

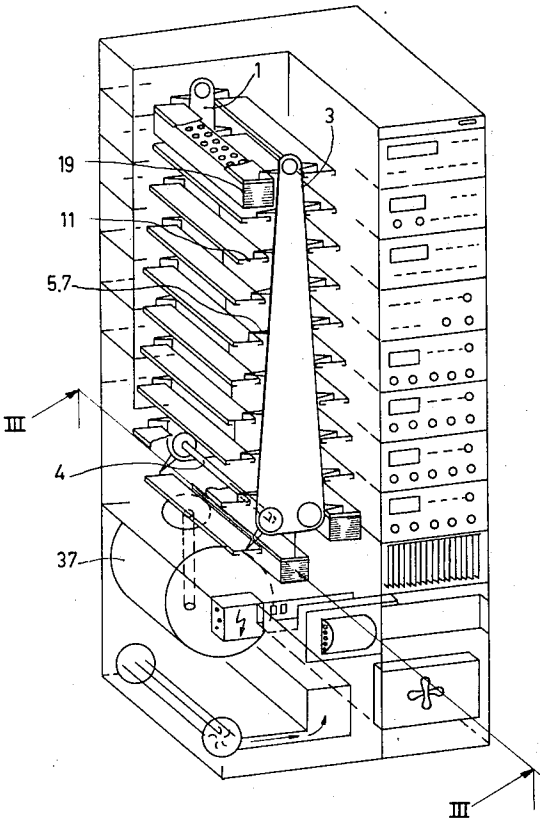
[54] APPARATUS FOR SELECTIVELY  
EXAMINING RADIOACTIVE SAMPLES

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[51] Int. Cl.....G01t 7/02, G01t 7/08  
[58] Field of Search.....250/71.5, 106 SC; 214/11, 16.4

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Primary Examiner—Archie R. Borchelt  
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[57] ABSTRACT  
An apparatus having a series of movable trays for holding a plurality of radioactive samples, and for transporting each tray and each sample carried thereon to a shielded detection unit for examination.  
6 Claims, 4 Drawing Figures



