This invention relates to the automatic identification of substances, and more particularly to the automatic identification, analysis and documentation of substances.

A major problem in many analytical procedures involves insuring that the results of an analysis of a sample are positively correlated with the sample which was analyzed. A further problem involves insuring that the sample which was analyzed (and the results of the analysis) are positively correlated with the supply from which the sample was taken. A prime example of these problems is found in the operation of a blood bank. Customarily, a supply of blood is drawn from a donor. A sample of the drawn blood is analyzed, inter alia, for blood type. The blood type is correlated to the supply of drawn blood. The supply of typed blood is given to a patient requiring blood of that particular type. The customary system is fraught with potential clerical errors. Initially, the blood is drawn separately into an independent sample storage container. Identification numbers are manually placed on these containers. The samples are each analyzed and the blood type thereof determined. The blood type is manually recorded in correlation with the identification number. When blood of a particular type is required, the identification number of a storage container having that type of blood is manually obtained, and the corresponding storage container is manually selected.

If blood of an incorrect type is given to a patient, the result may be fatal.

In the U.S. patent application of Jack Isreali, S.N. 391,091, filed Aug. 21, 1964, and assigned to the assignee of this application, there is shown, inter alia, a main storage container for a supply of blood, a sample storage container for a sample of the blood in the main container, and an indicia carrier attached to and between the two containers. The indicia carrier is initially provided with a row of holes along a line of severance in a combination array which uniquely identifies the container. After blood from the same donor has been stored in both containers, the indicia carrier is severed, resulting in each container having a portion of the carrier attached thereto which has an edge provided with a row of notches in a combination array which is identical with the original row of holes. The sample container may then be placed on an automatic sampler of an automatic analysis system with other containers. Each container is serially passed to a first station at which blood is removed from the container, analyzed and the analysis results charted on a recorder; and subsequently passed to a second station at which the indicia associated with the container are automatically sensed and the identification number printed adjacent the charted analysis results on the recorder.

It is an object of this invention to provide a system wherein both the results of the analysis of a sample and the identification number of that sample are digitally recorded in conjunction with the sample.

It is another object of this invention to provide a system wherein both the results of the chemical analysis of a sample and the identification number of that sample are automatically digitally recorded on a document which may be automatically processed by a computer to analyze the chemical analysis results, as for example to determine the blood type, and to record this determination in conjunction with the identification number.

It is still another object of this invention to provide a system wherein the main storage container may be automatically identified, and the predetermined blood type or other results of the chemical analysis may be automatically obtained and printed on the main storage container.

A feature of this invention is the provision of means for automatically extracting a sample from a sample container, chemically analyzing the sample, and providing the results in digital form; means for automatically sensing the identifying indicia on the sample container and providing the identification number in digital form; and means for automatically recording the results in correlation on a document which may be processed by a computer.

These and other objects, features and advantages will become apparent by reference to the following description of the invention considered in conjunction with the accompanying drawings in which:

**FIGURE 1** is a diagrammatic view of a system embodying this invention; and

**FIGURE 2** and 3 are a diagrammatic view of a second system embodying this invention when taken together as indicated in **FIGURE 4**.

In the drawing, the container assemblies have been prepunched, filled with blood, severed and the sample containers placed in a sampler 10 as shown in the Isreali application, supra. The sampler includes an endless sprocket chain 12 to which are mounted vertical, tubular, sample container carriers 14. A tubular sample container 16 is disposed in each carrier 14 and has a notched edge card 18 attached thereto by a boss which projects through a vertical slot in the carrier. The chain intermittently conveys each of the containers to a first station 20 at which a sample off-take tube 22 is located. A suitable sample tube which is translated in a given plane is shown in the United States patent to Jack Israel and Theodore Bilechmian, U.S. 3,251,229, issued May 17, 1966.

