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[54] **LABEL READING AND WRITING ON CYLINDRICAL CONTAINER**

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[51] **Int. Cl.**.. **G06k 7/14**; G01n 11/00; C10g 37/04; G01n 31/00

[58] **Field of Search**.....235/61.11 E, 61.11 D, 235/61.11 A, 61.11 R, 61.9 R; 360/2; 23/253, 259; 73/53; 209/73

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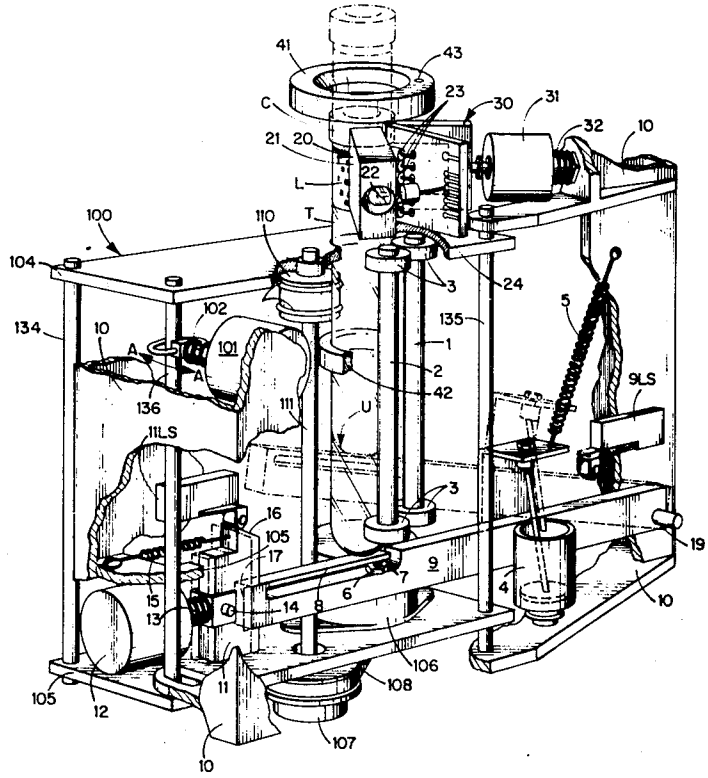
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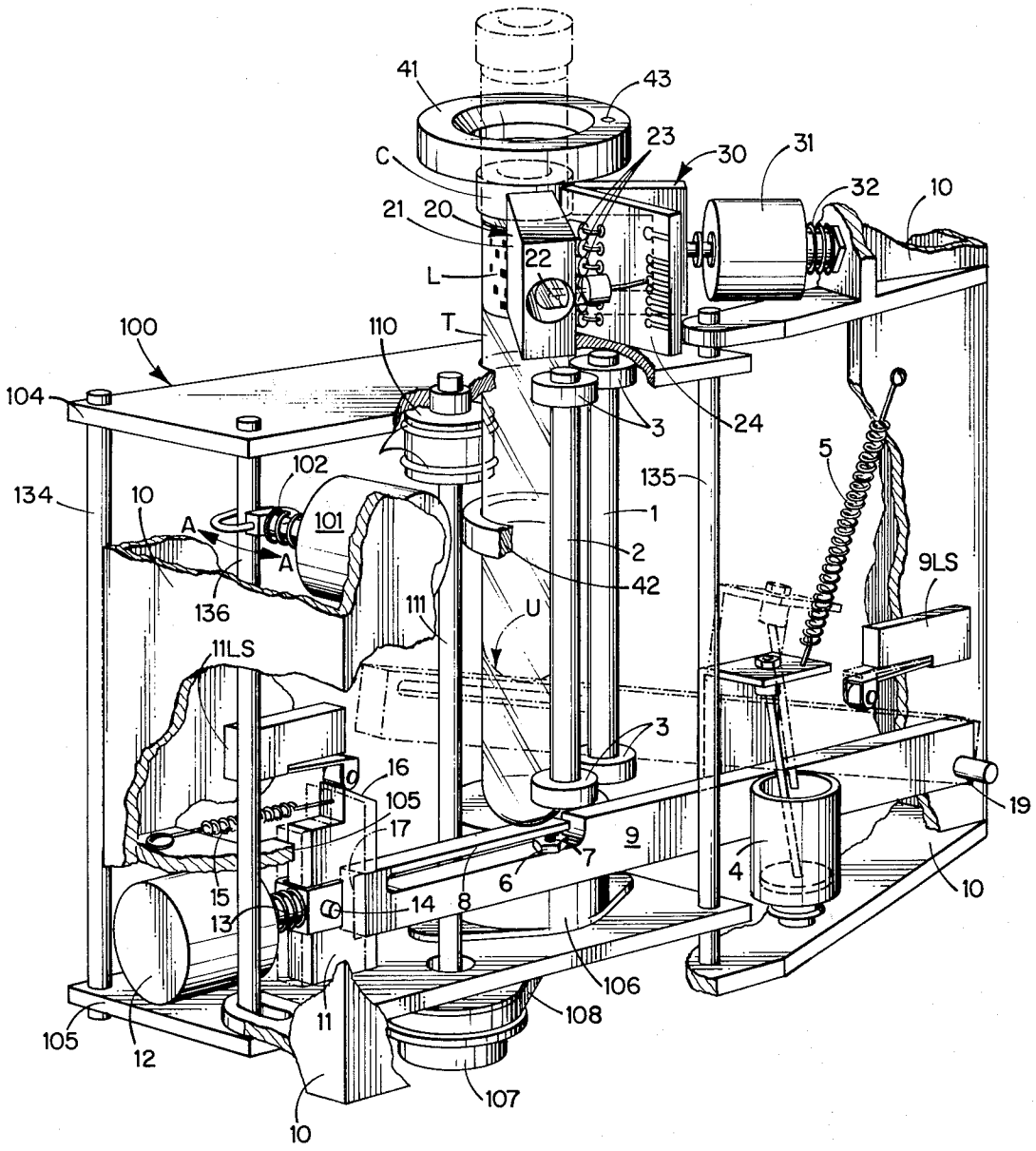
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[57] **ABSTRACT**

