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**(54) AUTOMATED DEVICE FOR PACKAGING TUBES AND PALLETISATION**

AUTOMATISIERTE VORRICHTUNG ZUR VERPACKUNG VON ROHREN UND PALLETISIERUNG  
DISPOSITIF AUTOMATISÉ POUR L'EMBALLAGE DES TUBES ET LA PALETTISATION

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## Description

### Technical field

**[0001]** The present invention relates to the technical field of automatic machines for the packaging and quality control of tubular articles and subsequent palletisation of the containers. Such novel device assembles a plurality of electromechanical devices having an automated process which makes the packaging of tubes in the boxes (number of pieces per row, quantity of rows, etc.) efficient according to the size of the tube to be packaged and then provides for palletising step.

### Prior art

**[0002]** As known, tubular containers, or tubes, must be directed, one by one and with a predetermined orientation, in a straight or carousel conveyor line, suitable for transferring them to a filling station, in which suitable dispensing members fill them with the articles. This is true in the step of filling the tubes, but further stations for controlling possible labelling of the tubes as well as the sealing of the tubes and ejection of any discarded material are provided for "upstream" of the filling station. At the moment there lacks a completely automated process, capable of supplying empty tubes well packed in the boxes which in turn are well positioned on the pallet. In this sense, it is clear from the prior art that the pallets currently used have uniform dimensions and the packs are loaded or arranged manually especially when it comes to small-scale productions or continuously variable productions. In other cases, especially in high production plants, PCs with dedicated software which allow to program the arrangement of the packagings on the pallet are provided for; in this case specialised personnel are required for programming and therefore it is convenient only for repetitive large-scale productions. Thus, besides the fact that there are obvious safety problems when the operator has to interact with the machines that partially package and palletise the tubes, current packaging islands and the related palletisation require human support in order to be able to effectively handle such industrial activities. The technical problem that arises lies in the fact that there is no automated device at all steps of the process. The object of the present invention is to provide a packaging machine which is faster than known solutions by combining the palletising step thereof. With reference to the prior art, as a patent which could claim the inventive step of combining the various packaging and palletising processes in a single solution is WO2013018074A1 (Apparatus and method for batching, packing and palletizing a granular product). However, it deals with loose and granular products which are not in any way part of the inherent problems of aluminium tubes. Other patents reveal numerous innovations in the palletising industry and others of the innovative packaging method. However, there is no inventiveness

and novelty in such product sector as pertains to the implementation of different automated actions enclosed in a single space which are listed in detail in the following description.

### Description of the invention

**[0003]** The technical solution obtained from the invention consists in providing a completely automated packaging, product control and palletising island 200, where in all the steps such device also provides for easy access (after release of the safety guard) from every point in all the process steps. Being managed by a PLC, the system is capable of generating and storing a detailed report:

- process faults,
- n° of packed boxes,
- batch n° and total and partial counter, n° of pieces, n° of total products.

**[0004]** The hardware part of the system containing a plurality of assembled devices is designed for a totally automatic format change in order to provide - as a technical advantage - the reduction of manual work by the operator in the vision of the supply chain regarding the manufacture of tubes and their packaging. In this sense, there is easy access to all the control panels provided with appropriate buttons necessary for operation in the control areas.

**[0005]** The assembly of the plurality of electromechanical devices also comprises a light tower arranged in an area visible from every point of the layout of the assembled system, by means of further light devices positioned on the main control panel. Besides the aforementioned system, there are safety devices, fixed protections and guards for access protected by interlocked safety systems or possible barriers in the access areas of the operator. In addition, there are various emergency buttons along the perimeter of the system, and the anthropomorphic palletiser is automatically deactivated in case of presence not foreseen in the work area.

**[0006]** Such system comprises a plurality of assembled devices capable of forming the box and the lid, inserting the tubes, depositing the box perfectly ready in an area defined for the subsequent step, i.e. palletising with a supply frequency of two tubes every second approximately.

**[0007]** The multifunction system and the relative software, developed for the many packaging applications, contain all the key functions for a simple and fast programming, for all the operations carried out directly in the manufacturing process.

