US006098924A

United States Patent [19]

Woodward et al.

[11] **Patent Number: 6,098,924**

[45] **Date of Patent: Aug. 8, 2000**

[54] **METHOD AND APPARATUS FOR GENERATING PROPULSIVE FORCES WITHOUT THE EJECTION OF PROPELLANT**

[75] Inventors: **James Woodward**, Anaheim; **Thomas Mahood**, Irvine, both of Calif.

[73] Assignee: **California State University, Fullerton Foundation**

[21] Appl. No.: **09/236,188**

[22] Filed: **Jan. 23, 1999**

[51] **Int. Cl.**[7] **B64D 35/00**

[52] **U.S. Cl.** **244/62**; 244/172

[58] **Field of Search** ..... 244/62, 53 R, 244/172

[56] **References Cited**

U.S. PATENT DOCUMENTS

5,280,864 1/1994 Woodward 244/62

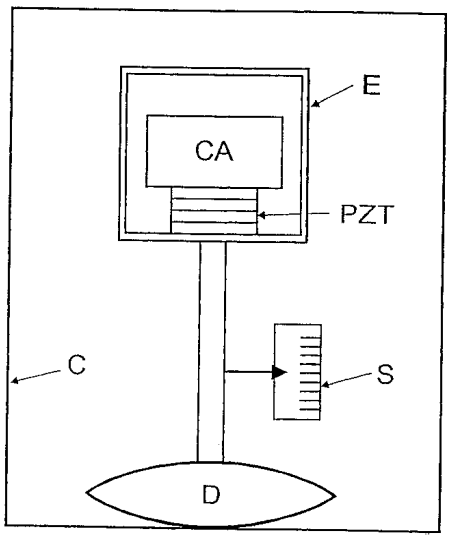
Primary Examiner—Galen L. Barefoot

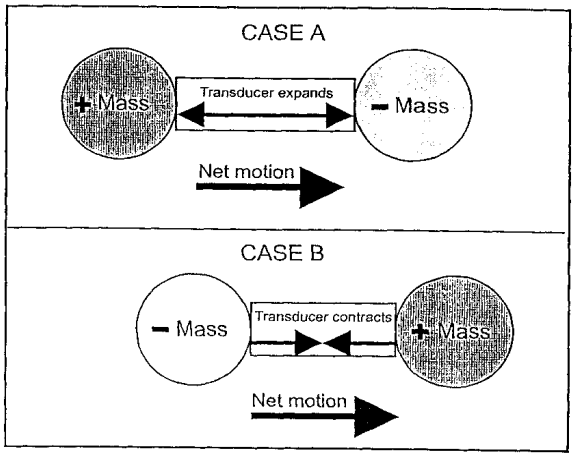
Attorney, Agent, or Firm—Leonard Tachner

[57] **ABSTRACT**

Mach's principle and local Lorentz-invariance together yield the prediction of transient rest mass fluctuations in accelerated objects. These restmass fluctuations, in both principle and practice, can be quite large and, in principle at least, negative. They suggest that exotic space time transport devices may be feasible, the least exotic being "impulse engines", devices that can produce accelerations without ejecting any material exhaust. Such "impulse engines" rely on inducing transient mass fluctuations in conventional electrical circuit components and combining them with a mechanically coupled pulsed thrust to produce propulsive forces without the ejection of any propellant. The invention comprises a method of producing propellant-less thrust by using force transducers (piezoelectric devices or their magnetic equivalents) attached to resonant mechanical structures. The force transducers are driven by two phase-locked voltage waveforms so that the transient mass fluctuation and mechanical excursion needed to produce a stationary thrust are both produced in the transducer itself.

