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THE DEVELOPMENT OF THE AUTOMATED SYSTEM FOR ACCOUNTING AND PACKING OF TURNOVER FOR THE PROTECTION OF ALCOHOL PRODUCTS ON THE BASIS OF THE USE OF RFID TECHNOLOGY

In this work the automated system for accounting of turnover and protection of the alcohol products was built, and it was also proposed to use the closures in combination with radio frequency tag for a created system. The ability of system functioning and closures is provided by using RFID technology.

Security system, automated system for accountin of turnover and protection of the alcohol products, radio frequency identification, radio frequency tag.

1. Problem formulation

Market Analysis of alcoholic products showed the tendency to the increasing in demand for products, which the producer protects from the falsification. The most important for the producer is a protection from falsification of packaging, because it is the first sign for identification by the user.

The usage of combination of different protection means by producers, that would be reliable and inexpensive, has created a large number of protection kinds. We can conclude at considering all common protection means, which are used by the producers of alcoholic products, that they are not always successful and well-founded. We proposed the automated system for accounting of turnover and protection, which controls the legality of alcohol products at all stages of its progress in order to decrease the incoming cases of falsified alcoholic beverages on the market. The work of developed system is based on wireless technology of data transmission, taking into account the latest developments in the sphere of information technology.

2. The structure of automated system for accounting of turnover and protection of the alcohol products

The automated system for accounting of turnover and protection of the alcohol products (ASATP) - is the organizational and economic mechanism of management by material and information flows. This system includes the technical means, which provide the movement of products and information on a definite logistics chain (Fig. 1).

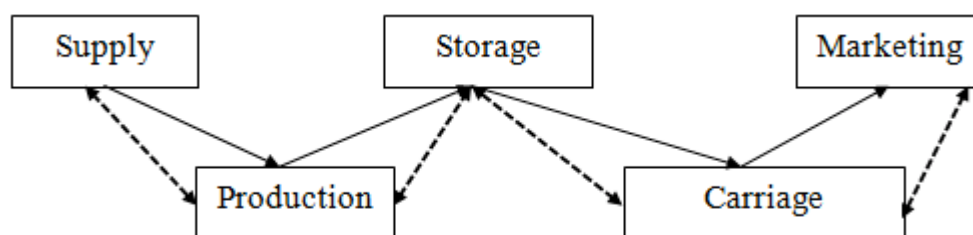


Fig. 1.The structure of logistics chain ASATP of the alcohol products:

—▶ - material flow; -▶ - the flow of information

The functions of the system consist of three consolidated transport and technological processes (Fig. 2). The first process **I** – is a production of materials for the alcohol beverages, the second **II** - production of alcoholic products, the third process **III** – realization of ready alcohol products. Each process consists of operations, on which the control by the movement and legality of products are carried out. The exchange of information between operations is carried out by RFID technology, which is based on touchless identification of products using radio frequency communication channel.

An identification of the products is carried out by individual digit identification code that is read from the memory of the electronic tags, attached to the unit of packaging [1,2].

In the production process **I**, the production of alcohol on the section **1** is carried out, the quality information of which is stored on the operation **2** on the radiofrequency tag with identification code that is entered into the database of server manufacturer **A**, after that the accounting of number and all movements of products are displayed in this database.

The ready-made products are sent to warehouses of manufacturer after the markings (operation **3**) for the following storage. The reading of data from radiofrequency tag and leading in the mark in the database of server data **A** about the transition of these products at the exportation of goods from the warehouse (sales operation **4**). The production of alcohol products **5** and marketing by the radiofrequency tag **6** is carried out on the second **II** process. The similarly as in process **I**, the ready-made products are registered in a database **B** and is stored (the operation **7**) and are sold (operation **8**).

The ready-made alcohol products are moved into the warehouses (operation **9**) of commercial enterprises on the **III** third process of realization, where the checkup of legality of received products by comparing of the identification code and information, placed on the RFID with the information in the database **B**, after that the information from the radiofrequency tag is registered in a database **C** of commercial enterprises and after that alcohol products are prepared for sale to consumers (operation **10**).

