

[54] **APPARATUS FOR TRANSPORT AND STORAGE OF LIQUID SPECIMENS FOR RADIO-IMMUNOASSAY FOR INSULIN**

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[56] **References Cited**

UNITED STATES PATENTS

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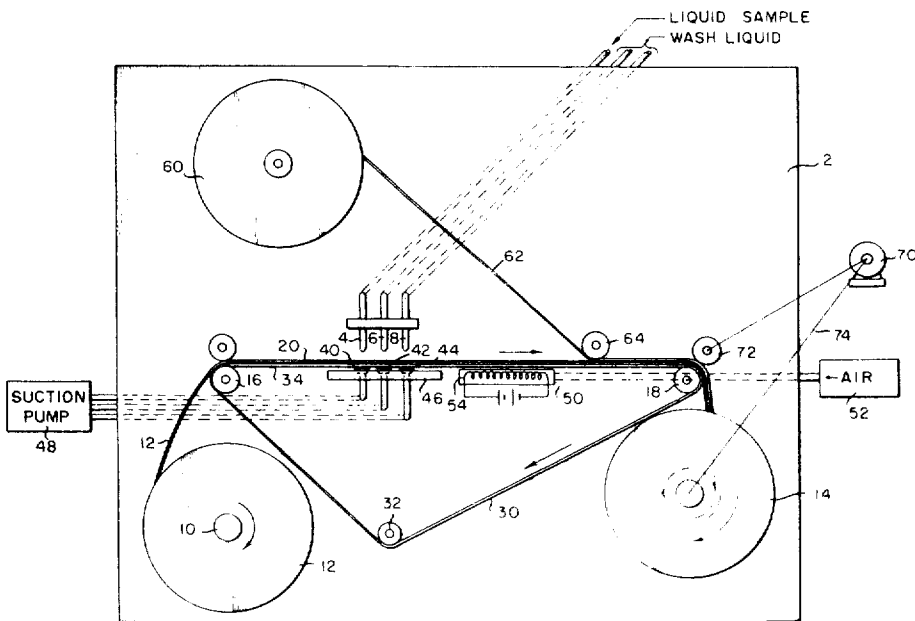
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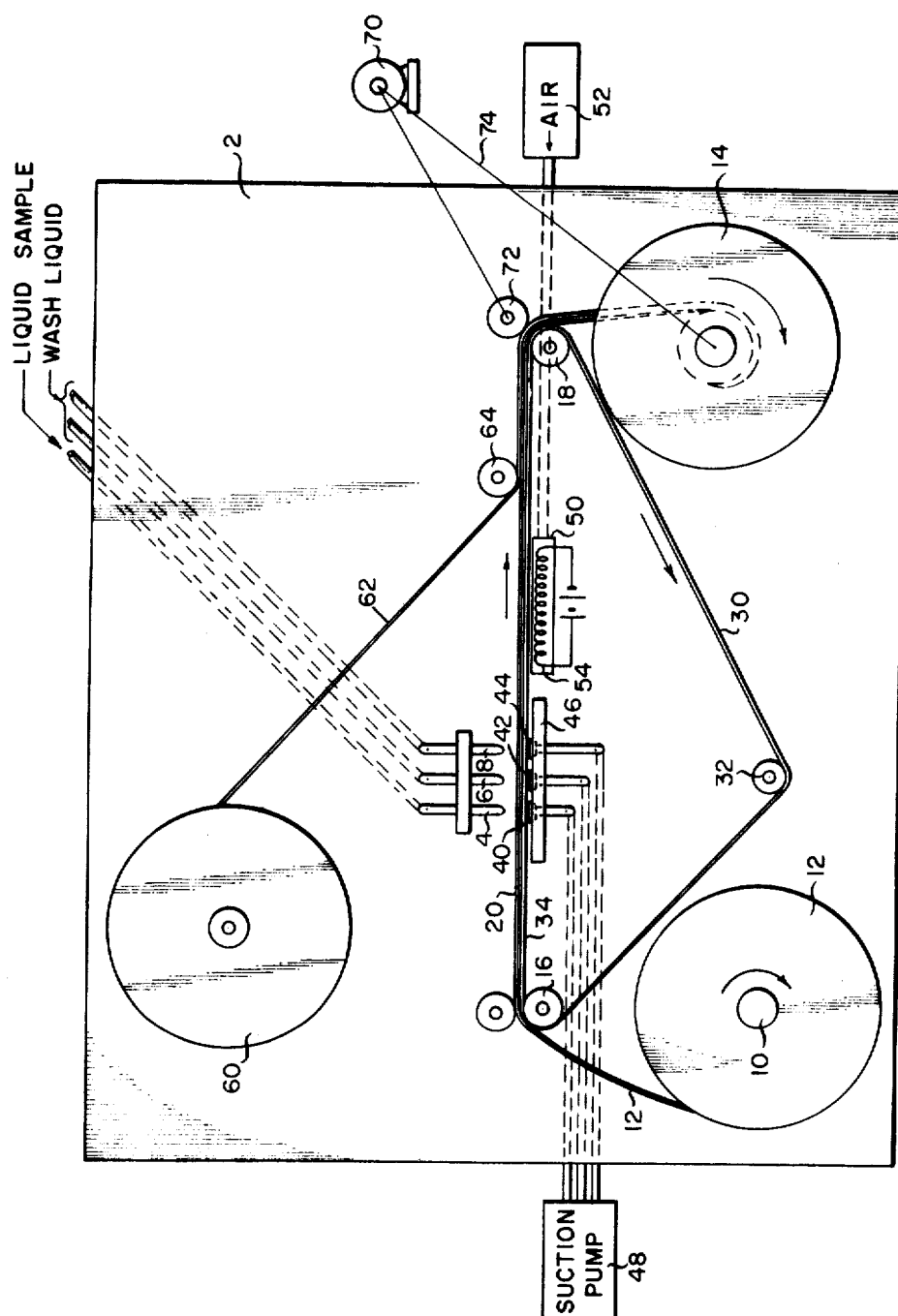
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[57] **ABSTRACT**