**[0008]** This aspect of seeking more efficient and effective solutions in the tube packaging step represents a technological innovation because it avoids the operator carrying out routine and repetitive operations, i.e. the preparation and control of packagings, the insertion of tubes into prepared boxes and lastly the insertion of

packagings, effectively and efficiently positioned on pallets. By way of example, there is a first step of controlling and counting the tubes placed in the packaging and palletising island. A second step of counting and inserting the tubes into the box. A third step of forming the lid, the box and its closure, and finally a fourth and final step of palletising to its degree of saturation, after which it is ejected.

**[0009]** The advantages offered by the present invention are apparent in the light of the description set forth herein and will be further clarified by the accompanying figures and the detailed description thereof.

#### Description of the figures

**[0010]** The invention will be described below in at least a preferred embodiment by way of non-limiting example and with the aid of the attached figures. With reference to Figure 1, indicated with reference numeral 100 is a plan view of a plurality of electromechanical and electronic devices assembled to ensure a sequential series process, comprising:

- a control station with video cameras 15;
- an unstacking device with vertical electrical axis for boxes 1, the vertical movement ensures the gripping of the box by the anthropomorphic robot 12 always at the same height, allowing the loading in the area underlying other boxes even with the process in progress;
- a position for applying glue for forming the boxes 2, after transferring the sheet, the glue is applied and the four walls of the box are closed;
- a sheet supply position 3 for forming the lid with operation identical to position 1;
- a lid forming station 4 with operation 2;
- the electromechanical device positions the box or the sheets in the working areas so as to ensure the continuity of the process 12;
- the rotation of the rotatable board 14 carries the empty box during the filling step 6 by means of an electromechanical device 8 in an inclined position given by the form of the board 14;
- a belt 7 conveys the tubes (correct number and position) allowing an easier grip by the electromechanical device;
- the electromechanical device 8 transfers - with the aid of a handling device provided with suction cups (to be replaced depending on the sizes) - the tubes by a number such to be filled by rows in the boxes 6;
- in such position 10, a transversal movement allows the displacement of the box towards the position 4 for the insertion of the lid onto the full box and the loading of the empty box;
- a pneumatic plunger 11 transfers the box to the closing area using the lid;
- the box is transferred to this area 13 so as to be picked up and conveyed for palletisation.

**[0011]** Represented with reference to Figure 2 is a process step characterised by the following block diagram 200:

- 5 - in the first step 16, there is monitoring by means of video cameras so as to verify the quality of the tubes and possible faulty tubes;
- in the second step 17, there is the counting of the tubes and the insertion of the tubes into the box;
- 10 - in the third step 18, there is the forming of the lid, the forming of the box and the closing of the box;
- in the fourth and last step 19, there is palletisation, i.e., in output, the packagings measuring 600 mm x 380 mm x 140 mm, or other volumetric sizes as a function of the volume of the tubular containers to be inserted, where the plurality of packagings of the same volumetric size containing the tubes are inserted onto the pallet up to the maximum filling of the pallet, saturation step of the pallet.

#### Detailed description of the invention

**[0012]** Further characteristics and advantages of the device according to the invention will become clearer from the following detailed description of an embodiment of the invention, provided with reference to the attached drawings, provided purely by way of non-limiting example.

**[0013]** In detail, the present invention reveals a system managed by a PLC that provides for choosing the batch to be produced, in which all the information of processes regarding, as final objective, the automated insertion of the tubes in the appropriate boxes and subsequent palletisation. Furthermore, the configuration of the device allows to limit the overall dimensions thereof and to have, at the same time, a high operating speed, certainly capable of meeting the productivity needs of modern industry 4.0 machines. A further object of the present invention is to provide a packaging machine which is more versatile with respect to known solutions or, in particular, which allows to easily change another box size and/or tube size.