In the first embodiment of **FIGURE 1**, the off-taken samples are supplied as a continuous stream to an automatic analysis apparatus 24 having a recorder 26. A suitable automatic analysis apparatus is shown in the U.S. patent to Leonard T. Skeegs, Edwin C. Whitehead, William J. Smythe, Jack Israel and Milton H. Pelavin, U.S. 3,241,432, issued March 22, 1966. The reaction portion of the apparatus may be set up for blood typing according to the U.S. patent application of William J. Smythe, S.N. 221,570, filed Sept. 5, 1962, and assigned to the assignee of this application. The recorder 26 of the Skeegs et al. application, supra, includes a potentiometer slide wire coupled pen 28 which charts a constant value for each of the analyses performed on each sample. The return conductor 30, which is coupled to the sliding contact 32 of the potentiometer 34, is thus energized with a voltage which is a function of the result of the analysis. This conductor 30 is coupled to the input of an analog to digital converter 36. Alternatively, should a recorder be utilized which itself does not provide a constant analog output signal for each of the analyses performed on each sample, then a suitable peak detection and holding circuit, for example and not by way of limitation, such as is shown in the U.S. patent to Milton H. Pelavin, U.S. 3,167,377, issued Jan. 26, 1965, may be coupled between the return conductor 30 and the converter 36. The output of the converter 36 is coupled to the input terminals of a card punch 38. The converter 36 provides a parallel digital output for actuating the punch elements to punch a digital value in a document, such as a punch card, which value is representative of the voltage on the con-
3

3,320,618

The card punch 38 thus punches in the card one or more sets of digits which are representative of the results of one or more analyses performed on the specific sample. The card punch automatically indexes the card so that several numbers may be punched therein.

The operation of the chemical analysis apparatus requires a finite time from start to finish, and the off-taking sample container is advanced from the first station 20 towards a second station 40. When the analysis is at its almost completion, the off-taking sample container is halted at the second station. A read-out mechanism 42, such as is disclosed in the Israeli application, supra, has a plurality of spaced apart parallel wires 44, is disposed at the second station. The wires engage the notched edge of the card 18. Those wires which are adjacent notches on the edge of the card 18 pass into these notches. Those wires which are adjacent lands on the edge of the card are deflected into contact with a ground bus 46. A potential is applied to the wires, and continuity to ground is established in each deflected wire. The output signals from the read-out mechanism are coupled to the input terminal of a digital code converter 48 which converts the code utilized on the edge-notched card 13 to the code utilized by the card punch 38. This may involve a conversion from a two out of five code to a decimal code. The output signals from the code converter 48 are coupled to the input of the card punch 38. The card punch 60 punches the identification number of the sample into the same card in which the results of the analyses of that particular sample are punched.

The output signals of the code converter 48 are also coupled to the input terminals of a digital printing mechanism 50, as shown in the Israeli application, supra. The printing mechanism prints the identification number of the particular sample adjacent the curves 52 representing the analytic results of that particular sample. These curves may be manually interpreted if necessary to provide the results of the analysis and to serve as an independent record for the analysis of each sample.

The determination of the blood type of a sample of blood, or any similar multiple analysis, requires the measurement of the intensity of each reaction, and the logical interpretation of these measurements. The measurement is provided by the analytic system 24. The logical interpretation is readily performed by a suitably programmed computer. For example, consider the ABO blood group system: The red cells in type A blood have type A antigens and are agglutinated by serum having type Anti-A antibodies. The red cells in type B blood have type B antigens and are agglutinated by serum having type Anti-B antibodies. The red cells in type O blood are not agglutinated by either a serum having type Anti-A antibodies or a serum having type Anti-B antibodies. The red cells in type AB blood have both type A and type B antigens and are agglutinated by either a serum having type Anti-A antibodies or a serum having type Anti-B antibodies.

These blood type cards provided by the card punch 56 are now fed into a sorter 58. The sorter is controlled by a read-out mechanism 60 similar to the read-out mechanism 42 whose output signals are coupled to the input terminals of a digital code converter 62 which is similar to the converter 48 and whose output signals are coupled to the input terminals of the sorter. Each of the main blood converters 64 is brought to the read-out mechanism 60 and its notched edge card 66 is sensed to determine its identification number. The sorter 58 sorts the card until it finds the blood type card having the identification number sensed by the read-out mechanism 60. The card reader reads out the blood type of the card and these output signals are coupled to the input terminals of a printer 68 which prints the blood type of the notched edge card 66 of the main blood supply container 64. The printer may also print out on the card 66 the identification number to show that the sorter 58 did locate the correct card. Thus each blood sample is automatically off-taken, analyzed, identified, determined, and the determination printed on the associated main blood supply.