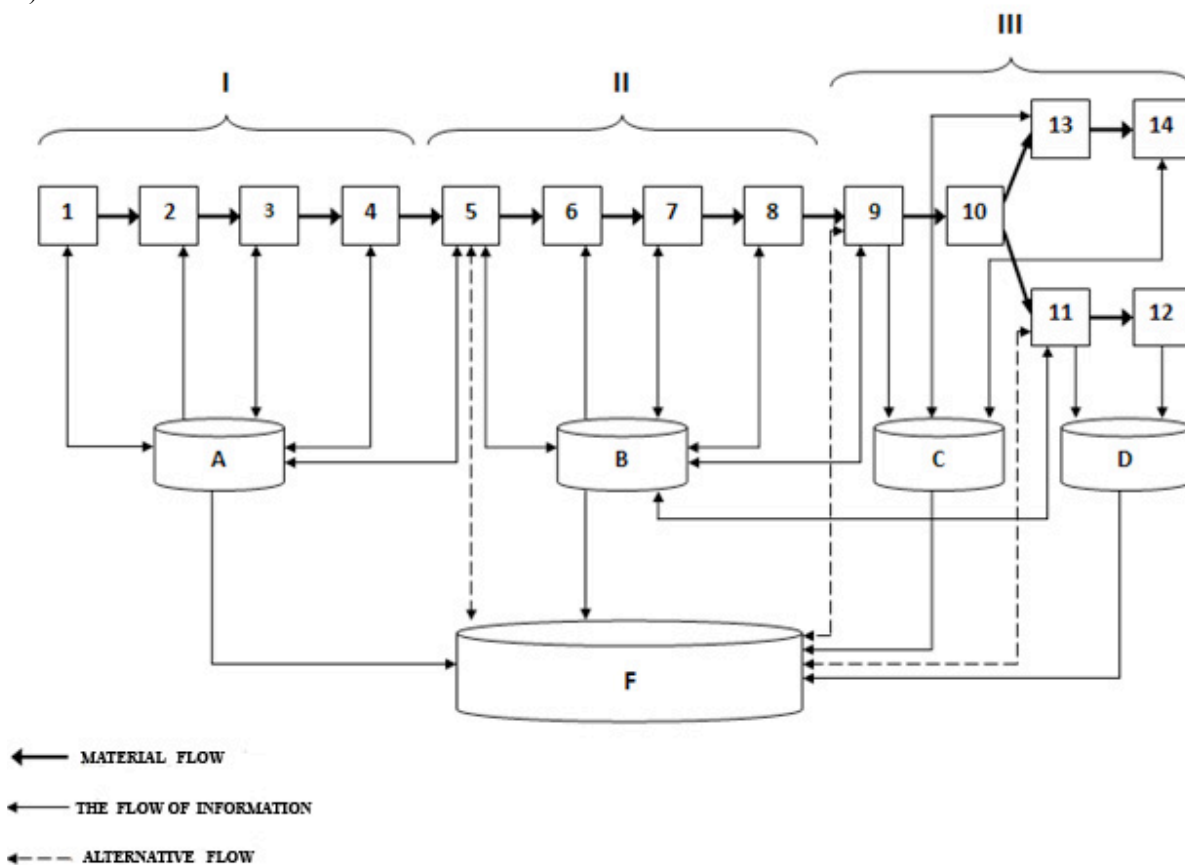


Fig. 2. Scheme of the automated system for accounting of turnover and protection of the alcoholic products

The producers and also certain commercial enterprises can sell their products on the International market, as well as foreign producers want to import their goods to our country, so the International and Ukrainian producers are faced with supervising customs authorities in case of product promotion.

Alcohol products, passing through the customs border, are checked at the customs post (operation **11**), information from the radiofrequency tag can be read and check, comparing with information from the database **B**, and are registered in the database **D** of customs post. The information about the import or export of alcoholic beverages is later entered in the database (operation **12**).

Customer is able to check the legality of products. With the implementation of alcohol in retail establishments He can visually identify the presence of radiofrequency tag, and read the information (operation 13) with the help of special devices that are in the commercial hall, and compare with the information of producer (operation 14), after that the code of producer is destroyed.

In turn, database of producers **A**, **B**, commercial enterprises **C**, and customs post **D** are integrated by database management system **F**, where data are about all made legal alcoholic products. All these databases are interlinked by information network [3].