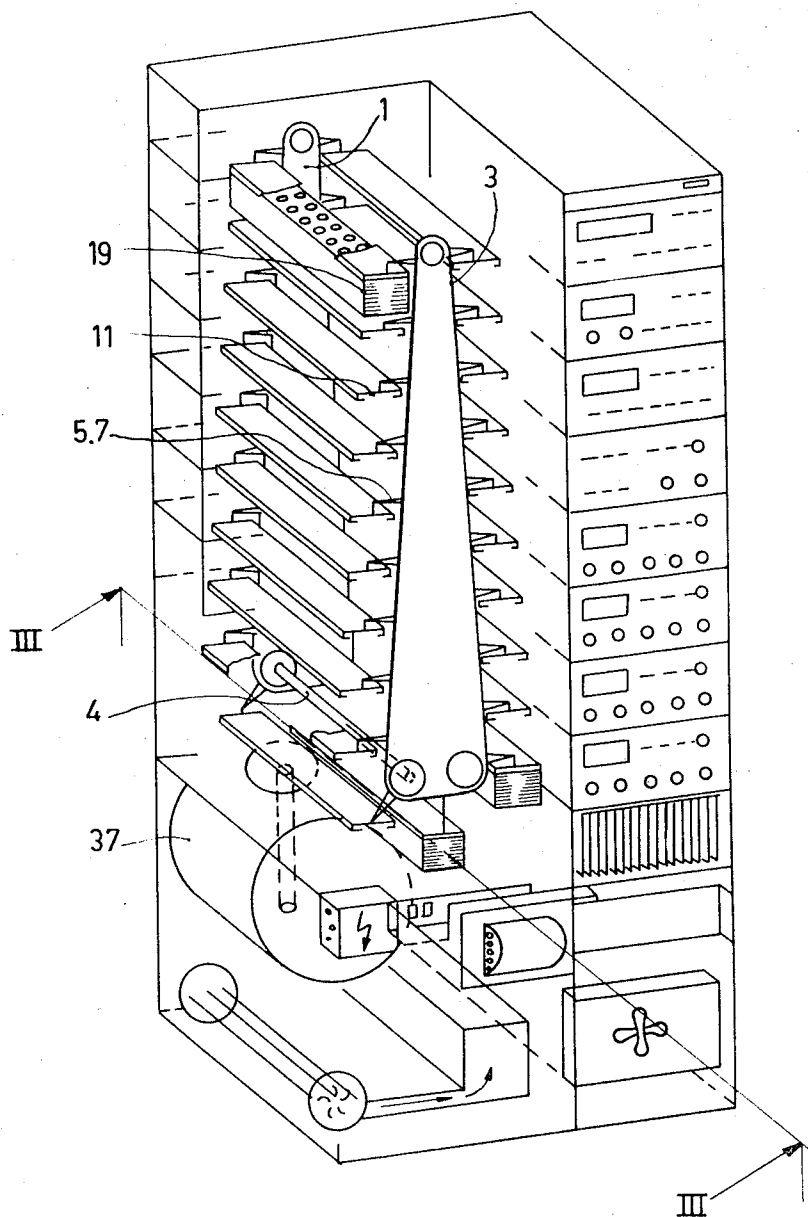


FIG. 1

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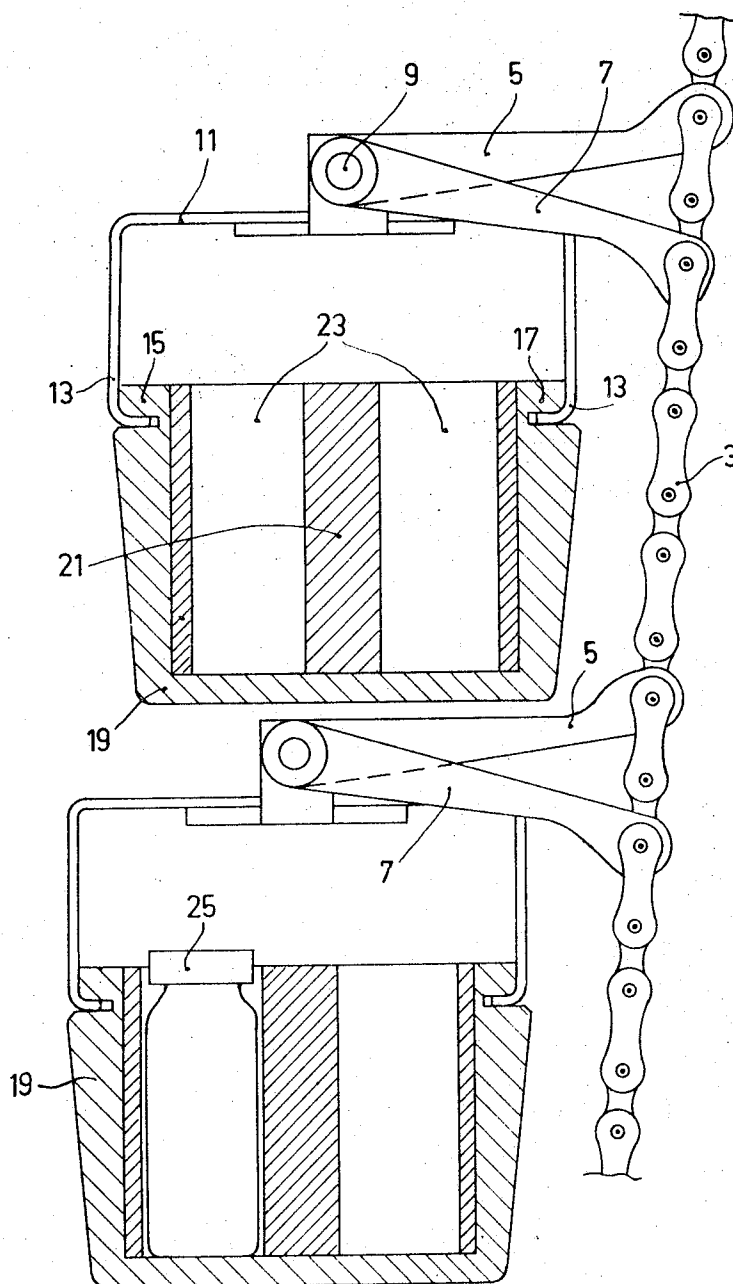