**[0014]** Such plurality of electromechanical devices process tubes having a diameter of 40 mm, although such size can be varied, and they are designed to work in line with the production machines upstream and downstream of such packaging and palletising island. The maximum size of the boxes to be packaged has the following characteristics: 600 mm x 380 mm x 140 mm, also in this case such volume is variable according to the size of the tubes to be packaged and palletised. Furthermore, such electromechanical devices assembled in a single production process have an acoustic emission below 80 dBA as well as a pneumatic supply of 6 bar and a 400 V50 Htz, three-phase alternating plus neutral and earth-connected electric power supply.

**[0015]** Such plurality of electromechanical and electrical devices allows to reach, as mentioned above, a supply frequency of approximately two tubes per second.

A further detail lies in the fact such devices of the island are interconnected and, through the continuous exchange of signals, they are made autonomous with each other.

**[0016]** The above ensures a total independence of the production cycle, the loading of the stacks of EPAL and of the blanks being the only thing the operator is required to see to. Such palletisation islands are provided with a large "customisable" warehouse for EPAL and blanks so as to minimise loading operations. Thanks to the flexibility and versatility of application, "robots" can also be used for production solutions in the simultaneous presence of different sizes or products.

**[0017]** Though the present invention has been described by way of non-limiting example, according to some preferred embodiments thereof, it should be observed that variations and/or modifications may be carried out by those skilled in the art without departing from the relative scope of protection, as defined by the attached claims.

## Claims

1. Device **characterised in that** a plurality of electromechanical devices are assembled sequentially for automating all the steps for packaging and palletising aluminium tubes (100) comprising:

- a control station with video cameras (15);
- an unstacking device with vertical electrical axis for boxes (1), the vertical movement ensures the gripping of the box by the anthropomorphic robot (12) always at the same height, allowing the loading in the area underlying other boxes even with the process in progress;
- a position for applying glue for forming boxes (2), after transferring the sheet, the glue is applied and the four walls of the box are closed;
- a sheet supply position (3) for forming the lid with operation identical to position (1);
- a lid forming station (4) with operation (2);
- the electromechanical device positions the box or the sheets in the working areas so as to ensure the continuity of the process (12);
- the rotation of the rotatable board (14) carries the empty box during the filling step (6) by means of an electromechanical device (8) in an inclined position given by the form of the board (14);
- a belt (7) for conveying tubes (correct amount and position) allowing a special and specific gripping for each size (8) by the electromechanical device;
- the electromechanical device (8) transfers - with the aid of a handling device provided with suction cups (to be replaced depending on the sizes) - the tubes by a number such to be filled by rows in the boxes (6);

- in such position (10), a transversal movement allows the displacement of the box towards the position (4) for the insertion of the lid onto the full box and the loading of the empty box;
- a pneumatic plunger (11) transfers the box to the closing area using the lid;
- the box is transferred to a palletisation area (13) so as to be picked up and conveyed for palletisation.

2. Method of use of a device according to the preceding claim **characterised in that**:

- in a first step (16), there is monitoring by means of the video cameras (15) so as to verify the quality of the tubes and possible faulty tubes;
- in a second step (17), there is the counting of the tubes and the insertion of the tubes into the box carried during filling in an inclined position ;
- in a third step (18), there is the forming of the lid, the forming of the box and the closing of the box;
- in a fourth and last step (19), there is palletisation, i.e., in output, the packagings measuring 600 mm x 380 mm x 140 mm, or other volumetric sizes as a function of the volume of the tubular containers to be inserted, where such packagings containing the tubes are inserted on the pallet up to the point of maximum volumetric filling of the pallet.

3. Device according to claim 1 **characterised in that** the electromechanical device comprises the replacement of the suction cups (8) and of the sheet required for making the boxes (18) as a function of the volume of the pipes to be picked up and inserted into the boxes.

4. Device according to claims 1 and 3 **characterised in that** the volumetric overall dimension of the packaging island, quality control and palletisation has a parallelepiped-like shape where in the automatic operating cycle, by means of a 400 V 50 Htz alternating three-phase power supply and a 6-bar pneumatic power supply, it has an acoustic emission lower than 80 dBA.

