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Lack(10) **Pub. No.: US 2004/0235397 A1**(43) **Pub. Date: Nov. 25, 2004**(54) **CONTAINER FOR AND USE OF THE
LATTER IN A PRODUCTION CENTER FOR
MANUFACTURING INDIVIDUAL
SPECTACLE LENSES ON PRESCRIPTION**(76) **Inventor: Oswin Lack, Huttenberg (DE)**

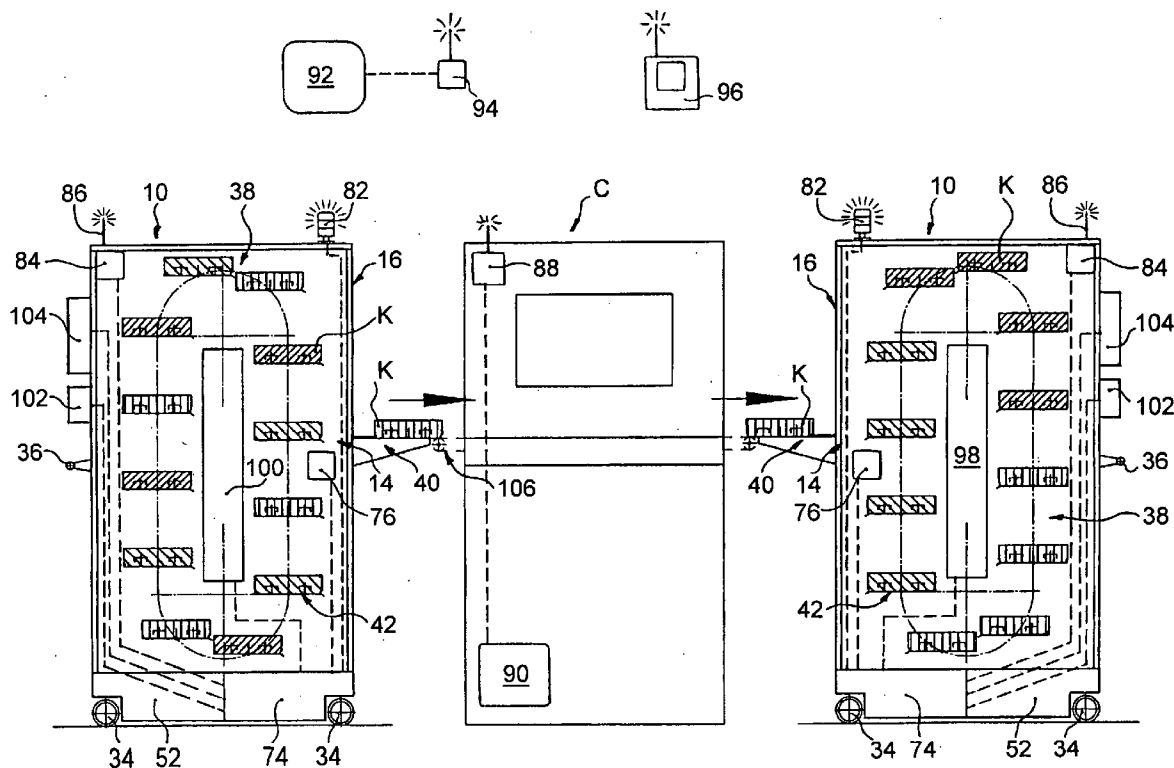
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Publication Classification(51) **Int. Cl.⁷ B24B 1/00**(52) **U.S. Cl. 451/41**(57) **ABSTRACT**

A container (10) for a production center for manufacturing individual spectacle lenses (L) on prescription, known as a prescription workshop, is disclosed, which prescription workshop has a number of workstations between which the spectacle lenses can be transported by means of transport boxes (K) which are each designed to receive one right and one left spectacle lens and possibly associated processing tools. According to the invention, the container is designed to receive a number of transport boxes in order to transport the latter between at least two workstations of the prescription workshop, the container having an insertion and output device (14) for the transport boxes, by means of which the transport boxes can be inserted into the container and a specific transport box can be output from the container when selected. The invention also comprises the use of the container according to the invention in a prescription workshop. As a result, a logistic system for a prescription workshop is provided by means of which an optimized material flow of the transport boxes can be ensured in a flexible manner and largely independent of the size of the prescription workshop and the structural conditions thereof.