FIG. 2

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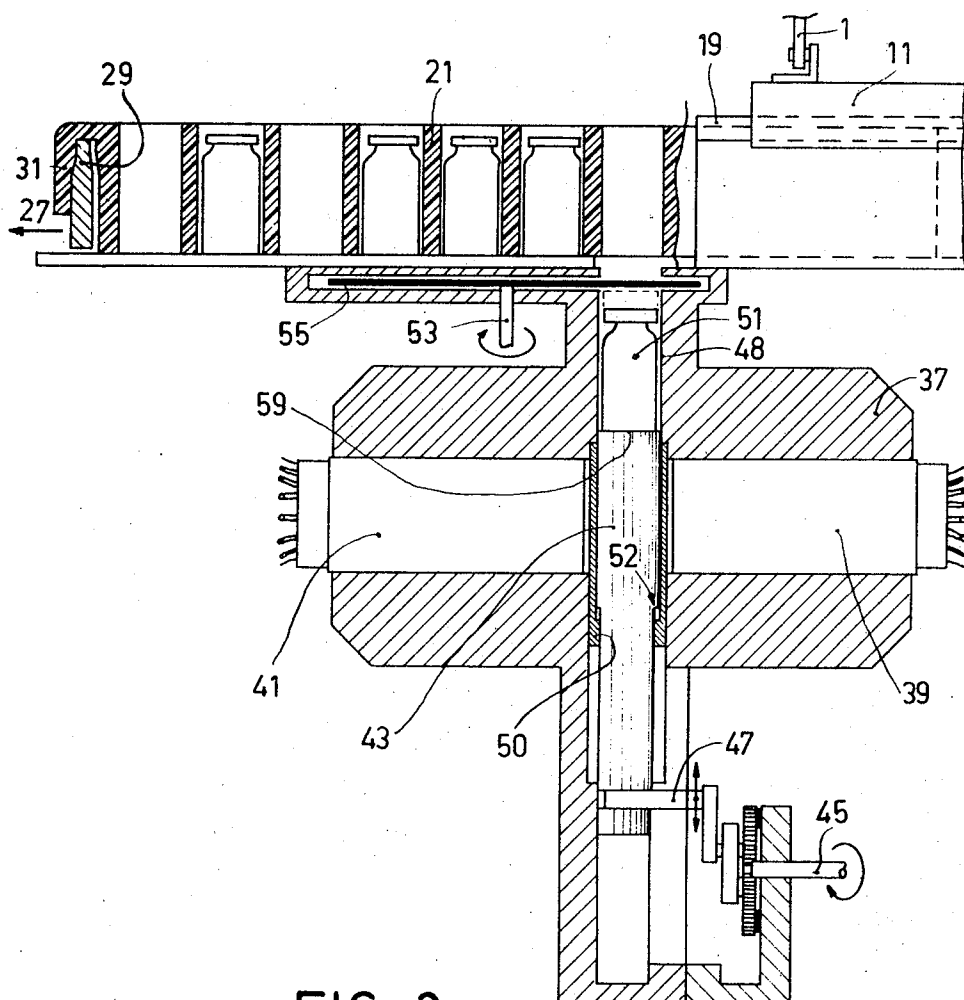


FIG. 3

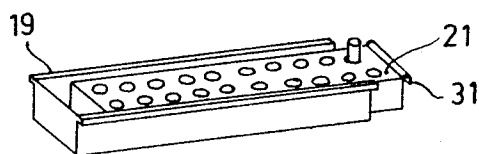


FIG. 4

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# APPARATUS FOR SELECTIVELY EXAMINING RADIOACTIVE SAMPLES

The invention relates to a composition changer for examining radioactive compositions which are present in containers and may be mixed with a scintillator liquid. The changer is provided with a plurality of parallel arranged holders which are each designed to hold a group of containers containing the compositions to be examined, means to remove a container from the holder, to bring said container in a shielded detector chamber, to examine it, and to remove it again from said chamber.

