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Zauft et al.

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[54] **DEVICE FOR COLLECTING, TRANSPORTING AND DIVIDING TEST CARRYING CONTAINERS**

[75] Inventors: **Karl-Heinz Zauft; Manfred Bogl; Klaus-Steffen Isensee; Helmut Rohlfs,** all of Erlangen, Germany

[73] Assignee: **Siemens Aktiengesellschaft,** Erlangen, Germany

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** ..... **23/259,** 23/253 R, 141/129

[51] **Int. Cl.** .. **B65b 43/42,** G01n 33/00, G01n 33/16

[58] **Field of Search** .. 23/259, 253 R, 230 R, 230 B, 23/230 US; 141/129, 130

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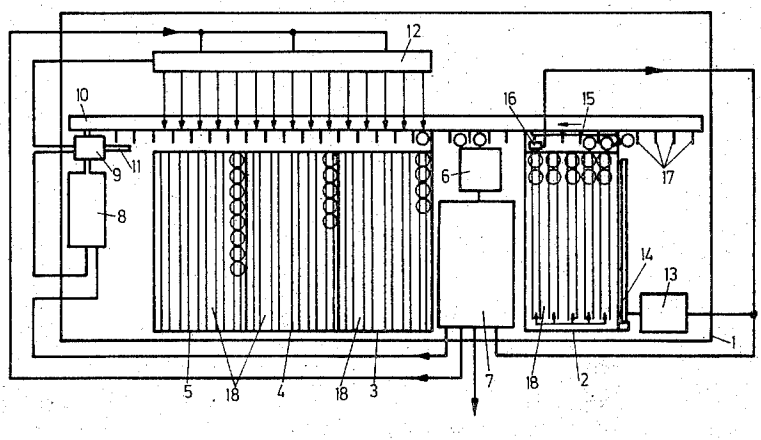
Primary Examiner—Joseph Scovronek

Attorney, Agent, or Firm—Richardo & Geier; V. Alexander Scher

[57] **ABSTRACT**

A device for collecting, transporting and dividing test carrying containers has a transporting band provided with suitable holding means which receive individually so-called entire test containers supplied from a store tank and having coded information for identification and treatment of the container contents. They are transported to a reading device and from there further into a decanting position of a test divider. There actuating electronic means influenced by the reading device operate a dosing and characterizing device to divide the entire contents of the container or a part thereof into so-called individually examined containers and to provide their codes. The invention is particularly characterized in that transporting band is moved from the decanting position to several storage tanks. A push-out device operated by the electronic means is located at the receiving side of the storage tanks and is used to move the individual entire testing containers corresponding to information produced by the reading device for the transporting band into a collecting tank corresponding to the required further treatment.