A test tube with a label is axially fed into a label processing machine and then rotated for label scan processing in the circumferential direction. The machine comprises scanning label processors including read and/or write means for extracting label data or modifying the label data. A tube transport assembly in the machine comprises means for guiding axial tube movement, locking the tube in an axial position for label processing, precisely aligning the tube with label processing equipment in the machine and rotating the aligned test tube.

11 Claims, 1 Drawing Figure




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LABEL READING AND WRITING ON CYLINDRICAL CONTAINER

BACKGROUND OF THE INVENTION

The present invention relates in general to processing package label data and more particularly concerns apparatus and techniques for reading and/or writing label information on a cylindrical container used in laboratory, clinic and hospital processing of specimens from patients or subjects. The invention facilitates automated processing of a test tube or other container with reliable reading and/or writing apparatus that is relatively economical and compact.

Accurate and fast labelling of specimen containers is of importance in hospital, clinical, laboratory operations. Prompt analysis may be of vital importance in some cases, and mislabelling of such information as patient identification or tests to be performed may produce serious consequences.

Accordingly it is an important object of the present invention to expedite the handling of specimen containers while avoiding erroneous label information.

It is a further object of the invention to provide a specimen container handling unit for receiving a specimen container and automatically reading and/or writing label information consistent with one or more of the preceding objects.

It is a further object of the invention to carry out one or more of the preceding objects with compact, portable relatively low-cost apparatus suitable for use at a number of locations.

It is a further object of the invention to accommodate specimen container tolerance variations consistent with one or more of the preceding objects.

It is a further object of the invention to provide improved speed of label processing consistent with one or more of the preceding objects.

SUMMARY OF THE INVENTION

According to the invention, scan processing means, such as read and write heads are utilized in combination with a container transport assembly mounted on a fixed chassis. The container transport assembly comprises rough guiding means for receiving an inserted labelled cylindrical specimen container and guiding it through axial movement (i.e. in a direction coincident with the container's cylindrical axis) from an initial position to a scan processing position, means for defining a scan processing position, means for rotating the container past label reading and writing heads in a scan processing operation, and means for subsequently releasing and axially ejecting the specimen container back to its first position to allow removal of the container.

The rough guiding and positioning means form a container rest which is mounted elastically on the fixed chassis. The inserted container is axially pressed against the rest which elastically yields in response to such pressing until the container is fully displaced from its first initial axial position to its second scanning processing position. The rest is locked to maintain the container in the second position.

Then a drive roller is moved into contact with the inserted specimen container and at least one roll bearing is provided so that the drive roller can rollably drive the container. The drive roller and roll bearing axes are parallel to the container's cylindrical axis. The scan

processing means comprise one or both of read and write heads of optical, thermal, electrical, magnetic, chemical or mechanical types, which are located on the fixed chassis in axial alignment with and adjacent to the label portion of an inserted container. After completion of scan processing, the rest is unlocked and it springs back to eject the container (wholly or partially) and reset the container rest in the first position for receiving a new container.