In a known composition changer a group of containers is accommodated in apertures along a circular periphery of a round disc. This disc forms a magazine for the containers which may be designed as small bottles. In this changer a plurality of said discs is fixedly arranged above one another and every time one disc is completely moved out of the stack and conveyed up to exactly above a detector chamber; by rotating the disc about its center a different container is led every time above the chamber and introduced therein. After examination the container is placed again in the disc which is conveyed back to the stack.

Although the known device is suitable for a very large number of containers, it has the drawback of being comparatively voluminous; because the containers are only arranged along a circular periphery. A disc having a large diameter is already required for proportionally few containers. Furthermore a complicated mechanism is required for the intricate transport path leading the disc from the stack to the measuring arrangement.

An object of the invention is to provide a changer in which the transport path for the containers is considerably simplified and shortened and which can accommodate a great many containers in a proportionally small volume. To this end the changer according to the invention is characterized in that the holders are oblong and are each designed to accommodate the containers in one or more parallel straight rows, the holders being movable in parallel with one another, in a path transversely to their longitudinal dimension and closed in itself.

In the device according to the invention all containers are thus moved in parallel rows along a path closed in itself. When a desired row has arrived in a pre-determined position in the afore-mentioned path, the desired container is removed from the holder by means of suitable members and conveyed to the measuring position.

Starting from an arrangement in which each holder may be provided with possibly a double row of containers, one embodiment of a composition changer has means for moving a holder preferably stepwise in its longitudinal direction when said holder has assumed a pre-determined position in the path. This provides the interesting possibility to accommodate the holders movably in gutter-like trays which are open at at least one end, said holders having a plurality of bottomless apertures for receiving the containers and extending in a vertical direction up to the bottoms of the trays. The containers, which are, for example, formed as sample bottles, then fit in the bottomless apertures of the holder which rests on the bottom of the trough-like tray in unextended position; not until the holder is slid out of the tray can the containers be conveyed in downward direction to a measuring chamber.

For transporting holders along a path which is closed in itself, use can be made of two chains between which the parallel movable holders are suspended in such manner that the mutual position of the containers is maintained during the transport of the holders along the path. The ends of each trough-like tray can then be fixed permanently to brackets which are secured to the links of the chains. In this connection it is otherwise noted that it is known per se from U.S. Pat. specification No. 3,302,025 to transport a large number of containers by means of a flexible belt along a measuring chamber housing a detector, pick-up members being utilized for removing the containers containing the compositions to be tested from the belt path and to be conveyed to the measuring chamber (and vice versa).

In order that the invention may be readily carried into effect it will now be described in detail, by way of example, with reference to the accompanying diagrammatic drawings in which:

FIG. 1 is a perspective elevational view of the changer according to the invention,

FIG. 2 relates to transporting holders containing sample bottles to be tested, along a path by means of a transport chain,

FIG. 3 is part of a vertical cross-section taken on the line III—III of FIG. 1, and

FIG. 4 is a perspective view of a transport tray having an extensible holder for samples to be tested.

The composition changer of FIG. 1 has two transport chains 1 and 3 which are synchronously moved by the same shaft 4 and between which a plurality of transport trays for sample bottles are suspended in brackets in the manner as for an endless conveyer. FIG. 2 shows the chain 3 in part and brackets 5, 7, which have a common pivot at 9 secured to the links of these chains. The brackets 5, 7 are shown as two lines in FIG. 1. Trough-like trays 19 for holding sample bottles to be tested are suspended between corresponding sets of brackets of the two chains. To this end use is made of carrier plates 11 secured to the brackets 5, 7 which carrier plates have bent edges 13 between which the trays 19 with their flanged edges 15 and 17 can slide.

Due to the endless arrangement, all holders remain comparatively horizontal. Each series of parallel arranged trays 19, which are open at one end, is furthermore designed to comprise a holder 21 of a synthetic material which can be slid out of the tray 19 in the longitudinal direction as is shown in FIG. 4. The holder 21 is provided with bottomless apertures 23 in which containers holding the compositions to be examined are held in place. In this example the containers are designed as small bottles 25 which are supported by the bottom of the tray 19 as long as the holder still completely remains in the tray.