5 Claims, 5 Drawing Figures



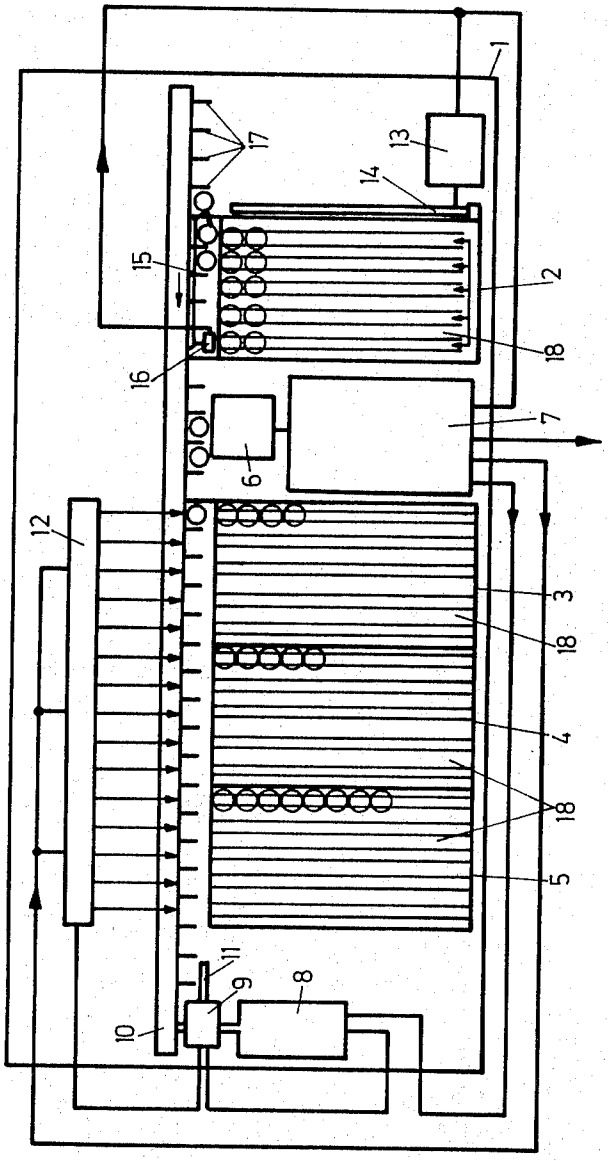


Fig.1

INVENTORS:
K.-H. Zauft, M. Bögl, K.-S. Isensee and H. Rohlfs
BY
Richards & Geier
ATTORNEYS

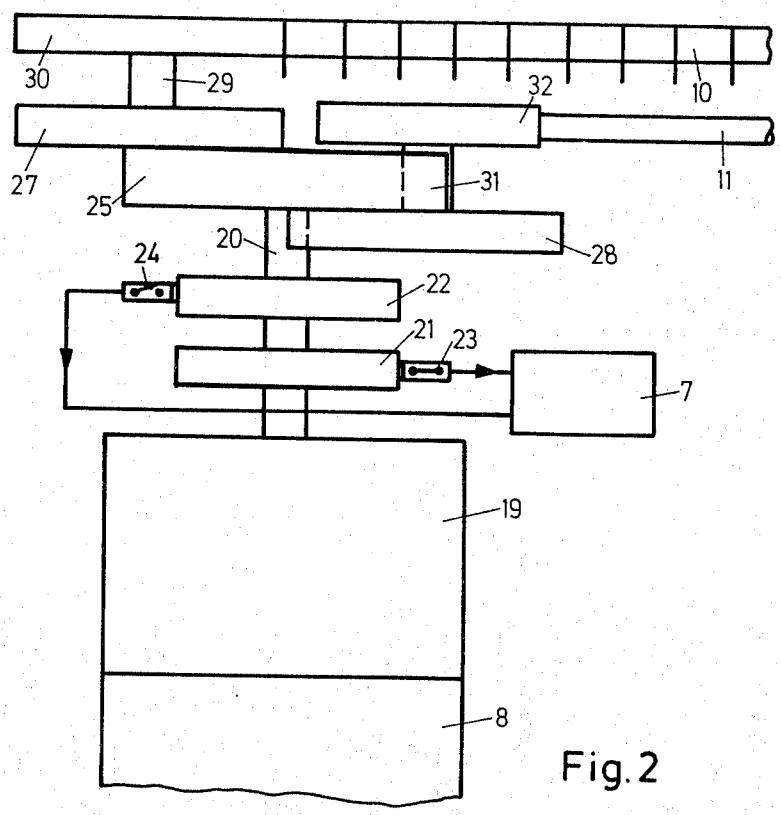


Fig. 2

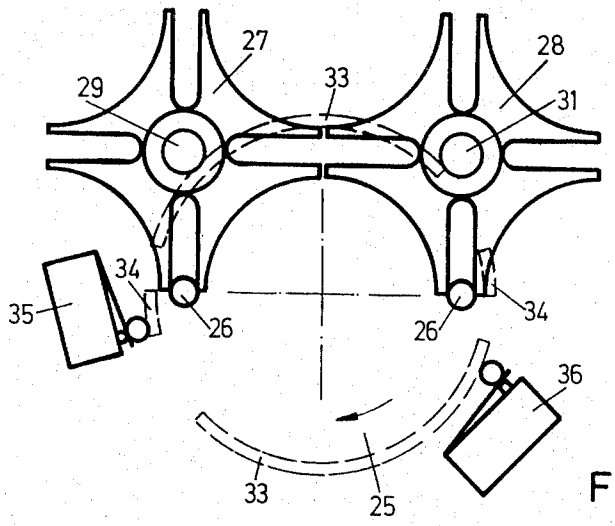


Fig. 3

INVENTORS:
K.-H. Zauft, M. Bögl, K.-S. Isensee and H. Rohlfs
BY
Richards & Geier
ATTORNEYS