This method enables monitoring at all stages of advancement of alcohol products and accurately confirming the legality of the ready-made products.

3. Technical means of implementation ASATP system

The analysis of protective elements showed that one of the reliable means of protection for alcoholic beverages is closure mean with dosimeter of different constructions and the radiofrequency (RFID) tag. We suggested combining these two protective elements in order to achieve the highest level of protection.

The bottom line of developed new protective element is in the entering RF tag in design of closure. Thus, it was suggested to use two variants for placing of radiofrequency tags on closures for the created automated system for accounting of turnover and protection of alcohol products [4].

We have developed a protective closure mean with retractable pipe where a radiofrequency tag is still attached to the inner side of the tear-off element of end face of decorative casing for the first variant of placing (Fig. 3).

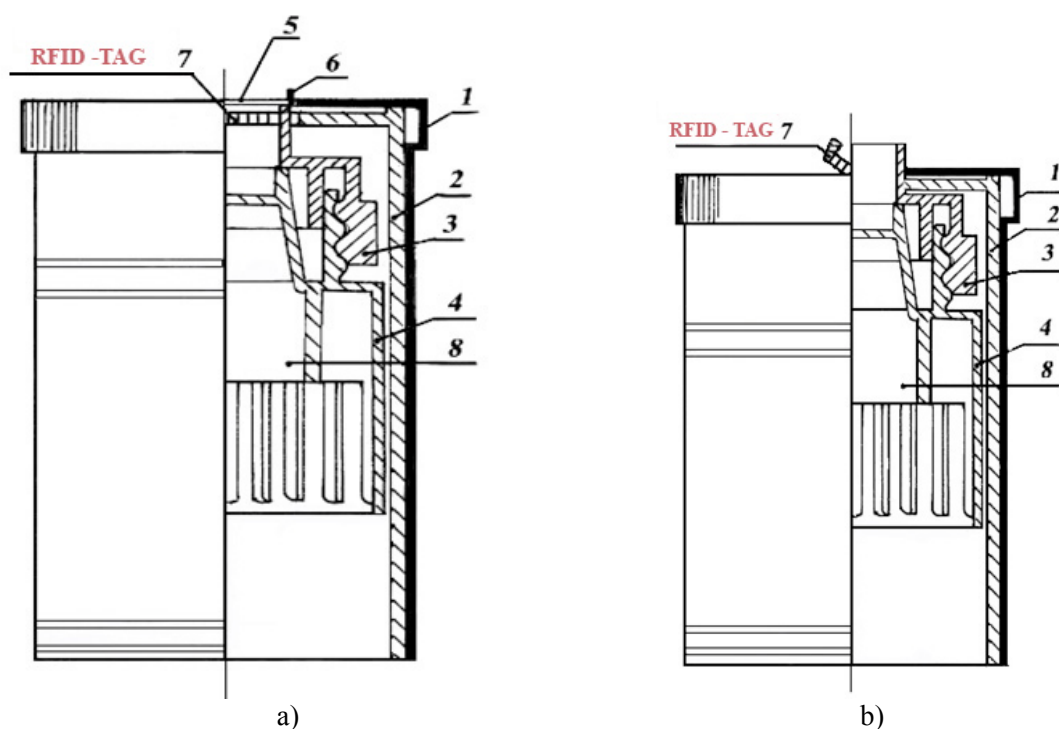


Fig. 3. View in slash of protective closure: a) - in the closed position, b) - in the open position.

For the second variant of placing of radiofrequency tag we have developed a protective closure mean for bottle, consisting of a screw cap with a control indicator belt, divider with external thread and a metal casing (Fig. 4). Radio-frequency tag still is attached to both sides of the metal casing with the possibility of its destruction at the displacement of these parts relative to each other. Also, an additional protective casing can be located on top of a radiofrequency tag, the main purpose of which is to block access to radiofrequency tag in order to avoid its unauthorized destruction [5].