In the lowest position of the chain path the holders 21 are successively slid out of the trays 19 in stepwise manner. To this end reference is also made to FIG. 3. The holder 21 is slid out of the tray 19 in the longitudinal direction with the aid of a lug 29 which is moved stepwise in the direction indicated by arrow 27 and co-acts with a hook-like part 31 of the holder 21. In unextended position the lug 29 is located at the extreme right. The hook-like part 31 is arranged behind the lug 29 in said extreme right position by moving the tray 19 in the direction transversely to the plane of the drawing whereby the part 31 slides over the lug 29. An index mechanism of conventional construction may serve to move on the lug 29.

A detector chamber formed by lead walls 37 and accommodating detection means 39, 41 is located underneath the chain conveyer. A plunger 43 can be displaced in the direction of height in an aperture 48 of this chamber; it is driven by a shaft 45 which causes the pin 47 inserted in plunger 43 to move up and down through a suitable gear. In its highest position the plunger 43 can receive a bottle 51 from the holder 21, and hold it between the detectors 39 and 41 in its lowest position at which the measurement for radioactivity takes place in conventional manner. The bushing 50 then provides for additional shielding of the light when the plunger 43 is in its upper position. As the plunger moves down the bushing is also taken along downwards by shoulder 52.

Furthermore there is provided a shield 55 rotatable by shaft 53 and having apertures the shield passes a bottle 51 in one position and covers the space above the lowered bottle 51 in light-tight manner at one position farther. After measurement shield 55 is further rotated until another aperture is released in the path of the plunger, and the bottle 51 can be lifted again into the holder 21. While the upper side 59 of the plunger 43 is in the broken-line position and forms a temporary base for the bottle 51, the holder 21 is displaced over a desired distance and another bottle can be lowered. When an entire row of bottles of a holder has been handled, the lug 29 is again moved to the extreme right and the holder 21 is thus returned to its

original position. Subsequently the chains 1, 3 are moved slightly further so that the second row of bottles of the same holder 21 can be slid out.

The composition changer furthermore comprises an electronic control section with which a desired program of operations, such as transporting, measuring, recording, can be carried out. This section can be seen in the right part of FIG. 1 and comprises a plurality of control and measuring units placed upon one another. Since these units do not form an essential part of the present invention their description has been omitted.

We claim:

1. Apparatus for retaining a plurality of sample containers of radioactive material and transporting one at a time to a detector for examination, comprising:

- a. a frame,
- b. a plurality of carriers movably disposed in spaced relationship on the frame,
- c. a plurality of holders, each (i) having a plurality of apertures along a longitudinal axis for retaining sample containers, and (ii) secured to and axially movable relative to one carrier,
- d. a transfer assembly for maintaining the carriers and holders spaced and parallel with respect to other carriers and holders, and for transporting the carriers and holders along a continuous generally elongated path having closely adjacent sides, with the carriers and holders on said sides of the path being correspondingly adjacent, the path also defining a discharge area to which each holder is transported,
- e. a shielded detector including an aperture for receiving one sample container at a time, and

f. the transfer assembly further comprising means cooperating with each holder at the discharge area, for selectively moving each holder axially with respect to its carrier and a selected container to a discharge point for transport from the holder to said detector for examination thereof, and returning the container to its holder.

2. Apparatus according to claim 1 wherein said transfer assembly moves each holder axially in steps for selectively locating each aperture of the holder closely adjacent the discharge area, before each container is transported from each holder to the detector.

3. Apparatus according to claim 1 wherein said transfer assembly further comprising a tray secured in an upright position to each carrier, with each holder supported by the bottom of a tray and each holder aperture being bottomless and oriented vertically, whereby axial movement of a holder relative to the corresponding tray permits containers to be moved at the discharge area vertically downward to the detector.

4. Apparatus according to claim 3 wherein said transfer assembly further comprises flexible guide means disposed along said path and motor means driving the assembly for transporting the carriers and holders.

5. Apparatus according to claim 1 wherein said frame further includes a closable duct between the discharge area and the detector, and said transfer assembly opens the duct before transporting each container via the duct to the detector, and subsequently closes the duct.

6. Apparatus according to claim 2 wherein the transfer assembly further comprises a pair of chain links spaced apart and supporting said carriers therebetween.

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