## Patentansprüche

1. Einrichtung, **dadurch gekennzeichnet, dass** mehrere elektromechanische Einrichtungen nacheinander montiert sind, um alle Schritte zum Verpacken und Palettieren von Aluminiumröhren (100) zu automatisieren, aufweisend:

- eine Kontrollstation mit Videokameras (15);
- eine Entstapelungsvorrichtung mit vertikaler elektrischer Achse für Schachteln (1), wobei

- die vertikale Bewegung das Greifen der Schachtel durch den anthropomorphen Roboter (12) immer auf derselben Höhe sicherstellt und das Beladen in dem Bereich unterhalb anderer Schachteln ermöglicht, selbst wenn der Prozess bereits läuft;
- eine Position zum Auftragen von Klebstoff zum Bilden von Schachteln (2), nach dem Transferieren des Bogens wird der Klebstoff aufgetragen und die vier Wände der Schachtel werden geschlossen;
- eine Bogen-Zuführposition (3) zum Bilden des Deckels mit einem identischen Vorgang wie an Position (1);
- eine Deckelbildungsstation (4) mit Arbeitsvorrichtung (2);
- die elektromechanische Einrichtung positioniert die Schachtel oder die Bögen in den Arbeitsbereichen, um die Kontinuität des Prozesses zu gewährleisten (12);
- die Drehung der drehbaren Platte (14) trägt die leere Schachtel während des Füllschritts (6) mittels einer elektromechanischen Einrichtung (8) in eine durch die Form der Platte (14) vorgegebene geneigte Position;
- ein Band (7) zum Fördern von Röhren (korrekte Menge und Position) ermöglicht ein spezielles und spezifisches Greifen für jede Größe (8) durch die elektromechanische Einrichtung;
- die elektromechanische Einrichtung (8) transferiert die Röhren - mit der Hilfe einer mit Saugnapfen versehenen Handhabungseinrichtung (die abhängig von den Größen auszutauschen ist) - in einer solchen Anzahl, dass sie reihenweise in die Schachteln (6) gefüllt werden können;
- in einer solchen Position (10) ermöglicht eine Querbewegung das Verlagern der Schachtel in Richtung der Position (4) zum Einfügen des Deckels auf die volle Schachtel und das Beladen der leeren Schachtel;
- ein pneumatischer Stößel (11) transferiert die Schachtel unter Verwendung des Deckels in den Schließbereich;
- die Schachtel wird in einen Palettierungsbereich (13) transferiert, um aufgenommen und zur Palettierung gefördert zu werden.
2. Verfahren der Verwendung einer Einrichtung gemäß dem vorhergehenden Anspruch, **dadurch gekennzeichnet, dass:**
- es in einem ersten Schritt (16) eine Überwachung mittels der Videokameras (15) gibt, um die Qualität der Röhren und mögliche fehlerhafte Röhren zu überprüfen;
- es in einem zweiten Schritt (17) das Zählen der Röhren und das Einsetzen der Röhren in die

Schachtel, die während des Füllens in einer geneigten Position getragen wird, gibt;

- es in einem dritten Schritt (18) das Bilden des Deckels, das Bilden der Schachtel und das Schließen der Schachtel gibt;

- es in einem vierten und letzten Schritt (19) das Palettieren gibt, d. h. am Ausgang werden die Verpackungen mit den Maßen 600 mm x 380 mm x 140 mm oder anderen volumetrischen Größen als Funktion vom Volumen der einzusetzenden röhrenförmigen Behälter, wobei solche Verpackungen, die die Röhren enthalten, auf die Palette bis zum Punkt der maximalen volumetrischen Füllung der Palette eingefügt werden.

3. Einrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die elektromechanische Einrichtung den Austausch der Saugnapfe (8) und des Bogens, der zum Herstellen der Schachteln (18) erforderlich ist, als Funktion des Volumens der aufzunehmenden und in die Schachteln einzusetzenden Röhren aufweist.
4. Einrichtung gemäß den Ansprüchen 1 und 3, **dadurch gekennzeichnet, dass** die volumetrische Gesamtmaßung der Verpackungsinsel, der Qualitätskontrolle und der Palettierung eine parallelepipedförmige Gestalt aufweist, wobei sie im automatischen Betriebszyklus mittels einer 400 V 50 Htz Wechselstrom-Dreiphasen-Leistungsversorgung und einer 6-bar-Pneumatik-Leistungsversorgung eine akustische Emission von weniger als 80 dBA aufweist.