The container alignments involved in insertion, positioning and circumferential scan driving for purposes of precision in automatically reading and writing label data are controlled by the apparatus rather than the technician and container ejection is also controlled by the apparatus to prevent disturbance of apparatus alignment or container breakage by the technician.

In a preferred form of the invention longitudinally elongated bearing assemblies are aligned with each scan processing head for lessening deviations from planned alignment which would otherwise be caused by dimensional variances or differing degrees of out-of-roundness of the specimen containers.

Drive roller means oppose the bearing assemblies across the diameter of the cylindrical container. The drive roller means are mounted on a chassis movable relative to a fixed chassis containing the tube transport assembly. The movable chassis carries a drive motor and means for coupling the drive motor and the drive roller means. Bringing the movable chassis into a driving position where the rotating drive roller means contacts the specimen container and energizing the drive motor rotates the specimen container to effect circumferential scanning. After scanning is complete, the movable chassis returns to a nondriving position with the drive roller means spaced from the specimen container. The longitudinal bearing assemblies are very small and have a low inertia compared to that of the assembly that rotates the specimen container. After the movable chassis is shifted to the nondriving position, the specimen container is ejected.

Numerous other features, objects and advantages of the invention will become apparent from the following specification when read in connection with the accompanying drawing the single FIGURE of which is:

BRIEF DESCRIPTION OF THE DRAWING

a partially cutaway isometric view of apparatus according to a preferred embodiment of the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to the drawing, processing apparatus for a test tube T with a label L and a plastic cap C comprises a fixed chassis **10** containing a tube transport assembly, reading head **20**, and writing head **30**, and a movable chassis **100**. Only small portions of the fixed chassis **10** are indicated in the drawing, the balance being cut away for a clearer illustration of components of the fixed chassis and the tube and other structure of the apparatus of a preferred embodiment.

The movable chassis **100** is pivotably mounted on the fixed chassis **10**. The movable chassis **100** comprises an upper plate **104** and a lower plate **105**. The two plates are interconnected by vertical spacer rods **134, 135** and **136** at corners of the plates. A fourth such rod may be provided at the fourth corner which is hidden from view in this illustration. The vertical rod **135** forms a

pivotal mounting for the movable chassis 100. A solenoid 101, acting against a spring 103, is operable to move the movable chassis 100 about the vertical pivotal axis formed through rod 135, shifting the movable chassis forward or backwards as indicated by the double-headed arrow AA. The tube transport assembly comprises spaced vertical shafts 1 and 2 parallel to the axial or longitudinal direction of tube insertion, each having a pair of axially spaced bearings 3 thereon. Bearings 3 are arranged to contact the inserted tube T at two spaced points along the periphery thereof.

A stop lever 9 defines the resting place for the bottom of the inserted tube T and comprises a flexible end portion 8 which is adjustable through a screw 7 and nut 6. The lever 9 is movable upwardly to a first position indicated by phantom lines by a tension spring 5. The lever 9 may be depressed from its phantom line position in the drawings to a second position shown in solid lines by urging test tube T downward upon it to overcome the action of spring 5. A dashpot damper 4 makes the lever motion an elastically-yielding motion in either direction of movement. The position of initial insertion of the test tube is indicated by the phantom lines U defining the bottom of the test tube when it first makes contact with the lever 9 in its first position. Further downward insertion of the test tube depresses the lever until it reaches the second position indicated by solid lines in the drawing. The lever 9 is pivotable about a horizontal axis of pin 19 mounted from the fixed chassis 10. A limit switch 9LS is actuated when lever 9 is in the first position.

A lever lock 11 is driven by a solenoid 12 against a solenoid spring 13. The lock 11 is also pivotable about a horizontal axis of pin 14 and has a cammed upper surface and a locking recess 17. Lock 11 pivots about pin 14 under tension from spring 15 secured to the fixed chassis 10. As the lever 9 moves downwardly, the lock 11 is initially tilted back to allow the lever 9 to contact the bottom of recess 17. That contact followed by continual downward pressure on tube T shifts lock 11 to the solid line position shown in the drawing.

Tube ejection is caused by energizing solenoid 12 to pull lock 11 towards the solenoid against the action of spring 13. Spring 15 then pulls the upper part of lock 11 counter-clockwise about pin 14 to allow lever 9 to be pulled upward by spring 5, thereby partially ejecting the tube T back to the position shown in phantom lines. A limit switch 11LS (acting in cooperation with the cammed surface 16) is actuated when lock 11 is in the position shown in the drawing.