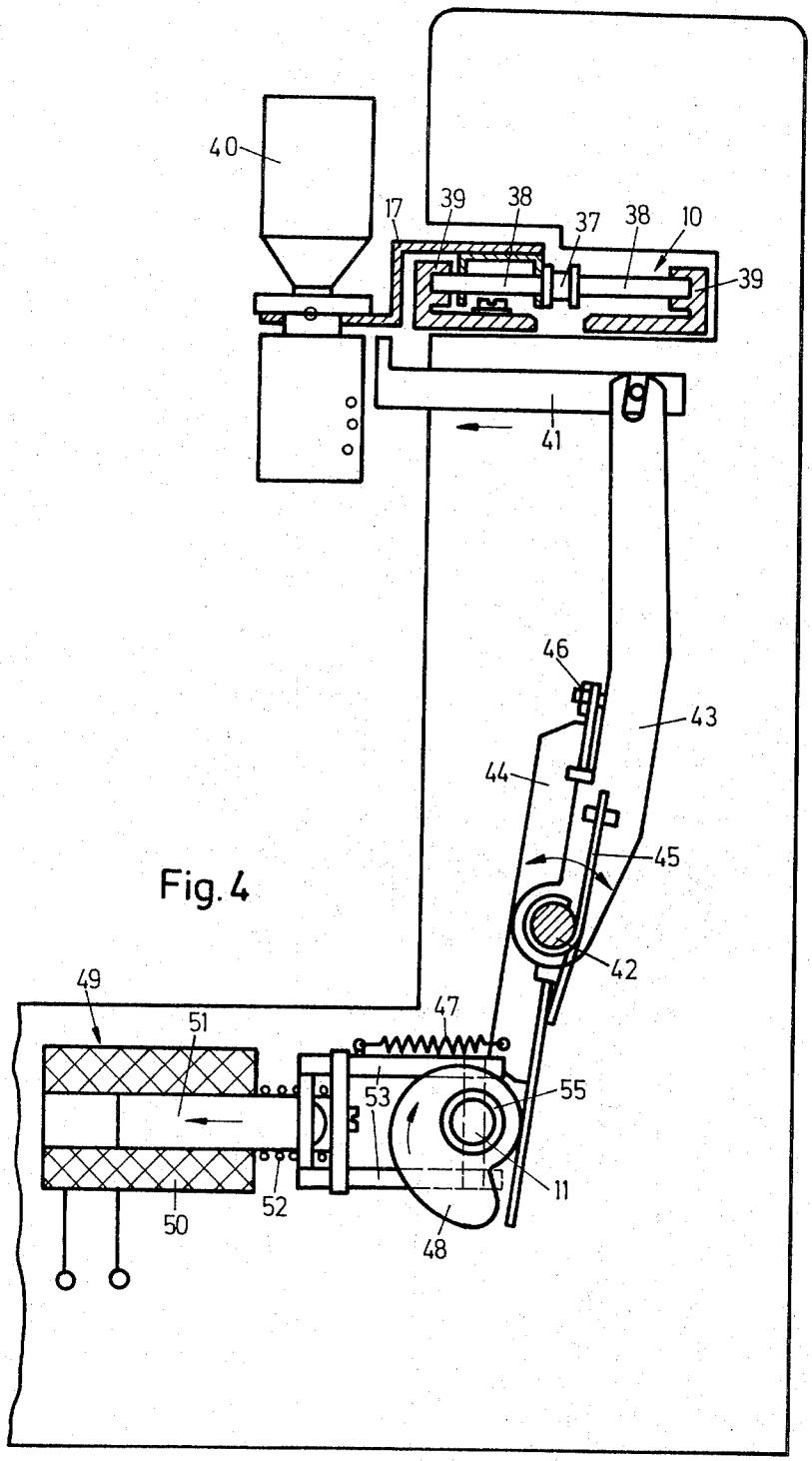


Fig. 4

INVENTORS:
K.-H. Zauft, M. Bögl, K.-S. Isensee and H. Rohlfs
BY
Richards & Geier
ATTORNEYS