#### Revendications

1. Dispositif **caractérisé en ce qu'**une pluralité de dispositifs électromécaniques sont assemblés séquentiellement pour automatiser toutes les étapes de conditionnement et de palettisation de tubes en aluminium (100) comprenant :
- une station de commande avec des caméras vidéo (15) ;
- un dispositif de désempilage avec un axe électrique vertical pour des boîtes (1), le mouvement vertical assure la préhension de la boîte par le robot anthropomorphe (12) toujours à la même hauteur, permettant le chargement dans la zone sous-jacente aux autres boîtes même avec le processus en cours ;
- une position d'application de colle pour former des boîtes (2), après transfert de la feuille, la colle est appliquée et les quatre parois de la boîte sont fermées ;
- une position d'alimentation en feuilles (3) pour

former le couvercle avec une opération identique à la position (1) ;

- une station de formage de couvercle (4) avec l'opération (2) ;
- le dispositif électromécanique positionne la boîte ou les feuilles dans les zones de travail de manière à assurer la continuité du processus (12) ;
- la rotation de la planche rotative (14) porte la boîte vide lors de l'étape de remplissage (6) au moyen d'un dispositif électromécanique (8) dans une position inclinée donnée par la forme de la planche (14) ;
- une courroie (7) pour convoier des tubes (quantité et position correctes) permettant une préhension spéciale et spécifique pour chaque taille (8) par le dispositif électromécanique ;
- le dispositif électromécanique (8) transfère - à l'aide d'un dispositif de manutention muni de ventouses (à remplacer en fonction des tailles) - les tubes d'un nombre tel qu'il doit être déposé par rangées dans les boîtes (6) ;
- dans une telle position (10), un mouvement transversal permet le déplacement de la boîte vers la position (4) pour l'insertion du couvercle sur la boîte pleine et le chargement de la boîte vide ;
- un piston pneumatique (11) transfère la boîte vers la zone de fermeture à l'aide du couvercle ;
- la boîte est transférée vers une zone de palettisation (13) de manière à être prélevée et convoyée pour palettisation.