Although an embodiment has been disclosed utilizing a sample liquid, sample solids may also be processed according to this invention. In such a case, the blood is allowed to liquid converter apparatus, shown in the United States patent application of Andres Ferrari and Nelson G. Kling, S.N. 222,013, filed Sept. 7, 1962, now Patent No. 3,223,485, and assigned to the same assignee as this application, may be incorporated into the sampler apparatus.

Further, although a card system has been shown as a buffer storage for the computer, other storage media may be utilized, such as punched tape, or magnetic tape, wherein the identification number of the sample and the results of the analyses on that sample are correlated, or the information may be sent to the computer directly without buffering. Similarly, although a card system has been shown as an output storage for the computer, other media, such as punched tape or magnetic tape, may be used, so long as the identification numbers and results are correlated and may be sorted.

Finally, if a logical analysis of the chemical analysis is not required, then the computer and its buffer storage may be omitted, with the output from the sample container reader and the automatic analysis apparatus being directed directly into the sorter storage.

In the second embodiment, shown in FIG. 2, the sample container 16 containing a blood sample is detached from its supply container 64*, retaining its notched edge card 18*. The sample container 16* is centrifuged to separate the drawn blood into two portions, viz.: an upper plasma portion and a lower red cell portion. The container 16* is then placed in a sampler 10* having an off-take mechanism 22* disposed at a first station and a readout mechanism 42* disposed at a second station. The off-take mechanism includes two off-take tubes, one long tube which aspirates the red cells from the lower portion of the container, and one short tube which aspirates the plasma from the upper portion of the container. Such an off-take mechanism is shown in the U.S. patent to Nelson G. Kling, U.S. 3,252,330, issued May 24, 1966. The off-take mechanism is coupled to an automatic analyzer apparatus 24*, such as is shown in the U.S. patent application of Jack Israeli and Milton H. Pelavin, S.N. 316,264, filed Oct. 15, 1963, and assigned to the assignee of this application. In this analyzer apparatus each sample of red cells is divided into four portions, and the companion sample of plasma is also divided into four portions, and these eight samples are processed contemporaneously. As shown in the U.S. patent application of William J. Smythe, S.N. 221,570, filed Sept. 5, 1963 and Vox Sanguinis, vol. 5, pp. 439-451. Each of the red cells is reacted with Anti-A serum, the second portion of red cells is reacted with Anti-B serum, the third portion is reacted with Anti-D or Rh serum, and the
fourth portion of red cells is mixed with a saline solution as a control. Further, the first portion of plasma is reacted with type A cells, the second portion is reacted with type B cells, the third portion is reacted with type O cells, and the fourth portion is mixed with a saline solution. The lengths of the reaction channels differ slightly so that the reacted red cell sample portions arrive concurrently in their respective four flow cells ahead of the concurrent arrival of the companion reacted plasma sample portions in their respective four flow cells. The analyzer concurrently measures the optical density of the red cell portions in their respective flow cells and the four pen recorders concurrently record the values; then the analyzer concurrently measures the optical density of the plasma portion in their respective flow cells and the recorder concurrently records these values.

Each of the channels of the four pen recorder has a respective potentiometer resistance 100A, 100B, 100C, 100D and a sliding tap 102A, 102B, 102C, 102D thereon which a potential is developed which is responsive to the optical density of the liquid in the respective flow cell.

The antigen and antibody content of the several blood types is set out in Table I, while the agglutination reaction of the red blood cells and the sera are set out in Tables II and III. If there is an agglutination reaction for a sample, the agglutinated red cells, either from the sample cells, or from the test cells in the case of sample sera, will be removed from the channel, as shown in S.N. 221,570, supra, and after the sample is treated to lyse any red cells therein for color will have a low optical density (high light transmittance) since there will have been very few red cells left in the sample to provide color. Thus the agglutination reactions for sample cells and sample sera of the same type will be opposite in result. There will be no agglutination reaction when a saline solution is added in lieu of a blood reagent.