A drive motor 106 and pulley 107 are mounted on the movable chassis 100, preferably from its lower plate 105, and are interconnected by a drive belt 108. The motor output shaft has a pulley (not shown) connected to the belt 108 which is sized to provide speed-reduction from the motor shaft to the pulley 107. The gear 107 drives a drive roller 110 via a vertical shaft 111. The drive roller 110 has a pair of spaced elastomeric drive rings thereon for frictionally engaging the tube T. When the movable chassis is pivoted about the vertical axis through rod 135 by the action of solenoid 101, the rings of the drive roller come in contact with the tube T.

Roller 110 extends slightly below the top plate 104 of the movable chassis 100. The drive roller 110 is spaced longitudinally between the spaced bearings 3 of each of shafts 1 and 2 and together with such shafts and their bearings rollably supports tube T. When drive motor 106 is energized, drive roller 110, bearings 3 and tube T rotate to effect circumferential scanning of label L. Preferably drive roller 10 is located axially between bearings 3 but above half the axial distance axially spaced pairs of bearings 3 to help insure positive drive of tube T.

The tube transport assembly comprises an upper guide 41 and a lower guide 42 on the apparatus which serve to guide the tube down to lever 9 as it is inserted and play no part in the precise alignment preferred for actual reading and writing operations.

When the apparatus is locked in the position shown in solid lines of the drawing, the label L is longitudinally aligned with a reading head 20 and a writing head 30. The reading head 20 comprises a light source 22 and an array of electrooptical reading elements (miniature photocells or phototransistors or the like) 23 mounted on a printed circuit board 24. Reading is done by reflection, the boards 23 and 24 being in vertical planes intersecting at a vertical line along the label L when in position for being scanned. The reading elements 23 are aligned with distinct horizontal channels or tracks on the label L.

The writing head 20 is preferably of the thermal writing type and comprises a vertical array of electrical heating elements (not shown) each aligned with a respective track of the label L. The writing head 30 is initially spaced from the test tube T and movable to a position adjacent to tube T by energizing solenoid 31 on the fixed chassis 10 to overcome the tension of spring 32. As the tube is rotated past the writing head 30 one of the detecting elements 23 senses a bar in one of the tracks which is used as a synchronization signal and acts through circuitry (not shown) to activate the solenoid 31 and move the writing head 30 into writing position. Writing and reading operations are then conducted as the tube T is rotated by drive roller 110 acting through its drive-rings 109 and with the aid of the reacting forces provided by bearings 3 on shafts 1 and 2. Preferably the scanning direction is such that reading head 20 scans what writing head 30 has recorded to verify that the information selected for recording is actually written upon the label so that automatic readers associated with later processing of the specimen container will correctly interpret the recorded information.

The label 99 may comprise a thermosensitive paper laminated to a polyester film backing or other laminates or single ply transparent materials, known per se, having a thermosensitive side. The thermosensitive side should face upwardly when the label is inserted and the label should be reproducibly aligned with the apparatus to register channel sections of the label with corresponding channels of the reading and writing heads. The label is driven in stepped increments past the reading and writing heads by pulse motor 12 via the above described drive train.

Discrimination between darkened and undarkened portions of the label is enhanced by limiting the light passing through the label to photodetector elements of the reader to visible light wavelengths, preferably blue. Since economical incandescent light sources have a major portion of their output at infrared wavelengths, blue filter block 82 is used to limit the light transmission from the source to the label and detector to essentially blue light. Blocking infrared light also prevents photochemically induced label deterioration.

The reader may comprise a single linear light source in lieu of the multiple light source elements shown. Alternatively, a single high speed integrating detector, together with time sequenced multiple light sources, may be used.

The specific logical circuitry for effecting reading, writing, synchronization and actuation of the respective solenoids and motors is not a part of the invention and may comprise any known technique apparent to those skilled in the art. This logical circuitry may use a signal provided by limit switch **11**LS to indicate tube T is properly seated and energize drive motor **106** and solenoid **101** to initiate scanning. Reading head **20** could provide an appropriate signal upon completion of scanning for de energizing motor **106** and solenoid **101** while energizing solenoid **12** to end scanning and eject tube T. The circuitry could respond to a signal provided by limit switch **9**LS when actuated by lever **9** to deenergize solenoid **12**.

The circumferential spacing between read head **20** and write head **30** in preferred embodiments of the present invention is preferably within 0.0015 inches for a tube diameter variation of ± 0.010 inches. The arrangement of elements helps achieve the preferred tolerances. The diameter of bearings **3** is preferably less than the horizontal distance between each bearing and drive roller **110** corresponding to nominal tube T diameter. The reading head **20**, that is its detecting portion on circuit card **24**, is directly above shaft **2**; the writing head **30** is directly above shaft **1**. This arrangement compensates for variations in test tube diameters (including roundness flaws) by allowing the horizontal position of drive roller **110** to vary in accordance with the diameter of a tube being scanned. A hole **43** angled down towards label L is provided in guide **41** to allow a technician to read man-readable information on label L.