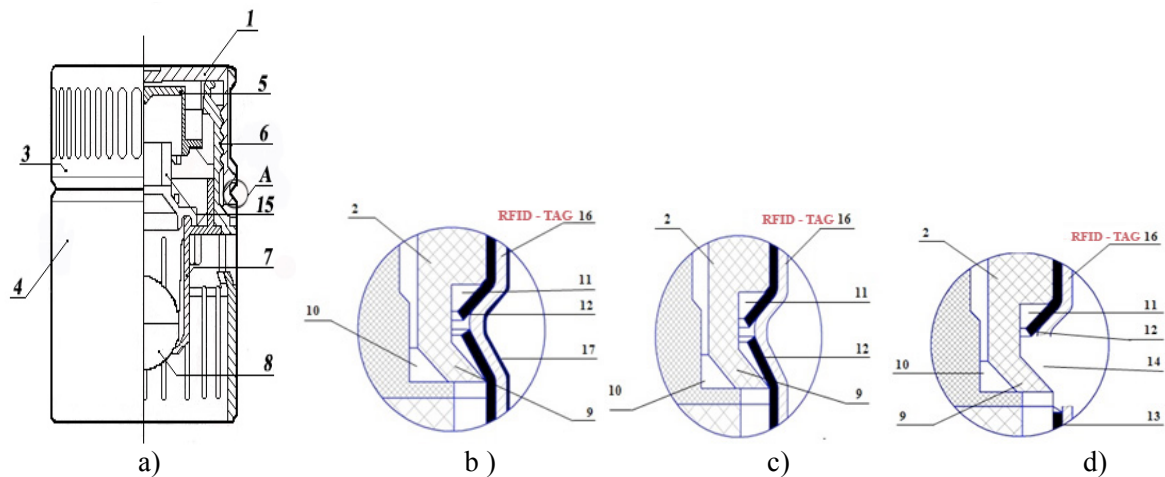


Fig. 4. a) General view of the protective closure mean with screw cap in slash, a view of node A: b) - in closed position, c) - with additional protective casing, d) - in the open position, 16 - radiofrequency tag.

This realization of closures allows to create an additional level of information security of packaging by the way of bottle identification by reading from RF tag in all processes ASATP. Also, the degree of bottle protection against unauthorized opening is increased.

Conclusions:

1. Automated system for accounting of turnover and protection of alcoholic products, which is protected by Ukrainian patent, provides control of the legality of alcohol products at all stages of its progress.
2. It was founded the use of information provision based on RFID technology for the implementation of the control system.
3. It was developed the new closures in conjunction with radiofrequency tags that are protected by two patents of Ukraine, increase the degree of packing protection of alcoholic products against falsification.

1. Пальчевський Б.О. Інформаційні технології проектування технологічного устаткування: Монографія /Б.О. Пальчевський. – Луцьк: Луцький НТУ, 20212. – 572 с.

2. Крестьянполь Л.Ю. Інформаційні технології в проектуванні системи захисту алкогольної продукції / Л.Ю. Крестьянполь // Наукові нотатки. Міжвузівський збірник. Вип. № 42.- Луцьк: ЛНТУ, 2013. – С.134-140.

3. Пат. 82057 Україна, МПК В65D 49/00, В65D 49/02. Захисний закупорювальний засіб / Малашко О.Є. Крестьянполь Л.Ю. – № у 2012 12182, заявл. 24.10.2012; опубл. 25.07.2013, Бюл. № 14.– 4 с.

4. Висновок про видачу патенту за заявленим № у 2012 14981, від 28.03 2013, Україна, МПК В67В 5/00. Захисний закупорювальний засіб для пляшки / Крестьянполь Л.Ю., заявл. 27.12.2012.

5. Пат. № 85858 Україна, МПК G06F 17/40, G06K 5/00. Спосіб неперервного інформаційного контролю алкогольної продукції при її виробництві, переміщенні та реалізації / Пальчевський Б.О., Крестьянполь Л.Ю. – № у 2013 02931, заявл. 11.03.2013, опубл. 10.12.2013, Бюл. № 23. – 4 с.

6. Дшхунян В.Л., Шаньгин В.Ф. Электронная идентификация. Бесконтактные идентификаторы и смарт карты. – М.: «Издательство АСТ»: Издательство «НТ Пресс», 2004. – 695 с.

7. Cujan Z. Obalova technika a identifikace. – Prerov: Vysoka skola logistiky o.p.s., 2012. – 210s. – ISBN 978-80-87179-18-52.