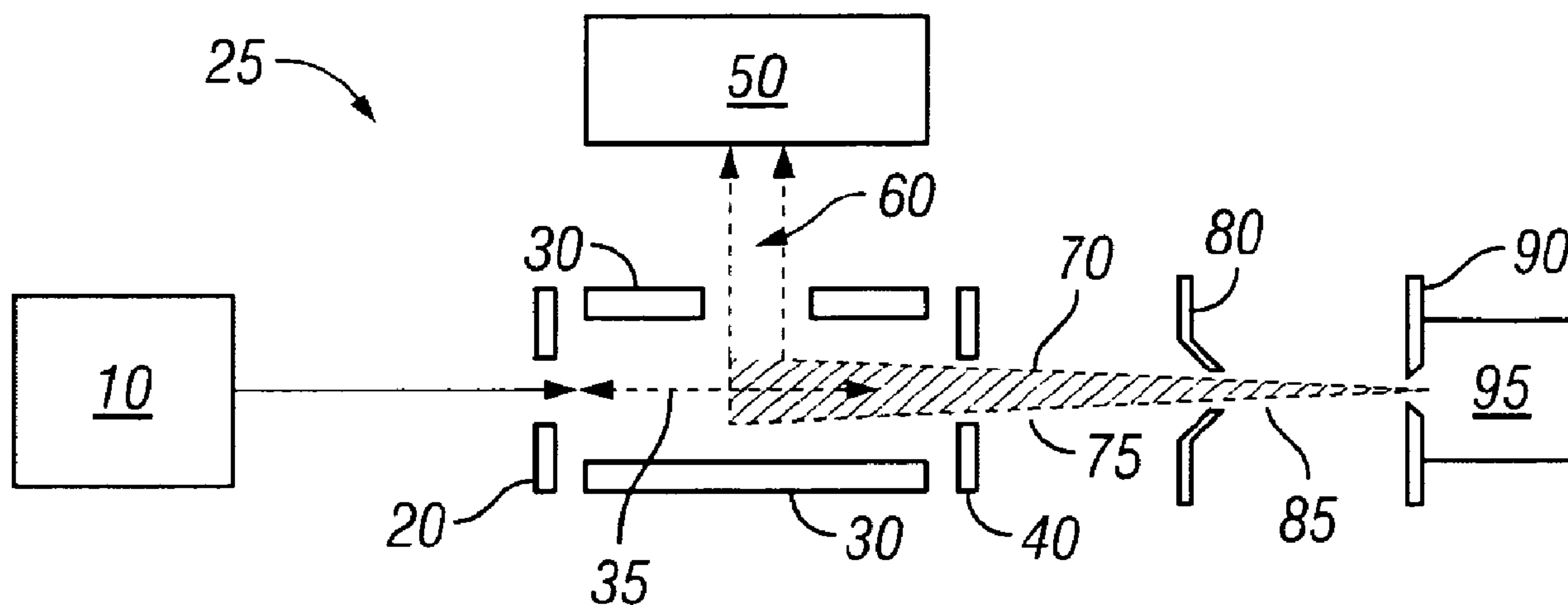




(86) Date de dépôt PCT/PCT Filing Date: 2009/09/11
(87) Date publication PCT/PCT Publication Date: 2010/04/01
(45) Date de délivrance/Issue Date: 2014/05/06
(85) Entrée phase nationale/National Entry: 2011/03/11
(86) N° demande PCT/PCT Application No.: EP 2009/061822
(87) N° publication PCT/PCT Publication No.: 2010/034630
(30) Priorité/Priority: 2008/09/23 (GB0817433.6)

(51) Cl.Int./Int.Cl. *H01J 49/04* (2006.01)
(72) Inventeurs/Inventors:
MAKAROV, ALEXANDER, DE;
DENISOV, EDUARD, DE
(73) Propriétaire/Owner:
THERMO FISHER SCIENTIFIC (BREMEN) GMBH, DE
(74) Agent: FREEDMAN & ASSOCIATES

(54) Titre : PIEGE A IONS POUR REFROIDIR LES IONS
(54) Title: ION TRAP FOR COOLING IONS



(57) Abrégé/Abstract:

A method of changing the kinetic energy of ions is provided, comprising: trapping ions in a trapping region of an ion trap; and directing a beam of gas through the trapping region, so as to change the kinetic energy of the trapped ions thereby. Also provided is a method of separating ions, the method comprising: causing ions to enter a trapping region of an ion trap along a first axis of the trapping region; directing a beam of gas along the first axis and applying an electric potential in the direction of the first axis so as to cause separation of the ions based on their ion mobility. An ion trap and a mass spectrometer for performing the methods are also provided.

- 1 -

ION TRAP FOR COOLING IONS

Technical Field

This invention relates to an ion trap for changing the
5 kinetic energy of ions and a method of changing the kinetic
energy of ions in an ion trap, preferably to cool the ions.

Background to the Invention

For high resolution mass spectrometers, it is desirable
10 that ions for analysis have a low emittance, since this
improves resolving power and sensitivity. The ion beam
emittance is in part determined by its temperature.
Traditionally, ions are cooled by collisions with a gas.
However, since the mass analyser operates at a high vacuum,
15 it is desirable to cool the ions outside of the mass
analyser.

Existing solutions have followed two divergent
strategies. A first strategy is to cool the ions in a trap,
external to the mass analyser, which contains a gas suitable
20 for cooling the ions, for example as shown in US-6,674,071.
However, in such devices, the ions can only be cooled to the
temperature of the gas, which is limited to that of the ion
optics of the trap, since the gas is effectively held within
the trap, in thermal equilibrium with the material with which
25 it is trapped. This places a limit on the minimum achievable
emittance of the cooled ion beam.

Moreover, when the trap is used for injecting the cooled
ions into the mass spectrometer, further problems arise.
Accelerating the ions through the gas can cause fragmentation
30 of the ions and removing the gas before ejecting the ions
limits the speed of operation significantly. If the ions are
accelerated using electric fields, as is typically done,