There has been described novel apparatus and techniques for rapidly and reliably reading and writing label information carried by a label on a cylindrical specimen container. The invention is especially useful in a preferred system where information recorded is immediately read out to insure that the information desired to be recorded was actually written upon the label. Accuracy is achieved despite variations in tube diameters. The apparatus may be operated by relatively unskilled personnel. The apparatus is operable over long intervals with relatively little maintenance.

It is evident that those skilled in the art may now make numerous uses and modifications of, and departures from the specific embodiments described herein without departing from the inventive concepts hereof. Consequently, the invention is to be construed as embracing each and every novel feature and novel combination of features present in, or possessed by the apparatus and techniques herein disclosed and limited solely by the scope and spirit of the appended claims.

What is claimed is:

1. Apparatus for scanning an essentially cylindrical labeled specimen container comprising,

rough guiding means for guiding said specimen container into a scanning position through insertion movement along a direction generally coincident with the nominal cylindrical axis of said specimen container,

means for positioning said specimen container axially so that a predetermined label portion thereof is at a predetermined axial scanning position,

means for rollably driving and supporting said specimen container for rotating said container about its nominal cylindrical axis to effect circumferential scanning of said label portion,

means located at said axial scanning position for performing at least one of reading and writing functions on the label portion during said scanning,

wherein said rough guiding and positioning means form a container rest which elastically yields from an initial axial position to said axial scanning position upon axially pressing said container against said rest until said axial scanning position is reached by the said label portion of the container,

means for locking said rest in said axial scanning position and for unlocking said rest and returning it from said axial scanning position to said initial position for container ejection,

said driving and supporting means comprise at least one bearing means having an axis parallel to the cylindrical axis of a container positioned for scanning located adjacent the container scanning position for exerting a reaction force against an inserted and locked container.

2. Apparatus in accordance with claim **1** wherein, said bearing axis is aligned with said means for reading and/or writing.

3. Apparatus in accordance with claim **2** wherein, said drive and support means comprise a drive roller with an axis parallel to the nominal cylindrical axis of a container positioned for scanning,

said drive roller being located adjacent the container scanning location for exerting a circumferential driving force against an inserted container.

4. Apparatus in accordance with claim **3** wherein, said scan processing means comprise read and write heads and corresponding bearings aligned with each of said read and write heads,

said drive roller axis opposing said bearing axis across the diameter of said container.

5. Apparatus in accordance with claim **1** further comprising,

means for forming a fixed chassis,

means for forming a movable chassis,

means for shifting the position of said movable chassis relative to the fixed chassis,

and wherein

the said scan processing means and the container rest are mounted on said fixed chassis, and

the said driving and supporting means comprise a drive roller mounted on said movable chassis and said bearing means mounted on said fixed chassis.

6. Apparatus in accordance with claim **5** wherein,

the driving and supporting means further comprise a motor and power train drive for said drive roller connected thereto and mounted on said movable chassis therewith.

7. Apparatus in accordance with claim **1** wherein,

the said locking means comprise means defining a translatable and pivotable locking recess which is arranged in relation to said container rest to be moved into locking position by said rest upon movement thereof to the said second position thereof and to be translated out of locking position

by an external force and means for applying said external force.

8. Apparatus in accordance with claim 7 wherein said container rest comprises a pivotable lever arm and said recess defining means are forwardly pivotable into locking position to grasp the lever and rearwardly translatable for unlocking.

9. Apparatus in accordance with claim 8 wherein the said locking means further comprise

first spring means loadable by said rearward translation of the locking element to provide resetting forward translation force thereto,

and second spring means connected to said recess forming means and loadable by movement of said rest to, and locking in, said second position thereof to provide a resetting pivoting action to said recess forming means upon unlocking of said rest and container ejection.

10. Apparatus in accordance with claim 9 further comprising

means for forming a fixed chassis,

means for forming a movable chassis,

means for shifting the position of said movable chassis relative to the fixed chassis,

and wherein

the said scan processing means and the container rest are mounted on said fixed chassis, and

said driving and supporting means comprise a drive roller mounted on said movable chassis and said bearing means mounted on said fixed chassis.

11. Apparatus in accordance with claim 10 wherein the driving and supporting means further comprise a motor and power train drive for said drive roller connected thereto and mounted on said movable chassis therewith.

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