<table>
<thead>
<tr>
<th>Blood group</th>
<th>Antigens on red cells</th>
<th>Antibodies in serum</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>Neither A nor B</td>
<td>Anti-A and Anti-B</td>
</tr>
<tr>
<td>A</td>
<td>A</td>
<td>Anti-A</td>
</tr>
<tr>
<td>B</td>
<td>B</td>
<td>Anti-B</td>
</tr>
<tr>
<td>AB</td>
<td>A and B</td>
<td>Anti-A, Anti-B</td>
</tr>
<tr>
<td>Rh positive</td>
<td>Rh positive</td>
<td>None</td>
</tr>
<tr>
<td>Rh negative</td>
<td>Rh negative</td>
<td>Anti-D</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Blood group</th>
<th>Reaction with Anti-A serum</th>
<th>Reaction with Anti-B serum</th>
<th>Reaction with Anti-D serum</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>No agglut.</td>
<td>No agglut.</td>
<td>No agglut.</td>
</tr>
<tr>
<td>B</td>
<td>No agglut.</td>
<td>Agglut.</td>
<td>No agglut.</td>
</tr>
<tr>
<td>AB</td>
<td>Agglut.</td>
<td>No agglut.</td>
<td>Agglut.</td>
</tr>
<tr>
<td>Rh positive</td>
<td>Agglut.</td>
<td>Agglut.</td>
<td>Agglut.</td>
</tr>
<tr>
<td>Rh negative</td>
<td>Agglut.</td>
<td>No agglut.</td>
<td>Agglut.</td>
</tr>
</tbody>
</table>

The test criterion is whether the optical density of a sample portion exceeds or does not exceed a predetermined value. This threshold for each of the eight portions of the total blood sample is established by a respective potentiometer. Potentiometers 104A, 104B, 104C and 104D provide the red cell thresholds, while potentiometers 106A, 106B, 106C and 106D provide the plasma thresholds. The potential at the recorder potentiometer is compared with the respective threshold potential in that channel by one of four comparators 107A, 107B, 107C, 107D, each having a respective sample input terminal 108A through D, and a respective threshold input terminal 110A through D. Each of the comparators is constructed as a differential amplifier. The inputs 110A–D are normally coupled to the red blood cell threshold potentiometers 104A–D through the moving contacts 112A–D of a relay solenoid 114 and the fixed contacts 116A–D respectively. When the relay solenoid 114 is energized, the inputs 110A–D are coupled to the plasma threshold potentiometers 106A–D through the moving contacts 112A–D and the fixed contacts 118A–D. Associated with the four comparators are four cell output AND gates 120A–D, and four plasma output AND gates 122A–D. Each comparator has an output terminal 124A–D which will provide a significant output when the potential supplied to the input terminal 108A–D is less than the potential supplied to the input terminal 110A–D. Each comparator has an output terminal 126A–D which will provide a significant output when the potential supplied to the input terminal 108A is greater than the potential supplied to the input terminal 110A–D.

A programmer 128 has a first output terminal 130 which provides clock pulses, a second output terminal 132 which is energized during the cell test cycle, a third output terminal 134 which is energized during the plasma test cycle, and a fourth output terminal 136 which provides a print pulse, and a fifth output terminal 138 which provides a reset pulse. Each cell output AND gate 120A–D has three input terminals, one coupled to the comparator output terminal 126A–D, one coupled to the clock pulse output terminal 130, and one coupled to the cell test cycle output terminal 132. Each plasma output AND gate 122A–D has three input terminals, one coupled to the comparator output terminal 126A–D, one coupled to the clock pulse output terminal 130, and one coupled to the plasma test cycle output terminal 134. Terminal 134 is also coupled to the relay solenoid 114.

Four flip-flops 140A–D are provided to store the information provided by the cell test cycle, and four flip-flops 142A–D are provided to store the information provided by the plasma test cycle. The output terminal of each cell output AND gate 120A–D is coupled to the input set terminal of the respective flip-flop 140A–D. The output terminal of each plasma output AND gate 122A–D is coupled to the input set terminal of the respective flip-flop 142A–D. The input reset terminal of each of the eight flip-flops 140A–D and 142A–D is coupled to the reset pulse terminal 135.

