col. 8, approx. lines 31-35): "Because both the deuteron and triton beams have the same direction relative to the machine axis, the combined current produces a magnetic field surrounding it, which serves to provide confinement for the individual ions and the space-charge-neutralizing electrons." The confining effect is also discussed at col. 3, line 61 to col. 4, line 36 (under section 2 of novel features of the invention) and col. 17, lines 36-46. Thus, the positive ion beams are pinched.

Appellants argue that Linlor does not teach injecting ions at "a mildly relativistic mean velocity." The examiner finds that Linlor's "mean velocity of the ions falls within the claimed range, as the claim language 'mildly relativistic mean velocity' is best understood" (EA5), where the examiner has interpreted "mildly relativistic mean velocity" to be a velocity "between zero and the speed of light" (emphasis omitted) (EA5). The examiner's interpretation is in error because "mildly relativistic mean velocity" requires a velocity which is a significant fraction of the speed of light, e.g., \$=0.3 to 0.8. Linlor describes a deuterium atom velocity of $12x10^{8}$ cm/s (col. 5, line 19; col. 13, lines 67-68; col. 16, line 51), which is assumed to be the injected velocity; we assume the injected velocity would be the same for the D_2^+ molecular ion. This is ($12x10^{6}$ m/s)/($3x10^{8}$ m/s) = 0.04c, where c is the speed of light. This is not a "mildly-relativistic mean velocity." The finding of anticipation is in error and the § 102(b) rejection of claims 1-4 and 6-9 is reversed.

<u>35 U.S.C. § 103</u>

<u>Linlor and Ashkin</u>

The examiner applies Ashkin as evidence that "the laser would accelerate the positive ion beam" (EA3) and "[t]herefore, the positive ions would inherently have had a mildly-relativistic mean velocity" (EA3). <u>First</u>, Ashkin does not describe acceleration of particles to "mildly-relativistic mean velocities." One of the fastest speeds is "velocities between 10^{7} and 10^{8} centimeters per second" (col. 6, lines 6-7), which is well below the speed of light. Second, since the lasers in Linlor are directed counter to the ion beam velocity it is not understood how the examiner thinks the lasers will accelerate the ion beams. The examiner has not made a prima facie showing that the lasers in Linlor will accelerate the ions to a mildly-relativistic mean velocity. The rejection of claims 1-4 and 6-9 under § 103 over Linlor and Ashkin is reversed.

Linlor, Ashkin, and Miller

Miller is applied to show an organic gas and a KrF laser as recited in claims 5 and 10. Miller adds nothing to the rejection over Linlor and Ashkin as to the independent claims 1 and 6. The rejection of claims 1-10 over Linlor, Ashkin, and Miller is reversed.

Winterberg (1975) and Winterberg (1980)

The examiner finds (EA4):

> Winterberg (1975) discloses apparatus and method for creating a plasma channel and injecting a relativistic electron beam into the channel. Winterberg discloses a laser surrounding the electron beam (page 977, figure 2). Hence, the beam would be injected into a laser generated plasma channel.

Winterberg (1975) discloses an annular laser beam in a vacuum (page 977); it does not disclose that the laser beam generates a "plasma channel in a gas" through which the electron beam passes. Winterberg (1975) discloses that the annular laser beam is focused on the target a short time before the electron beam and forms a narrow convergent annular plasma channel (page 977) after which the electron beam transforms the target into a highly conducting plasma (page 979). The electron beam is confined by the plasma and is focused down to a small diameter as it approaches the vertex point (page 979). Therefore, Winterberg (1975) does not teach "creating a plasma channel in a gas" or injecting an electron beam into the plasma channel. Further, the electron beam in Winterberg (1975) is pinched by the plasma created by the annular laser beam and is not pinched because of a net current as recited in the claims. The rejection starts based on a number of erroneous findings.

Winterberg (1975) states that it is possible "to abandon electron beams altogether and instead use intense ion beams" (page 3). The examiner states that it would have been obvious to modify Winterberg (1975) to use a positive ion beam to achieve the advantages notes in the paragraph bridging pages 3 and 4 of Winterberg (1980). Appellants argue that the examiner's rejection provides no factual basis for combining the references (Br6), that the examiner does not show an ion beam with a mildly relativistic mean velocity (Br6), and does not explain how Winterberg (1980) teaches how to use ion beams instead of electron beams (Br7). We agree with appellants that the examiner reasoning fails to establish a prima face case of obviousness. Winterberg (1980) does not disclose or suggest making self-pinched, mildly-relativistic velocity positive ion beams. As noted in the preceding paragraph, Winterberg (1975) is deficient in teaching creating a plasma channel and creating a beam that is pinched because of net currents in the beam. Thus, even if the references were combined, they would not suggest the claimed invention. The rejection of claims 1-10 under Winterberg (1975) and Winterberg (1980) is reversed.

CONCLUSION

The rejections of claims 1-10 are reversed.

REVERSED

LEE E. BARRETT)
Administrative Patent Judge)
)
)
)
) BOARD OF PATENT
RICHARD TORCZON) APPEALS
Administrative Patent Judge) AND
) INTERFERENCES
)
)
)
PARSHOTAM S. LALL)
Administrative Patent Judge)

Appeal No. 97-0866
Application 07/801,248

Thomas E. McDonnell
DEPARTMENT OF THE NAVY
Counsel for the
Naval Research Laboratory
Washington, DC 20375-5000