Samples from a number of individual liquid specimens containing varying and unknown amounts of insulin are made radioactive and are sequentially supplied to a continuously moving paper strip to impregnate the strip with separate spaced specimens along its length, which are then washed and dried. Cellophane tape is continuously adhesively united to the strip bearing the impregnated and dried specimens and the composite strip and tape are stored in a roll from which the strip may be taken for examination and analysis of the separate specimens.

2 Claims, 1 Drawing Figure





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DESCRIPTION OF THE DRAWINGS

The single FIGURE of the drawings is a front view of the transport and storage apparatus provided by the invention.

DESCRIPTION OF THE INVENTION

This invention relates broadly to liquid analysis apparatus of the type providing a series of liquid samples and, more particularly, to apparatus for storing the samples for later study and analysis.

In United States Letters Pat. No. 3,134,263, issued May, 26, 1964 to E. B. M. de Jong, for Sample — Supply Device for Automatic Analysis Apparatus, there is described apparatus for producing a stream of discrete radioactive liquid samples which are separated from each other by intervening segments of a wash liquid disposed between a pair of air segments. The wash liquid segments are effective to cleanse the walls of the analysis apparatus and prevent contamination of a sample by a preceding sample, and this cleansing action is in addition to the cleansing action provided by the intervening air segments. In that patent analysis apparatus is generally disclosed at 34 but is not part of the patented invention and therefore is not specifically described. The specification of the patent is incorporated into this specification by reference, as an example of auto-analysis apparatus, but it will be understood that other apparatus may be used to produce the stream of samples which are transported and stored by the means provided by this invention. The patented apparatus is commercially available under the trademark Technicon.

In accordance with the invention, means are provided for applying the stream of radioactive liquid samples emerging from a standard auto-analyzer apparatus such as the Technicon to an absorbent strip on which the successive samples are separated, washed and dried, after which they are sealed by a plastic strip and collected on a take-up reel from which they may be removed for scanning and evaluation at any later, convenient time.

One form which the invention may take is illustrated in the drawings and comprises a rigid mounting base of any suitable size, shape and material having a preferably vertical front surface 2. Three depending capillary tubes 4, 6, 8 having open lower ends are mounted on this surface and are connected to parts of the auto-analyzer apparatus to produce through tube 4 a spaced series of liquid samples, and through tubes 6, 8 two wash liquids.

Means are provided by the invention for receiving the liquid samples and wash liquid from tubes 4, 6, 8, and such means comprise first a rotatable supply reel 10 on which there is mounted a roll of absorbent strip material 12 such as filter paper. A coil compression spring, which is not shown, may be provided for applying tension to reel 10 to cause an even rate of delivery of paper from the roll. As illustrated, the supply reel is mounted below and at one side of the group of tubes 4, 6, 8. At the other side of the group of tubes and also below them there is rotatably mounted on the base a take-up reel 14, and the strip of absorbent material 12 is led from the supply reel 10 to the take-up reel 14 over sprocket-type guide rollers 16, 18 which are so spaced and arranged with respect to reels 10, 14 and the group of tubes 4, 6, 8 that a horizontal reach of the absorbent strip passes just below the lower ends of the tubes, as shown at 20.