2. Procédé d'utilisation d'un dispositif selon la revendication précédente **caractérisé en ce que** :

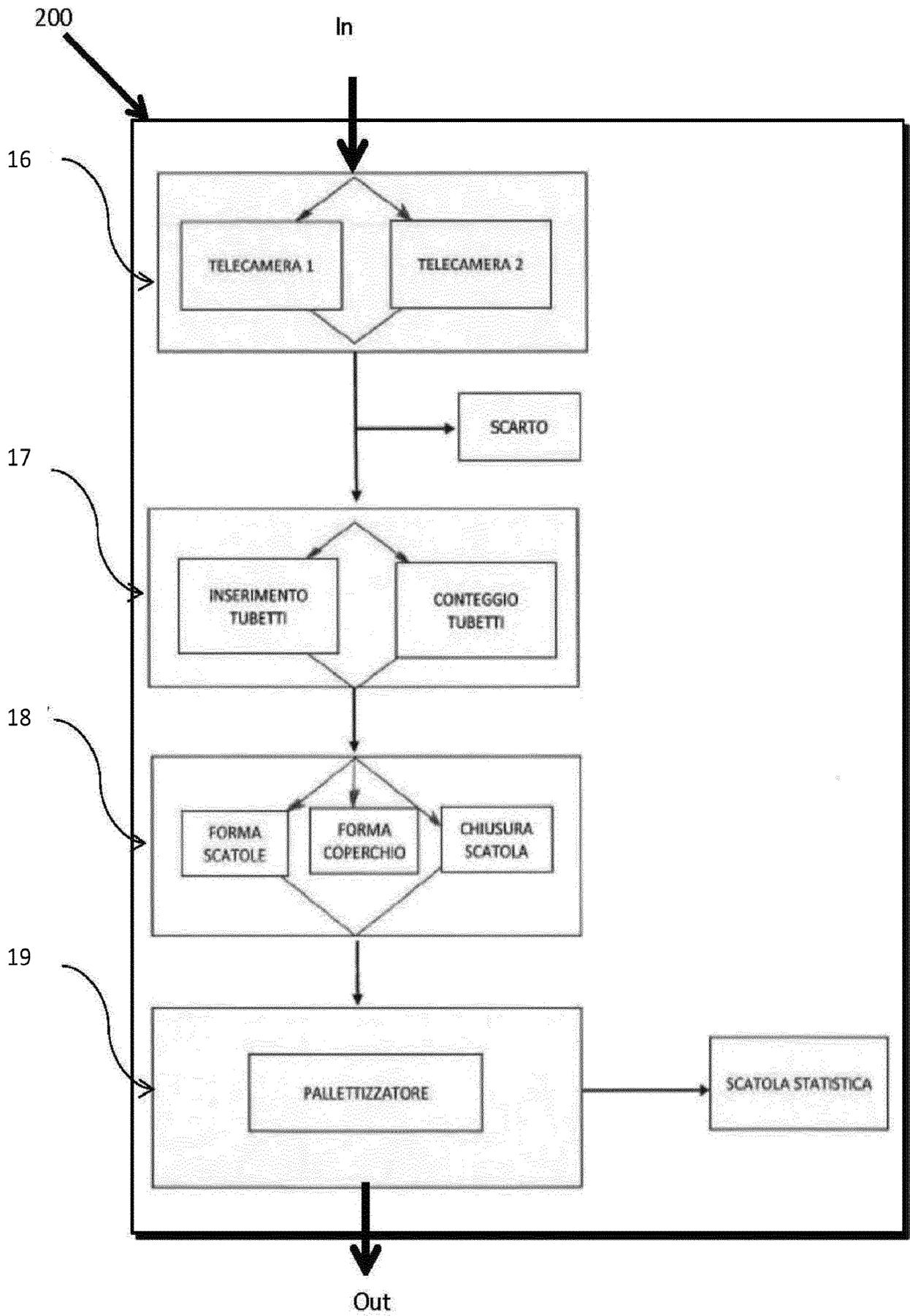
- dans une première étape (16), il y a surveillance au moyen des caméras vidéo (15) de manière à vérifier la qualité des tubes et les éventuels tubes défectueux ;
- dans une deuxième étape (17), il y a le comptage des tubes et l'insertion des tubes dans la boîte transportée lors du remplissage dans une position inclinée ;
- dans une troisième étape (18), il y a le formage du couvercle, le formage de la boîte et la fermeture de la boîte ;
- dans une quatrième et dernière étape (19), il y a palettisation, c'est-à-dire en sortie, les emballages mesurant 600 mm x 380 mm x 140 mm, ou d'autres dimensions volumétriques en fonction du volume des contenants tubulaires à insérer, où de tels emballages contenant les tubes sont insérés sur la palette jusqu'au point de remplissage volumétrique maximal de la palette.

3. Dispositif selon la revendication 1, **caractérisé en ce que** le dispositif électromécanique comprend le

remplacement des ventouses (8) et de la feuille nécessaire à la confection des boîtes (18) en fonction du volume des tuyaux à prélever et à insérer dans les boîtes.

4. Dispositif selon les revendications 1 et 3 **caractérisé en ce que** la dimension globale volumétrique de l'îlot de conditionnement, du contrôle qualité et de la palettisation présente une forme de type parallélépipède où dans le cycle de fonctionnement automatique, au moyen d'une alimentation triphasée 400 V 50 Htz et d'une alimentation pneumatique 6 bar, elle présente une émission acoustique inférieure à 80 dBA.





**REFERENCES CITED IN THE DESCRIPTION**

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