20 Claims, 19 Drawing Sheets





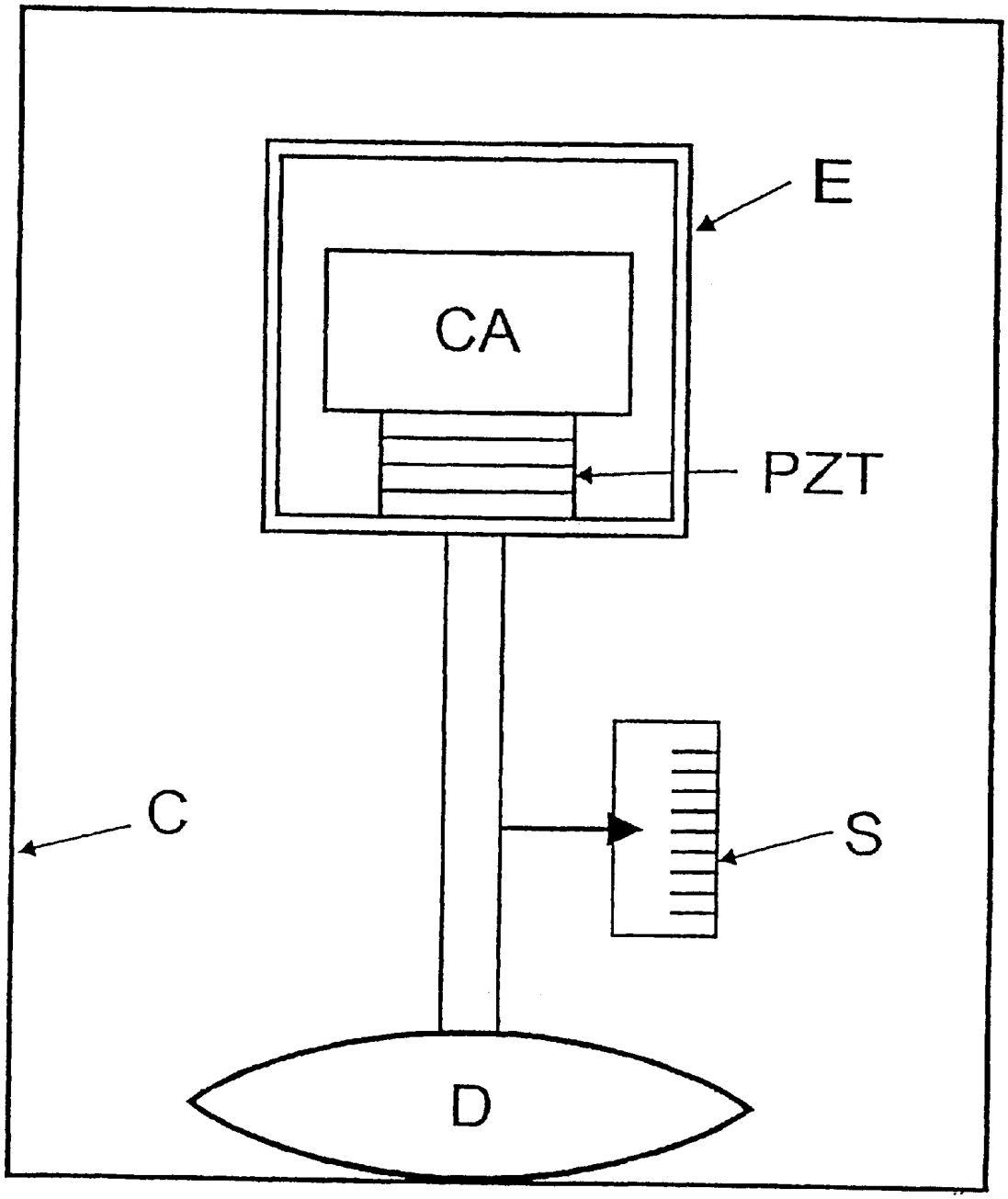


FIG. 1

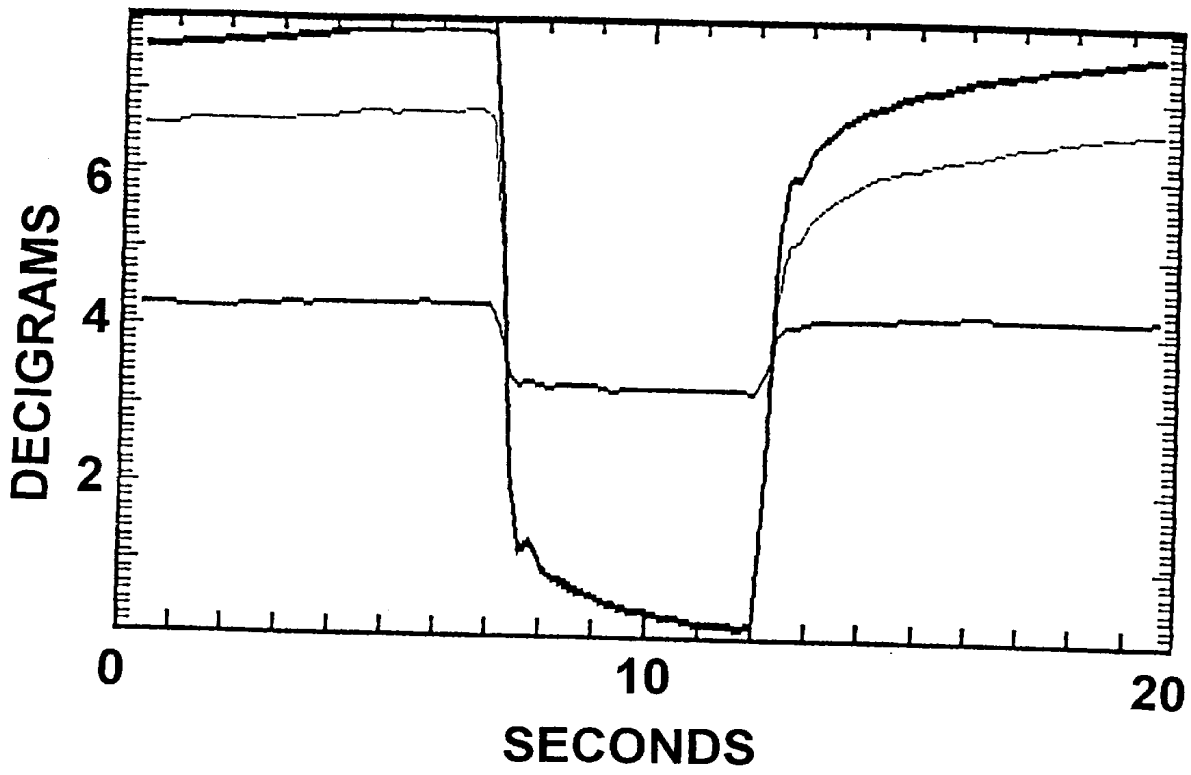


FIG. 2

