due to 'turn-around' time. A further advantage results from the fact that ions are not timed through any source extraction or focussing optics.

Also, an ion-storage device as described may employ any form of ion lens and ion source, including high pressure sources. However, for any given mass-to-charge ratio the ions entering the defined region should preferably (though not necessarily) all have the same energy. Accordingly, the device may attain a higher mass resolving power if the associated ion source produces ions having a relatively small spread of energies. Ion sources for which the energy spread is usually quite small (~0.5 eV) include electron impact sources and thermospray sources, commonly used in liquid and gas chromatography mass spectrometry.

Furthermore, because the ion storage device has a relatively high duty cycle, the device is well suited to the analysis of small sample volumes (such as biological and biochemical samples, for example) which may be delivered over a relatively short time scale using conventional inlet systems, such as a liquid chromatograph for example.

It will be understood that an ion storage device as described, has general utility in applications requiring both the storage and spatial time focussing of ions having different mass-to-charge ratios.

In a particular application, the ion storage device may constitute the flight path of a time-of-flight mass spectrometer, ions having different mass-to-charge ratios exiting the defined region being detected separately at different times using a suitable detector.

I claim:

1. An ion-storage device for storing ions moving along a path, comprising field generating means for subjecting ions to an electrostatic retarding field during an initial part only of a preset time interval, the electrostatic retarding field having a spatial variation such that ions which have the same mass-to-charge ratio and enter the ion storage device during said initial part of the pre-set time interval are all brought to a time focus during the remaining part of that time interval.

2. An ion storage device as claimed in claim **1**, wherein the spatial variation of the electrostatic retarding field is such that the velocity of an ion during said initial part of the preset time interval is related linearly to its separation along the path from the point at which the ion is brought to a time focus.

3. An ion-storage device as claimed in claim **1**, wherein the electrostatic retarding field is an electrostatic quadrupole field.

4. A mass spectrometry system as claimed in claim **3**, wherein the field generating means comprises an electrode structure having rotational symmetry about the longitudinal axis of the ion storage device.

5. A mass spectrometry system as claimed in claim **4**, wherein the electrode structure comprises a first electrode having a spherical or hyperboloid electrode surface and a second electrode having a conical electrode surface facing the electrode surface of the first electrode, wherein the second electrode is maintained at a retarding voltage with respect to the first electrode during said initial part of the or each preset time interval and has an exit aperture by which ions can exit the ion storage device, and the first electrode has an entrance aperture by which the ions can enter the ion storage device.

6. A mass spectrometry system as claimed in claim **5**, wherein the retarding voltage is such that the ions are brought to said time focus at the exit aperture of the second electrode.

7. A mass spectrometry system as claimed in claim **4**, wherein the electrode structure comprises a plurality of electrodes spaced at intervals along the longitudinal axis of the ion storage device, each electrode in the plurality substantially conforming to a respective equipotential surface in the electrostatic quadrupole field and being maintained at a respective relative retarding voltage during the initial part of the or each said preset time interval, and having a respective aperture for enabling the ions to travel through the ion storage device.

8. A mass spectrometry system as claimed in claim **7**, wherein the electrode structure comprises a further electrode having a conical electrode surface, the further electrode having an exit aperture by which ions can exit the ion storage device and being maintained at a relative retarding voltage during the initial part of the or each said preset time interval.

9. A mass spectrometry system as claimed in claim **8**, wherein the respective retarding voltages on the electrodes are such that the ions are brought to a time focus at the exit aperture of the further electrode.

10. An ion-storage device as claimed in claim **3**, wherein the field generating means has a monopole electrode structure comprising a first electrode having an electrode surface of substantially V-shaped transverse cross-section and a second electrode having an electrode surface of curvilinear transverse cross-section facing the electrode surface of the first electrode, wherein the first electrode is maintained in operation at a retarding voltage relative to the second electrode and has an aperture whereby ions can exit the device, and the second electrode has an aperture whereby ions can enter the device.

11. An ion storage device as claimed in claim **3**, wherein the field generating means has a monopole electrode structure comprising an electrically conductive member having a substantially V-shaped transverse cross-section and an electrically resistive member having a substantially V-shaped transverse cross-section, wherein the electrically conductive and the electrically resistive members define a closed structure bounding a defined region and the electrically conductive member is maintained, in operation, at a retarding voltage relative to the apex of the electrically resistive member and the members have respective apertures by which ions can enter and exit the defined region.

12. An ion storage device as claimed in claim **10**, wherein the monopole electrode structure has a plurality of additional electrodes disposed at the sides and/or ends of the structure, wherein each additional electrode extends along a respective line of intersection with a selected equipotential in the electrostatic quadrupole field and is maintained at a respective retarding voltage.

13. An ion storage device as claimed in claim **12**, wherein the sides are parallel.

14. An ion-storage device as claimed in claim **1**, wherein ions are subjected to the electrostatic retarding field during successive said time intervals.

15. An ion-storage device as claimed in claim **1**, including means operative during the remaining part of the or each said preset time interval to prevent ions entering the device during that or those periods.

16. An ion-storage device as claimed in claim **1**, wherein the ratio of the initial part of the preset time interval to the remaining part of the preset time interval is proportional to