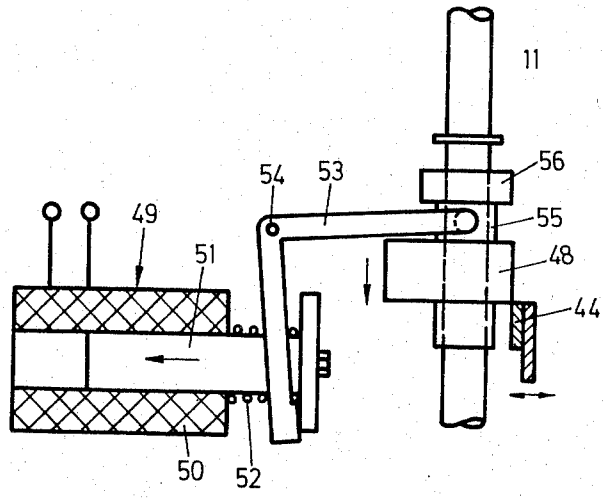


Fig. 5

INVENTORS:
K.-H. Zauft, M. Bögl, K.-S. Isensee and H. Rohlfs
BY
Richards & Geier
ATTORNEYS

DEVICE FOR COLLECTING, TRANSPORTING AND DIVIDING TEST CARRYING CONTAINERS

This invention relates to a device for collecting, transporting and dividing test carrying containers wherein a transporting band provided with suitable holding means which receive individually so-called entire test containers supplied from a store tank and having coded information for identification and treatment of the container contents, transports them to a reading device and from there into a decanting position of a test divider. There actuating electronic means influenced by the reading device operate a dosing and characterizing device to divide the entire contents of a container or a part thereof into so-called individually examined containers and to provide their codes.

Devices of this type serve primarily to simplify and to rationalize the work of the clinical personnel. For that purpose serum containers (entire test containers) coming from the stations and provided with the necessary information about patient identification and the type of the required examinations, which are changed into a text readable by a machine, are gathered into a tank and are supplied individually to a so-called test divider. This divider is used to divide the substance to be examined from the entire test container into so-called individual test containers which are then divided among the individual examining locations. At the same time information impressed upon the entire test container is read and is transmitted to the individual test containers.

Devices are known which avoid the necessity of bringing each entire test container by hand and individually to the test divider by providing means collecting these containers and automatically supplying them to the test divider and also removing containers which are not necessary any more. In one of these known devices a number of containers, for example five, is initially collected in transporting magazines. Then a number of these magazines is placed together as a transported unit in two columns in such manner that in one of these columns the number of magazines is less by one than the total possible number. Then the two columns are shifted against each other by a suitable moving mechanism in the manner of a so-called paternoster. Then the outer magazine of each column, looking in the transporting direction, is exchanged for one in the other column while moving past the test divider, which divides the interior of each container corresponding to provided information and also supplies information to individual test containers.

This known device has above all the drawback that it is limited to a single inner cycle. Thus it is not possible to select the total test containers located in the magazines after they were moved past the test divider and to supply them to different further treatments. Rather such further distribution must be carried out by hand on the basis of available clear text information. Since by no means can all analyses be carried out automatically it is quite often necessary to separate individual total test containers and to supply them to special mostly mechanical analysis containers or to non-automatic analysis locations. Such manual operations in an automat obviously considerably impede the operation and also require a high extent of attention.

An object of the present invention is to provide a device which is compact and easily observable and yet

which makes it possible after collecting and transporting the total test containers to the test divider and after removal of partial tests required for automatic analysis, to carry out a selection of the total test containers according to specific considerations and at the same time collect the selected containers in common tanks.

Other objects of the present invention will become apparent in the course of the following specification.

In the accomplishment of the objectives of the present invention it was found advisable to move the transporting band for the containers past the decanting position of the test divider to several storage tanks having receiving magazines connected at the receiving side with push-out devices operated by the actuating electronic means of the test divider for moving the individual total test containers corresponding to information supplied by the reading device from the transporting band into a collecting tank corresponding to the magazines for the required further treatment. Due to this arrangement manual handling is limited to a minimum and is necessary only when a certain test must be subjected to a special treatment or when the examination must be conducted under specific time pressure.

An arrangement which is particularly advantageous and can be easily seen and served by non-specialized workers and which constitutes a further embodiment of the present invention consists in that the collecting tank and the supply tank are made as rectangular building blocks adapted one to the other, each having a supporting frame with recesses extending transversely to the direction of movement of the transporting bank for guiding and holding the containers, whereby these recesses serve as receiving magazines and whereby each of them is provided with a push-out device.

The invention will appear more clealy from the following detailed description when taken in connection with the accompanying drawings showing by way of example only, a preferred embodiment of the inventive idea.

In the drawings:

FIG. 1 is a simplified diagrammatic view of the entire device.

FIG. 2 is a diagram illustrating the operating device.

FIG. 3 is a side view showing the driving mechanism.

FIG. 4 is a section through the push-out mechanism.