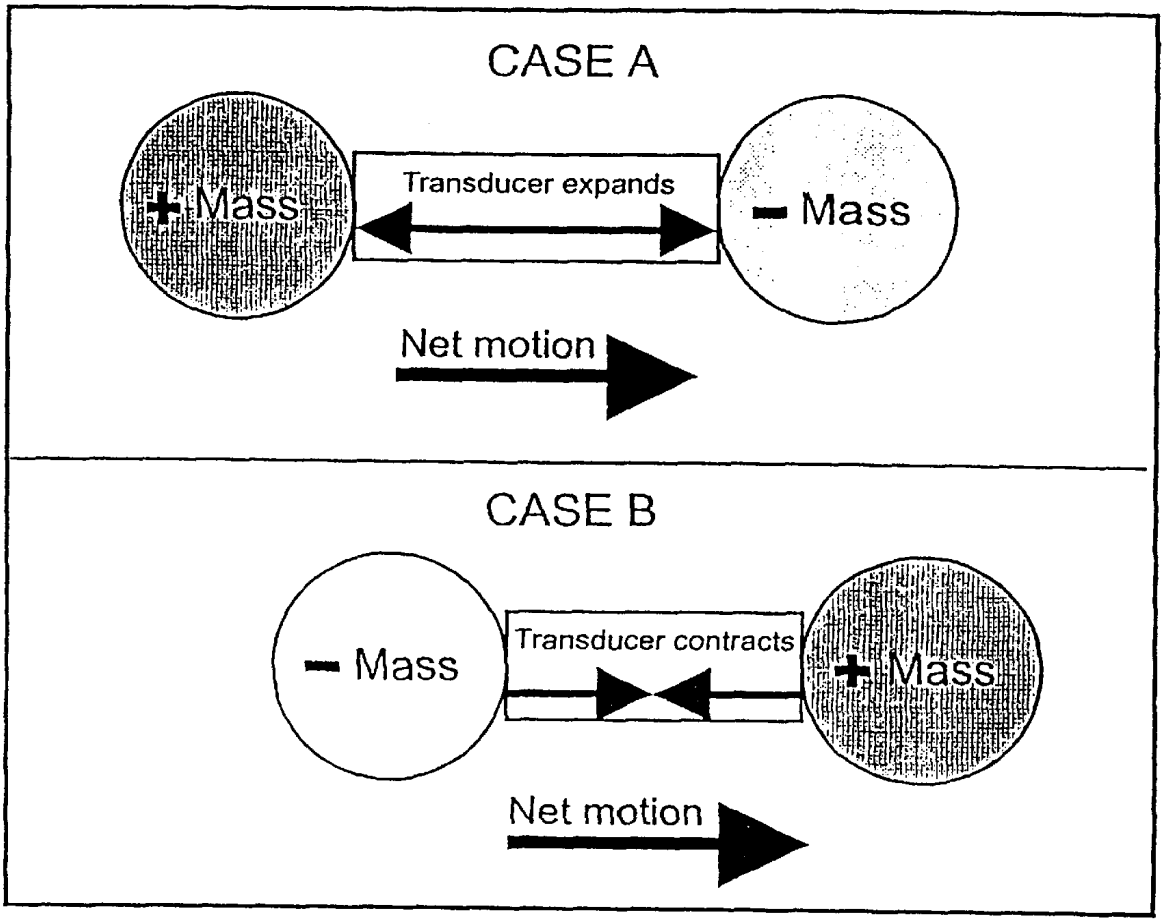

CASE A
+ Mass
Transducer expands
− Mass
Net motion
CASE B
− Mass
Transducer contracts
+ Mass
Net motion

FIG. 3