United States Patent

Holderith

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[54] MACHINE READABLE LABEL AND SAMPLE IDENTIFICATION SYSTEM UTILIZING THE SAME

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[52] **U.S. Cl.** .....**235/61.11 A**, 23/253, 235/61.12 R

[51] **Int. Cl.** **G01n 31/00**, G06k 19/02

[58] **Field of Search** .....235/61.12, 61.12 C, 61.7 B, 235/61.111, 61.11 R; 340/146.3 RR; 234/30; 250/219 D; 73/53; 23/230, 253; 139/333

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[57] **ABSTRACT**

An improved label for containers and the like is provided. The label includes an undersheet having a surface of electrically conductive material and an oversheet of insulating material adapted to overlie the undersheet. The oversheet includes a plurality of holes punched therein in a pattern indicative, in a prearranged code, of the contents of the container. A method of identifying specimens is also provided wherein the hole pattern in the oversheet of one container is reproduced on a sheet of insulating material which is then used as an oversheet for the label of subsequent containers which are to be filled from the sample container.

2 Claims, 3 Drawing Figures

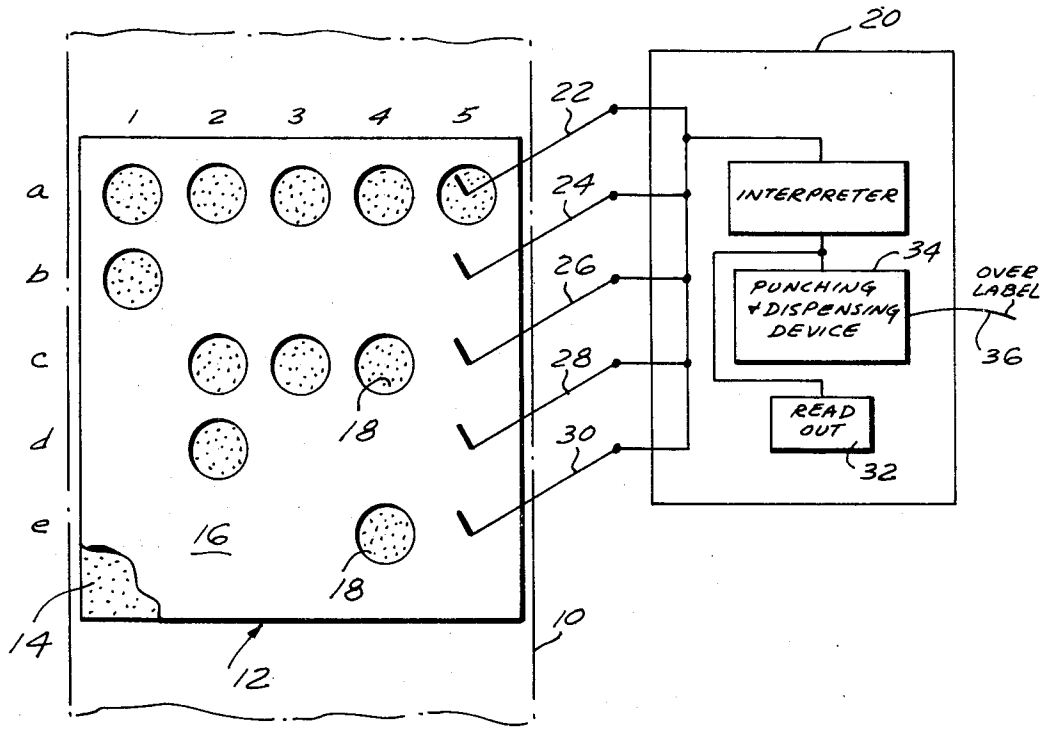


FIG. 2

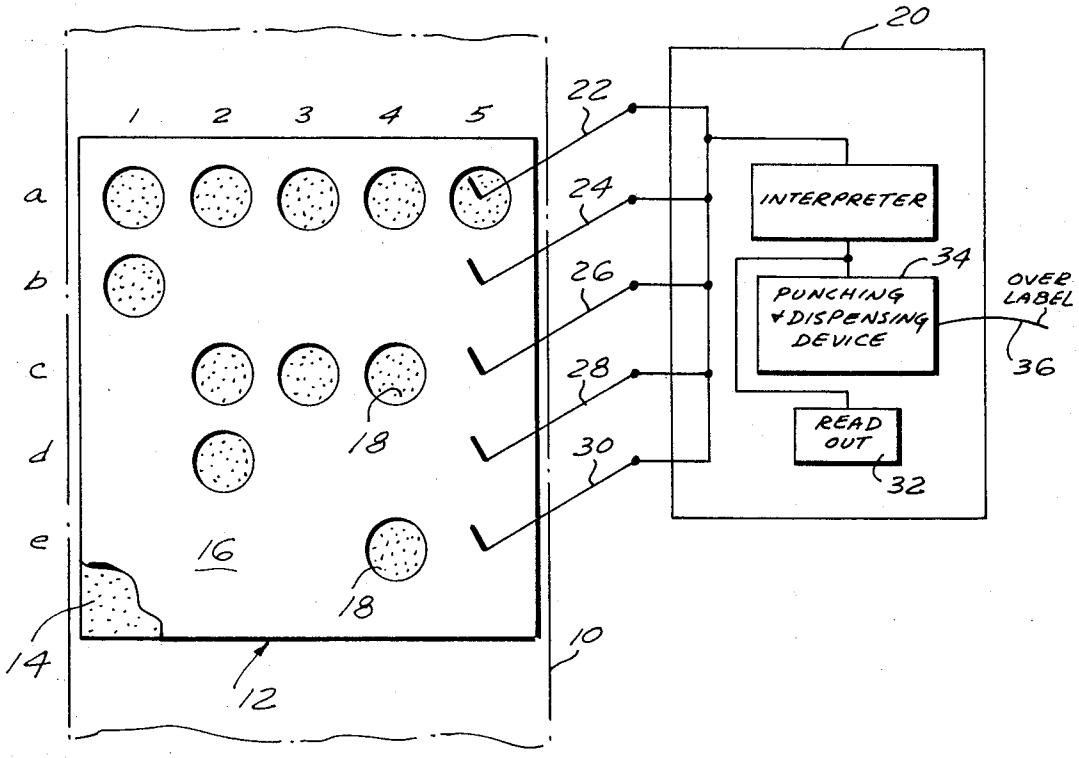


FIG. 3

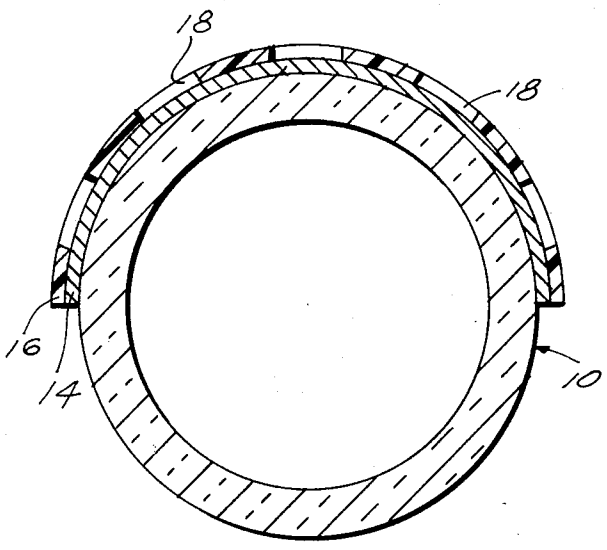
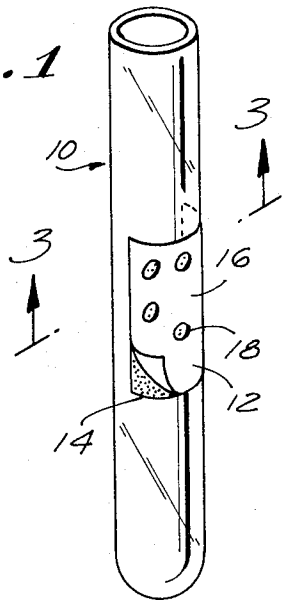


FIG. 1



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MACHINE READABLE LABEL AND SAMPLE IDENTIFICATION SYSTEM UTILIZING THE SAME

BACKGROUND OF THE INVENTION

In the collection of blood for laboratory purposes, the first step is usually the filling out of a request by the attending physician specifying patient and tests required. The technologist who is to collect the blood assembles a number of request forms and a sufficient number of collecting vessels and goes to the bedside of the various patients to obtain the necessary specimens. It is common practice, at the time of drawing, to establish the identity of the sample by affixing a paper label to the tube into which the blood will be drawn, and writing on the label the patient's name. When the blood is taken to the laboratory a list is made of all the tubes received and each tube is assigned a number, usually called an accession number. The list, in addition to the accession number, often includes the patient's name and a description of the tests to be performed.