FIG. 5 is a section through the device operating the push-out mechanism.

FIG. 1 shows that within the frame **1** there is a supply tank **2** which receives the so-called total test containers to be divided, which contain the tests coming from the stations, as well as three collecting tanks **3, 4** and **5** into which total test containers divided according to specific criteria can be introduced. The supply tank is a brick box. The apparatus also includes a reading device **6** which receives information carried upon or along with the total examining containers and which transmits them to the actuating electronic device **7.** Furthermore the apparatus includes a transporting device with a driving motor **8,** gears **9,** a transporting band **10** and a diagrammatically indicated camshaft **11.** The camshaft is a part of a push-out device **12** the purpose of which is to move the containers from the transporting band into the collecting tanks. A further transportation device has a motor **13** and a transporting chain **14** for

moving the containers in groups from the inlet of the supply tank 2 to the transporting band 10. The supply tank 2 as well as the collecting tanks 3, 4, 5 have support 18 not shown in detail, which is provided with recesses extending transversely to the direction of movement of the transporting band and used to receive the containers.

The basic operation of the apparatus is as follows:

The total test containers are inserted in the receiving magazines of the supply tank 2, they are guided by the transporting device 13, 14 in the direction of the transporting band 10 and are shifted into its holding arms 17 which are arranged comb-like. At the same time the tumbler switch 15 located at the outlet of the supply tank 2 is energized and it actuates the switch 16 when a group of containers has reached the holding arms of the transporting band 10. The switch remains energized until the last container has left the outlet region of the supply tank 2 and during that time period it stops the motor 13. Furthermore the switch by means of the electronic device 7 provides information about the end of the supplying procedure. Thereupon the electronic device switches on the motor 8 which starts the motion of the transporting band 10 through the gears 9. Thus the serum containers located upon the transporting band are moved to the reading device 6 which absorbs the machine-readable information provided on or next to the containers and transmit it to the electronic device 7 which releases actuating procedures corresponding to the information. By way of example, the information can consist of the requirement that the test contained in the total test containers should be divided among individual test containers by means of a dosing device (which does not constitute the subject of this invention and is therefore not illustrated), whereupon these individual test containers provided with the necessary information are supplied to specific automatized working locations for the desired analysis of their contents. However, the information provided upon the total test container can also read that the total contents or remaining contents of the total test container should be supplied to non-automatic analysing working locations or to mechanical analysing tanks not included in the automatic testing procedure. Furthermore, it may be necessary to again supply a part of the contents of the container to the reading device for further division of the remaining test subject, so that the test could be divided among further individual test containers. This procedure can be repeated several times.

In order to be able to carry out this division of the total test container, the transporting band moves the containers along several collecting tanks 3, 4, 5. When a specific total test container reaches the tank provided for its further treatment, the electronic device will operate the push-out device 12 with the camshaft 11 and the magnetically operated rams which will be described in detail hereinafter, so that this container will be shifted into one of the magazines of the tank to which it belongs.

To avoid a clamping of the container in the transporting device during the push-in and push-out procedures the transporting band is moved step-wise in synchronism with the push-out rhythm. This is accomplished by the operating device shown diagrammatically in FIGS. 2 and 3.

The motor 8 moves the driving shaft 20 through a reduction gear 19. This shaft carries the two cam discs 21, 22 which operate the switches 23, 24 as well as the driving disc 25 of a double maltese drive with the maltese crosses 27 and 28 (FIG. 3). The maltese cross 27 drives the transporting band 10 by means of the shaft 29 and the driving wheel 30, while the maltese cross 28 drives the excenter shaft 11 by means of the shaft 31 and the guide drive 32. The arrangement shown in FIG. 3 is such that during the movement phase of one of the maltese crosses, the other maltese cross stands still. Due to this arrangement no push-out movement can take place during transportation and vice versa. Pairs of actuating segments 33 and 34 are mounted upon the driving disc 25. These pairs of segments operate the switch 35 for a stop of the motor 8 defined in space, as well as the switch 36 for freeing the actuating mechanism of the push-out device 12, also defined in space. The switches 23, 24 provide that the electronic device 7 supplies one information impulse for each rotation of the shaft 20 for the movement of the push-in device and also for the movement of the transportation device in a space location corresponding to the coding of the individual containers.