Five output AND gates 144A–E are provided to characterize the results of the tests on each total sample of blood. Alternatively, the gate 144A will provide an output signal in the case of type AB blood, the gate 144B in the case of type A blood, the gate 144C in the case of type B blood, the gate 144D in the case of type O blood, and in conjunction with the foregoing, the gate 144E will provide an output in the case of type D or Rh positive blood. The input terminals of these AND gates are coupled by a matrix to the output terminals of the flip-flops 140A–D and 142; and to the output terminal 146 of an inverter 148. Six error AND gates 150A–F have their input terminals also coupled by this matrix to the output terminals of the flip-flops, each of the gates providing an output in the event of two majority inconsistent inputs thereon. The output terminals of the error AND gates 150A–F are coupled to the input terminals of an error or gate 152 where output terminal 154 is coupled to the input terminal 156 of the inverter 148. Thus, in the event of no inconsistency in the relative states of the flip-flops 140A–D and 142D there will not be any output signal from the error AND gates 150A–F and no
output signal from the error OR gate 152. The inverter will then provide a signal to the inputs of the characterizing AND gates 144-A-E. If there is an error output signal, the inverter will not provide an output signal, and each of the characterizing gates will be precluded from providing an output signal.

Five printers 160-A-E may be provided to print tags for attachment to the main blood containers 64. Each of these printers has a single element to print a blood type character, "A", "B", "O", and "Error", respectively. Each of these printers has a dual element to normally print "-" as indicative of Rh- and, when energized, to print "+" as indicative of Rh+. Finally, each of these printers has a set of numerical print elements and a code converter input therefore to print the identification number of the particular blood sample. The output terminal 158 of the RH AND gate 144E is coupled to the dual element in each of the printers, and the output conductors 161 readout mechanism 42 are coupled to the code converter of each of the printers.

Five print relays are provided, each having a solenoid 162A-E and a respective normally open contact assembly 164A-E. The output terminals of the characterizing AND gates 144A-D are respectively coupled to the print relay solenoids 162A-D; and the output terminal 154 of the error OR gate 152 is coupled to the print relay solenoid 162E. The input of each of the contact assemblies 164A-E is coupled to the print signal output terminal 136 of the programmer 128. The output of each of the contact assemblies 164A-E is coupled to the overall printing actuator mechanism of the respective printer 160A-E.

In operation, the red blood cells and the plasma are concurrently aspirated from a given sample container 120 by the off-take mechanism 22 as a stream, the red blood cells are cleansed, diluted and divided into four substreams, and the plasma is also divided into four substreams. Each of the streams is mixed with a reagent comprising an appropriate one of the group of antibodies, and antigens and salines previously discussed.

Any agglutinated red cells are removed from each stream and each stream is lyzed to provide a homogeneous color from any remaining red blood cells therein. The plasma streams are delayed, in phase, so that the cell samples arrive at their respective flow cells first. At this time the terminal 132 of the programmer is energized and the optical density readings from the cell flow cells are compared with the threshold values established by the respective potentiometers 104A-D, and the results fed through the AND gates 120A-D to the flip-flops 140A-D.

When terminal 130 provides a clock pulse, the plasma samples now arrive at their respective flow cells, and at this time the terminal 132 is deenergized and the terminal 134 is energized. The relay 114 is energized, transferring the movable contacts 112A-D from the fixed contacts 116A-D to the fixed contacts 118A-D. The optical density readings from the plasma flow cells are now compared with the threshold values established by the respective potentiometer 106A-D, and the results fed through the AND gates 122A-D to the flip-flops 142A-B when the terminal 130 provides a clock pulse. The AND gates 144A-D determine whether the blood is type AB, A, B, or O. The AND gate 144E determines whether or not the blood is type Rh- or Rh+, and the AND gates 150A-F and the OR gate 154 determine whether the status of the flip-flops are mutually consistent. The identification number is fed from the read-out mechanism 42 to the identification number print wheels of each of the printers. If an error has not been made, and the blood is Rh+, the AND gate 144E energizes the "Rh+" print element in each of the printers, and one of the AND gates energizes its associated relay solenoid 162A-D. If an error has been made, the OR gate 152 energizes its relay solenoid 162E. When the print terminal 136 of the programmer provides a pulse, the transferred one of the contact assemblies 164A-E couples the pulse to the appropriate printer which prints out the identification number and either the appropriate blood type including Rh factor, or "Error." When the reset terminal 138 provides a pulse, all of the flip-flops are reset and the apparatus is prepared for a new sample cycle.