After the initial entries have been made on the accession list the blood samples are sorted into groups of like tests such as hematology and chemistry and the contained samples are each divided into two or more aliquots as required to perform the various tests. Each aliquot-containing tube is commonly labeled with a paper label onto which is copied all or part of the information on the primary or collection tube label. When all the tubes have been prepared for analysis and every sample division has taken place the tubes are taken to the site of analysis where the desired tests are performed. The results are then placed on the accession list and reported back to the physician.

If the test is being made on an automatic machine, it is common practice to add to the accession list the position of the tube in the rack or circular tray that is used in the test machine. As the automatic testing instrument begins to operate, the sample which has been placed in the number one position is tested first and the results of that test are reported out first; the second sample is tested second and reported out second, and so on, until each sample is read and the results reported out. The reporting may be in the form of printed numbers on a continuous sheet, a continuous curve on a strip chart, holes in a punch card or tape, or other means. The test results, reported in order of tray position, are then correlated with the accession number list containing the patient's name and the results are reported to the physician.

It is obvious from the above brief description that a great many sources of error exist in the usual handling and identification procedure. These may be due to possible misidentification of the blood sample with the patient from whom it was drawn, error in the numerous manual transcriptions of number-name data involved or, in the case of an automatic testing instrument, to the danger of transposing samples in the test machine tray when they are identified only by position.

Attempts have been made to alleviate the problem such as by preprinting a supply of labels so that manual preparation is not necessary. However, there is still a major source for error since the number of tubes to be drawn is not standard from patient to patient or from time to time for the same patient. Thus there is the possibility that too few or too many preprinted labels may be provided. In the former case, it may be necessary to prepare extra labels manually with the consequent danger of manual transcription error. In the latter case, the excess labels may be improperly used if care is not exercised to see that they are destroyed. The above problems are well known to persons familiar with clinical laboratory practice.

It is, therefore, the principal object of the present invention to provide a simple and convenient label for a sample container and an efficient and accurate method for automatically reproducing identically as many, and only as many additional labels as required for sample subdivisions or additions.

SUMMARY OF THE INVENTION

These and other objects and advantages are attained in accordance with the present invention by providing a label comprising an undersheet having an electrically conductive outer surface and an oversheet, having a plurality of holes punched thereon in a prearranged pattern adapted to be aligned over and affixed to the conductive surface of the undersheet. A method of sample identification is also provided wherein a master sample is collected in a container having affixed thereto an undersheet having an outer surface of an electrically conductive material. An oversheet provided with a plurality of holes punched therein in a pattern indicative, in some prearranged code, of the sample is affixed to the container overlying the undersheet. The oversheet is affixed to the container at the time of filling the container. Thereafter, as required for subsequent processing, the contents of the master sample container is divided out into additional containers, each of which has affixed thereto an undersheet with an electrically conductive outer surface and the oversheet is automatically reproduced in total or in part to form an oversheet for placement over the undersheet of the additional containers, thus enabling the technician to maintain a constant reference of each container to the original source of the container contents.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. 1 is a perspective view of a container in the form of a test tube provided with a label in accordance with the present invention, wherein the oversheet is partially removed to expose the electrically conductive outersurface of the undersheet;

FIG. 2 is a schematic representation of the method and means for interpreting and reproducing such a label; and

FIG. 3 is a sectional view taken along reference lines 3—3 of FIG. 1 in the direction indicated by the arrows.

BRIEF DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention is illustrated in the accompanying drawing wherein similar components bear the same reference numeral throughout the several views. Reference is now made to FIG. 1 in particular wherein a container **10** in the form of a glass test tube **10** is depicted provided with a label **12**. Label **12** comprises a laminate structure including an undersheet **14** which is a generally flat member having an electrically conductive outer surface and an oversheet **16** formed of an insulating material which is also generally flat. In a successful practice of the invention, undersheet **14** was a metallic foil and oversheet **16** consisted of paper.

Oversheet **16** is provided with a plurality of holes **18** punched into it in a manner similar to the coding of a Hollerith card. In assembling the label **12** the undersheet **14** is first securely affixed to test tube **10**. The holes are then punched in oversheet **16**, in the desired code positions, and the oversheet is positioned over the undersheet. To simplify the securement of the oversheet to the undersheet, one surface of the oversheet is provided with a pressure-sensitive adhesive.

In the illustrated embodiment of the label shown in FIG. 2, the label is provided with five rows (left to right) of five columns (top to bottom) of positions where holes can be punched. Row (a) has all five holes always punched and serves as a common return lead. Rows (b), (c), (d) and (e) have holes punched in their respective columns in such position as to manifest, by an agreed-upon code a five-digit number between 00001 and 99999. Five digits are used here only as illustrative. In practice the number of digits is only limited by the size of the holes and the size of the label.