FIG. 4 is a section through the device at about the height of the collecting tank 4. It shows that the transporting band 10 having the shape of a chain, is provided with links 37 which are guided by sidewise projecting pins 38 in profiled ledges 39 located on both sides of the pin ends. Some of the pins 38 carry comb-like holding arms 17 upon the side directed toward the tanks, the containers 40 to be examined being hung upon these arms so that they can be pushed out in the direction of the tanks. The pushing of each specific container takes place by means of the ram 41. It is shifted in the pushout direction by a lever rotatably mounted upon the axle 42. This lever consists of two parts, namely, a lever arm 43 and a lever arm 44. The two lever arms are separately mounted upon the axle 42. They are pressed against each other tongue-like by the spring 45 above the axis of rotation, so that they touch each other under pressure at the end of the set screw 46 carried by the arm 44. One part of the arm 44 extends in the opposite direction beyond the axis of rotation and is pressed by the spring 47 against the cam disc 48. This cam disc which is movable in the axial direction, is mounted upon the camshaft 11 and is rotated by it. The axial movement takes place by a magnetically actuated coupling which is shown in front view in FIG. 5. This coupling device consists of a stroke magnet 49 having a winding 50 which when excited moves the magnet core 51 against the pressure of the spring 52 in the direction of the arrow. This causes the swinging of the lever 53 about its pivot 54 which moves the cam disc 48 located upon the sleeve 55. The disc 48 normally is located so close to the lever arm 44 that the arm lies against the outer surface of the sleeve. During the following rotation of the excenter shaft 11 the lever 44 is swung about its pivot 42 and will move the ram 41 through the lever 43 in the direction of the arrow, so that it will push the container 40 out of the holding arm 17 into the magazine corresponding to the read information. After the ending of the push-out procedure the magnetic coil 50 is switched off, so that the cam disc 48 is moved back into the illustrated basic position by means of the lever 53 and disc 56 fixed upon the sleeve and by the spring 52. The number of these push-out mechanisms corresponds to the number of receiving magazines.

Due to the resilient arrangement of the two arms **43, 44** of the leverage the push-out device cannot suffer any damage if a container is clamped in the transporting band or if the corresponding magazine is overfilled. In such cases the spring **45** will absorb the moving impulse.

The push-out magnets can be so constructed that when a container in a magazine is filled the stroke magnet located next in the direction of movement is actuated automatically by a contact located at the end of each magazine, or so that the stroke magnets corresponding to all magazines pertaining to a collecting tank **3, 4, 5** are actuated simultaneously, whereby, as already stated, the movement impulses of lever systems pertaining to filled magazines, are received by the springs **45.**

The collecting tanks **3, 4, 5** can be provided with end contacts (not shown) which stop the driving motor of the transporting device and release a signal when a magazine is completely filled. The part of the transporting band **10** which is located in front of the supply tank **2** in the direction of movement can be used to receive by hand individual containers which must be treated particularly urgently.

What is claimed is:

1. A device for collecting, transporting and distributing test carrying containers, having coded information for identification and treatment of their contents, said device comprising a transporting band having container-receiving means, a tank supplying containers to said band, a reading device, electronic actuating means connected with said reading device, a plurality of collecting tanks, means moving said transporting band with containers therein to said reading device and thence to said collecting tanks, said supplying tank and said collecting tanks consisting of interconnected rectangular building blocks and having container-receiving recesses extending transversely to the direction of movement of said band, and a push-out device connected with and actuated by said electronic actuating means for moving individual containers from said band into recesses of specific tanks corresponding to information provided by said reading device.

2. A device in accordance with claim **1,** comprising a separate transporting device having means transporting groups of said containers extending parallel to the direction of movement of said transporting band from said supply tank to said transporting band.

3. A device in accordance with claim **2,** wherein said separate transporting device comprises a driving motor and a tumbler switch connected with said motor and located at the outlet of said supply tank below said container-receiving means of the transporting band, said tumbler switch stopping said transporting device after transporting one of said groups until the last container of said one group has left the outlet region of said supply tank.

4. A device in accordance with claim **1,** wherein said push-out device comprises a number of push-out levers equal to the number of said collecting tanks, a camshaft and cams carried by said camshaft, said electronic means operatively connecting each of said cams during a rotation of said camshaft with a specific push-out lever.

5. A device in accordance with claim **4,** having a step-wise operated switching device and a motor, the means moving said transporting band having a driving shaft, said switching device being connected with said motor, said driving shaft and said camshaft for driving said driving shaft and said camshaft in synchronism.

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