The printed tags provided by the printers may be manually applied to the appropriate blood supply containers 64. It will be appreciated that the information from the gates 144A-E and 152 may alternatively be fed to a data card punch similar to that shown as 56 in FIG. 1, together with the identification number provided by the read-out mechanism 42, to produce a data card. The data card may then be fed to a sorter similar to 58 to automatically print out on the blood supply containers as described with reference to FIG. 1. Alternatively, in lieu of the use of the single element to print a blood type character in each of the printers 160-A-E, a roll of preprinted tags may be used.

While we have shown and described preferred embodiments of the invention, it will be understood that the invention may be embodied otherwise than as herein specifically illustrated or described, and that certain changes in the form and arrangement of parts and in the specific manner of practicing the invention may be made without departing from the underlying idea or principles of this invention within the scope of the appended claims.

1. A system comprising: a plurality of sample containers, each of said sample containers bearing indicia identifying said sample container, and adapted to contain a sample therein; analysis means for analyzing a plurality of liquid samples and for providing an output signal responsive to the result of each analysis; off-take means for removing a quantity of sample from each of said sample containers and for supplying these samples to said analysis means as a continuous stream of serum samples; a plurality of supply containers, each of said supply containers bearing indicia identifying said supply container and correlating said supply container with one of said plurality of sample containers; means coupled to said analysis means for reading out the indicia identifying each said sample container, for reading out the indicia identifying said supply container, and for providing each supply container with indicia responsive to the results of the analysis of the substance in the correlated sample container.

2. A system comprising: a plurality of sample containers, each of said sample containers having a first elongated member attached thereto, which member bears a plurality of notches including a zero notch; an array of said sample containers with an identification number, and adapted to contain a sample therein; analysis means for analyzing a plurality of liquid samples and for sequentially providing an output signal responsive to the result of each analysis; off-take means for removing a quantity of sample from each of said sample containers and for supplying the samples to said analysis means as a continuous stream of serum samples; first read-out means for sensing said array of notches on said first elongated member of each sample container and for providing an identification signal responsive thereto; first recording means coupled to said first read-out means for digitally recording on a document an identification number responsive to the identification signal, and coupled to said analysis means for digitally recording on the document the result of the analysis performed on the sample taken from that read out sample container in correlation with the identification number.

3. A system comprising: a plurality of sample containers, each of said sample containers having a first elongated member attached thereto, which member bears a plurality of notches in an edge thereof in a combinational array providing said sample container with an identification number, and adapted to contain a sample substance therein; analysis means for analyzing a plurality of liquid
samples and for sequentially providing an output signal responsive to the result of each analysis; off-take means for removing a quantity of sample from each of said sample containers and for supplying the samples to said analysis means as a continuous stream of seriatim samples; first read-out means for sensing said array of notches on said first elongated member of each sample container and for providing an identification signal responsive thereto; first recording means coupled to said first read-out means for punching on a card an identification signal, and coupled to said analysis means for punching on the card the result of the analysis performed on the sample taken from the read-out sample container in correlation with the identification number; second read-out means for sensing said array of notches on said second elongated member of each sample container and for providing an identification signal responsive thereto; sorting means coupled to said second read-out means for sorting the sample container identification numbers recorded by said recording means for the identification number responsive to the supply container identification number sensed by said second read-out means and for providing a result signal responsive to the result recorded in correlation with the sorted-for sample container identification number; and second recording means coupled to said sorting means for recording on the read-out supply container a result number responsive to the result signal.

4. A system comprising: a plurality of sample containers, each of said sample containers having a first elongated member attached thereto, which member has a plurality of notches in an edge thereof in a combinational array providing said sample container with an identification number, and adapted to contain a sample therein; analysis means for analyzing a plurality of liquid samples and for sequentially providing an output signal responsive to the result of each analysis; off-take means for removing a quantity of sample from each of said sample containers and for supplying the samples to said analysis means as a continuous stream of seriatim samples; a plurality of supply containers, each of said supply containers having a second elongated member attached thereto, which member has a plurality of notches in an edge thereof in a combinational array providing said supply container with an identification number which is correlated to the identification number of one of said sample containers; first read-out means for sensing said array of notches on said elongated member of each sample container, and for providing an identification signal responsive thereto; first recording means coupled to said first read-out means for digitally recording on a document an identification number responsive to the identification number, and coupled to said analysis means for recording on the document the result of the analysis performed on the sample taken from that read-out sample container in correlation with the identification number; and second read-out means for sensing said array of notches on said second elongated member of each supply container and for providing an identification signal responsive thereto; first recording means coupled to said first read-out means for digitally recording on a document a sample container identification number which is correlated to the identification number of one of said sample containers; and adapted to contain a sample therein; and analysis means for analyzing a plurality of liquid samples and for sequentially providing an output signal responsive to the result of each analysis; off-take means for removing a quantity of sample from each of said sample containers and for supplying the supplies to said analysis means as a continuous stream of seriatim samples; first read-out means for sensing said array of notches on said first elongated member of each sample container seriatim; and for providing an identification number signal in response thereto; buffer storage means coupled to said first read-out means for storing the signal responsive to the result recorded in correlation with the sorted-for sample container identification number sensed by said second read-out means, and coupled to said analysis means for storing in correlation with the respective identification number signal the result signal to the result of the analysis on the respective sample.