One such code, now in common use, is the so-called quaternary code illustrated as follows:

Position	Code
b	1

c	2
d	4
e	7

In such a code each four-digit vertical matrix represents one digit. If a hole is punched in the matrix at position (b) only, the digit "1" is represented. If a hole is punched in position (c), the digit "2" is represented. A combination of positions (b) and (c) represents the digit "3" and so on. Thus it can be seen that any digit from 0 to 9 can be represented by a combination of none, one or more than one hole punched in the matrix at a given position. Furthermore, if more than one such column matrix be employed more than one digit in a row may be represented. Referring again to the illustrated label of FIG. **2** it can be appreciated that the number represented is 16,290.

FIG. **2** also schematically illustrates a reading device **20** consisting of five brushes, **22**, **24**, **26**, **28** and **30**, of wire or other suitable material which are so arranged that if a label **12** is passed under them from right to left, each brush describes a path across one row of hole positions. The first row, row (a), always being punched, allows the establishment of electrical contact between brush **22** and the conductive undersheet **14** in the case of every column that passes underneath. Rows (b), (c), (d) and (e) are only punched as desired so that brushes **24**, **26**, **28** and **30** make electrical contact selectively as the brushes pass over the label. In those cases where one or more of the brushes make contact with the undersheet **14**, one or more circuits between the common brush **22** and sensing brushes will be completed per column, manifesting a pattern which can be interpreted to represent a five-digit number. Reading device **20**, in addition to interpreting label **12**, may include a readout **32** for translating the label code to written numbers and a punching and dispensing device **34** which is controlled by the signals from the brushes to reproduce the hole pattern in label **12** in a paper strip **36** which comprises the output of the punching and dispensing device **34**. The paper strip **36** may be used as the oversheet for a specimen container. Such interpreting and punching devices are well defined and well known particularly by those familiar with the art of computer component design.

If a container which has affixed to it a decoded laminate label as described above in accordance with the present invention were to be rotated about a sensing device as described above, or if the sensing device were to be rotated about the container, a pattern of temporary electrical connections, or signals would be generated that could be used to signal the punching device **34** to punch sheet **36** from a stored unpunched roll. Sheet **36** would therefore be a duplicate of the oversheet portion **16** of the original laminate label **12** being "read." Thus, by using a container provided with a label as described above for a master sample vessel together with a device as described above to "read" such a label and punch a similar hole pattern in a sheet to be used as an oversheet for a specimen container (which has affixed thereto a conductive undersheet) the information contained on the master sample label could be reproduced without introducing the human error inherent in manual transcription. In other words, such a label could be used to produce exact copies of its hole pattern in strips of paper which could then be applied over the electrically conducting undersheet of tubes into which portions of the original had been placed.

Thus, by collecting the original sample in a container having an electrically conductive underlabel affixed thereto, placing an overlabel having a plurality of holes therein in a pattern indicative of the contents of the container over the underlabel, placing specimens of the sample in containers provided with similar underlabels, reproducing the overlabel hole pattern in a sheet for use as an overlabel for each container to carry specimens from the original sample, and affixing the sheet over the specimen underlabel, an automatic system of sample identification is provided wherein each specimen may be related to the master sample from which it is taken.

Having thus described the invention, what is claimed is:

1. The method of identifying multiple specimens representing portions of a master sample of a body fluid such as blood wherein examination of the fluid is indicative of the condition of the host and for correlating such specimens to the master sample comprising the steps of:

a. Collecting the master sample in a container having affixed thereto an underlabel having an electrically conductive outer surface;

b. Punching a plurality of holes in an overlabel formed of insulating material indicating in a prearranged code the contents of said master sample container;

c. Affixing said overlabel to said master sample container overlying said underlabel;

d. Placing a specimen of said master sample into a specimen container having affixed thereto an underlabel having an electrically conductive outer surface;

e. Forming an overlabel from a label blank of electrically insulating material for said specimen container by automatically reproducing all or part of the hole pattern of said sample container overlabel in said blank; and,

f. Affixing said specimen container overlabel over said specimen container underlabel.

2. The invention in accordance with claim **1** wherein said sample container overlabel holes are disposed in discrete positions along aligned rows and columns and said specimen container overlabel forming step comprises the substeps of:

a. automatically "reading" said master sample vessel label by bushing said master sample label parallel to said rows with a plurality of bushes aligned with said columns, said bushes being adapted to generate electrical signals in response to each hole in said master sample label; and

b. simultaneously bushing said label blank with means adapted to form holes in said overlabel blank in response to said electrical signals whereby to reproduce a pattern of holes in said label blank identical to the hole pattern in said master sample label.

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