Means are provided by the invention for supporting and pulling the horizontal reach 20 of the absorbent strip 12, and comprises a chemically inert, perforated endless belt 30 which is trained over rollers 16, 18 below the absorbent strip and also beneath a third roller 32 which is located beneath and between rollers 16, 18 whereby the endless belt forms an inverted triangle having its horizontal base 34 below and in supporting contact relation to the horizontal reach 20 of the absorbent strip.

Means are provided by the invention for causing the liquid sample falling from capillary tube 4 and the successive washes falling from tubes 6, 8 to be held on the absorbent strip 12 without spreading, thereby to provide discrete samples embedded in the strip, which may be separately scanned and evaluated. Such means comprise three porcelain filter discs 40, 42, 44 which are positioned, respectively, beneath the tubes 4, 6, 8 and also beneath the horizontal reach formed by the parts 20, 34 of the absorbent strip 12 and the endless belt 30. These filter discs are mounted on a glass tube 46 and each is connected by tubing to a vacuum pump 48.

Means are also provided for heating the washed samples after impregnation into the absorbent strip, and such means are positioned adjacent and downstream from the filter discs which have just been described. These means comprise an elongated horizontal tube 50 which is positioned below the horizontal reaches 20, 34 and which is connected to a source of air under pressure 52 and within which is an electrical resistance heating element 54. The upper part of the tube is provided with an elongated opening just below the horizontal reaches 20, 34 to direct heated air upwardly onto the strips.

Means are provided for sealing the absorbent strip 12 after the washed samples have been impregnated into it, and such means comprise a reel 60 which is rotatably mounted on the mounting base above the supply reel 10 and above the horizontal reaches 20, 34 of the two strips 12, 30. A roll of cellophane strip 62 (or other suitable material) is mounted on this reel and is trained from the reel under a roller 64 into surface contact with the upper surface of the horizontal reach 20 of the absorbent strip 12 downstream of the area of impingement of heated air from tube 50. The cellophane strip is not adhered or otherwise connected to strip 12 but moves in surface contact with it to be wound with strip 12 on the take-up reel 14.

Any suitable means may be provided for imparting the necessary movement to the apparatus to cause the absorbent strip and cellophane tape to be drawn from their respective supply rolls to the take-up roll on reel 14. In the described embodiment these means comprise an electric motor 70 the armature of which is connected to a roller 72 which drives the belt 30 and strip 12 by friction. The motor armature is also connected by slipping belt 74 to reel 14 to positively drive it and coil on it the composite strip 12, 62.

In the use and operation of the described apparatus the motor 70 is operated to cause the belt 30 to move in its endless path with its upper horizontal reach 34 below and in surface contact with the horizontal reach 20 of the absorbent strip 12, thus supporting the horizontal reach of the absorbent strip and assisting its movement. At the same time motor 70 drives the take-up reel 14, causing the composite absorbent strip and cellophane strip to coil up on that reel. Liquid samples from the auto-analyzer apparatus periodically drop from capillary tube 4 onto the absorbent strip and are fixed there by vacuum applied through filter disc 40, after which each sample is subjected to washes from capillary tubes 6, 8, each being fixed by vacuum applied, respectively, through filter discs 42, 44. Each fixed and washed sample then passes with the moving absorbent strip over the drying area provided by the upwardly directed air stream from tube 50. Cellophane strip 62 now engages the upper surface of the impregnated absorbent strip 12 and the two strips are moved in surface-to-surface engagement into the storage roll on take-up reel 14, from which any part may be scanned and evaluated at any time.

We claim:

1. Apparatus for transporting and storing liquid samples supplied by an auto-analyzer apparatus, comprising a supporting base, a capillary tube vertically mounted on the base and having an open lower end and being adapted to receive and dispense a series of separate liquid samples, at least one additional capillary tube vertically mounted on the base adjacent the first capillary tube and having an open lower end and being adapted to receive and dispense a wash liquid, a supply roll of absorbent strip material rotatably mounted on the base,

3

a storage roll rotatably mounted on the base, means for guiding strip material from the supply roll to the storage roll over a path passing under said tubes, means for causing the strip to pass along said path from the supply roll to the storage roll, a filter disc beneath each of said tubes and beneath the strip, and means for applying suction to each disc.

4

2. Apparatus according to claim 1 comprising, in addition, means positioned upstream of the strip from the filter discs and below the strip for directing a stream of heated air upwardly onto the strip.

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