7. A system comprising: a plurality of sample containers, each of said sample containers having a first elongated member attached thereto, which member has a plurality of notches in an edge thereof in a combinational array providing said sample container with an identification number, and adapted to contain a sample therein; analysis means for analyzing a plurality of liquid samples and for sequentially providing an output signal responsive to the result of each analysis; off-take means for removing a quantity of sample from each of said sample containers and for supplying the samples to said analysis means as a continuous stream of seriatim samples; a plurality of supply containers, each of said supply containers having a second elongated member attached thereto, which member has a plurality of notches in an edge thereof in a combinational array providing said supply container with an identification number which is correlated to the identification number of one of said sample containers; first read-out means for sensing said array of notches on said elongated member of each sample container seriatim, and for providing an identification number signal in response thereto; buffer storage means coupled to said first read-out means for storing the signal responsive to the result of each said identification number, and coupled to said analysis means for storing in correlation with the respective identification number signal the result signal to the result of the analysis on the respective sample; second read-out means for sensing said array of notches on said second elongated member of each supply container seriatim, and for providing an identification number signal in response thereto; sorting means coupled to said second read-out means for sorting the sample container identification numbers in said buffer.
3,320,618

A storage means for the identification number correlated to the supply container identification number sensed by said second read-out means and for providing a resultant signal responsive to the result recorded in correlation with the sorted-for sample container identification number; and second recording means coupled to said sorting means for recording on the read-out supply container a result number responsive to the result signal.

8. A system comprising: a plurality of sample containers, each of said sample containers having a first elongated member attached thereto, which member has a plurality of notches in an edge thereof in a combinational array providing said sample container with an identification number which is identical to the identification number of one of said sample containers; first read-out means for sensing said array of notches on said first elongated member of each sample container seriatim, and for providing an identification number signal in response thereto; buffer storage means coupled to said first read-out means for storing the signal responsive to each of said identification numbers, and coupled to said analysis means for storing in correlation with the respective identification number signal the signals responsive to the results of the analyses on the respective sample; logically operating means coupled to said buffer storage means for performing a logical operation on the signals representative of the results of the analyses on the respective sample, and providing a signal responsive to the result of the logical operation, and a correlated signal responsive to the identification number of the sample on which these analyses were performed; additional storage means coupled to said logically operating means for storing the signal responsive to the identification number of each of said samples and the signal responsive to the result of the logical operation concerned with that sample; second read-out means for sensing said array of notches on said second elongated member of each supply container seriatim, and for providing an identification number signal in response thereto; sorting means coupled to said second read-out means for sorting the sample container identification numbers in said additional storage means for the identification number correlated to the supply container identification number sensed by said second read-out means and for providing a result signal responsive to the result recorded in correlation with the sorted-for sample container identification number; and second recording means coupled to said sorting means for recording on the read-out supply container result indicia responsive to the result signal.

9. A system comprising: a plurality of sample containers, each of said sample containers having a plurality of notches in an edge thereof in a combinational array providing said sample container with an identification number which is identical to the identification number of one of said sample containers; first read-out means for sensing said array of notches on said first elongated member of each sample container seriatim, and for providing an identification number signal in response thereto; analysis means for contemporaneously analyzing a plurality of portions of each sample of a plurality of seriatim samples; logic means for correlating the signals provided by said analysis means for each sample and providing a signal responsive to such correlation; said analysis means and said logic means operating seriatim upon each sample; recording means coupled to said logic means for recording the correlation responsive signal.

10. A system comprising: first means for providing a plurality of unique samples; analysis means for contemporaneously analyzing a plurality of portions of each sample of a plurality of seriatim samples; means for conveying samples from said first means seriatim to said analysis means; said analysis means providing a plurality of signals respectively responsive to the results of the analyses of the plurality of portions of each sample; said logic means for correlating the signals provided by said analysis means for each sample and providing a signal responsive to such correlation; said analysis means and said logic means operating seriatim upon each sample; recording means coupled to said logic means for recording the correlation responsive signal.
means coupled to said sorting means for recording on the read-out supply container a result number responsive to the result signal.

14. A system comprising: a plurality of sample containers, each of said sample containers having a plurality of indicia thereon in a combinational array providing said sample container with an identification number, and adapted to contain a sample therein; analysis means for analyzing a plurality of samples and for sequentially providing an output signal responsive to the result of each analysis means for obtaining a quantity of sample from each of said sample containers and for supplying the samples to said analysis means as a continuous stream of serrati samples; first read-out means for sensing said array of indicia on each sample container serrati; and for providing an identification number signal in response thereto; buffer storage means coupled to said first read-out means for storing the signal responsive to each of said identification numbers, and coupled to said analysis means for storing in correlation with the respective identification number signal the signal responsive to the result of the analysis on the respective sample.

15. A system comprising: a plurality of sample containers, each of said sample containers having a plurality of indicia thereon in a combinational array providing said sample container with an identification number, and adapted to contain a sample substance therein; analysis means for analyzing a plurality of samples and for sequentially providing an output signal responsive to the result of each analysis; means for obtaining a quantity of sample substance from each of said sample containers and for supplying the substances to said analysis means as a continuous stream of serrati samples; a plurality of supply containers, each of said supply containers having a second elongated member attached thereto, which member has a plurality of indicia thereon in a combinational array providing said supply container with an identification number which is correlated to the identification number of one of said sample containers; first read-out means for sensing said array of indicia on each sample container serrati, and for providing an identification number signal in response thereto; buffer storage means coupled to said first read-out means for storing the signal responsive to each of said identification numbers, and coupled to said analysis means for storing in correlation with the respective identification number signal the signal responsive to the result of the analysis on the respective sample; second read-out means for sensing said array of indicia on said second elongated member of each supply container serrati, and for providing an identification number signal in response thereto; sorting means coupled to said second read-out means for sorting the sample container identification numbers in said buffer storage means for the identification number correlated to the supply container identification number sensed by said second read-out means and for providing a resultant signal responsive to the result recorded in correlation with the sorted-for sample container identification number; and second recording means coupled to said sorting means for recording on the read-out supply container a result number responsive to the result signal.

16. A system comprising: a plurality of sample containers, each of said sample containers having a plurality of indicia thereon in a combinational array providing said sample container with a unique identification number, and adapted to contain a sample therein; analysis means for sequentially analyzing a plurality of samples and for providing output signals responsive to the results of each analysis; means for obtaining a quantity of sample from each of said sample containers and for supplying the samples to said analysis means as a continuous stream of serrati samples; a plurality of supply containers, each of said supply containers having a plurality of indicia thereon in a combinational array providing said supply container with an identification number which is identical to the identification number of one of said sample containers; first read-out means for sensing said array of indicia on each sample container serrati, and for providing an identification number signal in response thereto; buffer storage means coupled to said first read-out means for storing the signal responsive to each of said identification numbers, and coupled to said analysis means for storing in correlation with the respective identification number signal the signals responsive to the results of the analyses on the respective sample; logically operating means coupled to said buffer storage means for performing a logical operation on the signals representative of the results of the analyses of each sample, and providing a signal responsive to the result of the logical operation, and a correlated signal responsive to the result of the logical operation concerned with that sample; second read-out means for sensing said array of indicia on each supply container serrati, and for providing an identification number signal in response thereto; sorting means coupled to said second read-out means for sorting the sample container identification numbers in said additional storage means for the identification number correlated to the supply container identification number sensed by said second read-out means and for providing a result signal responsive to the result recorded in correlation with the sorted-for sample container identification number; and second recording means coupled to said sorting means for recording on the read-out supply container result indicia responsive to the result signal.

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RICHARD R. WILKINSON, Primary Examiner.
J. W. HARTARY, Assistant Examiner.