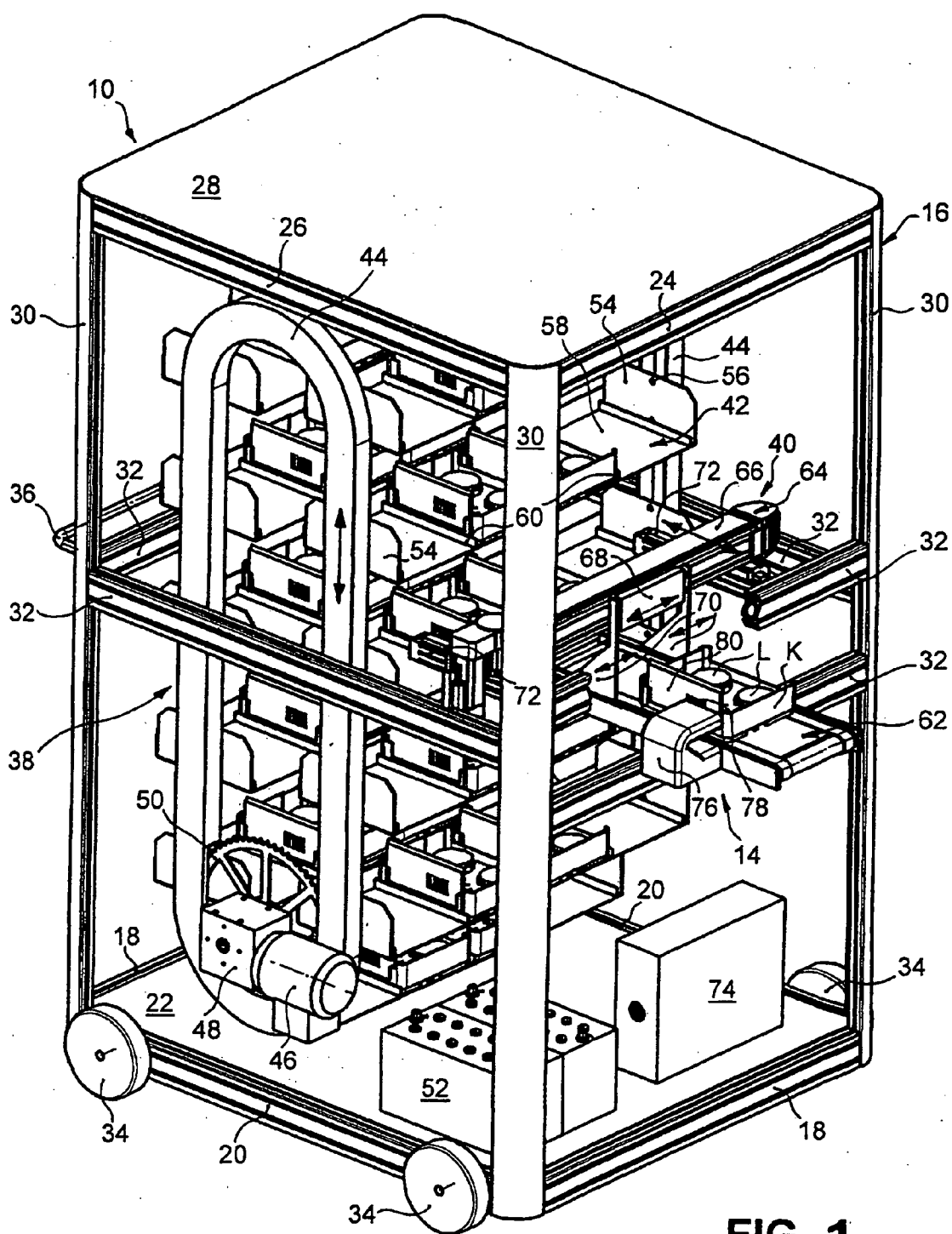
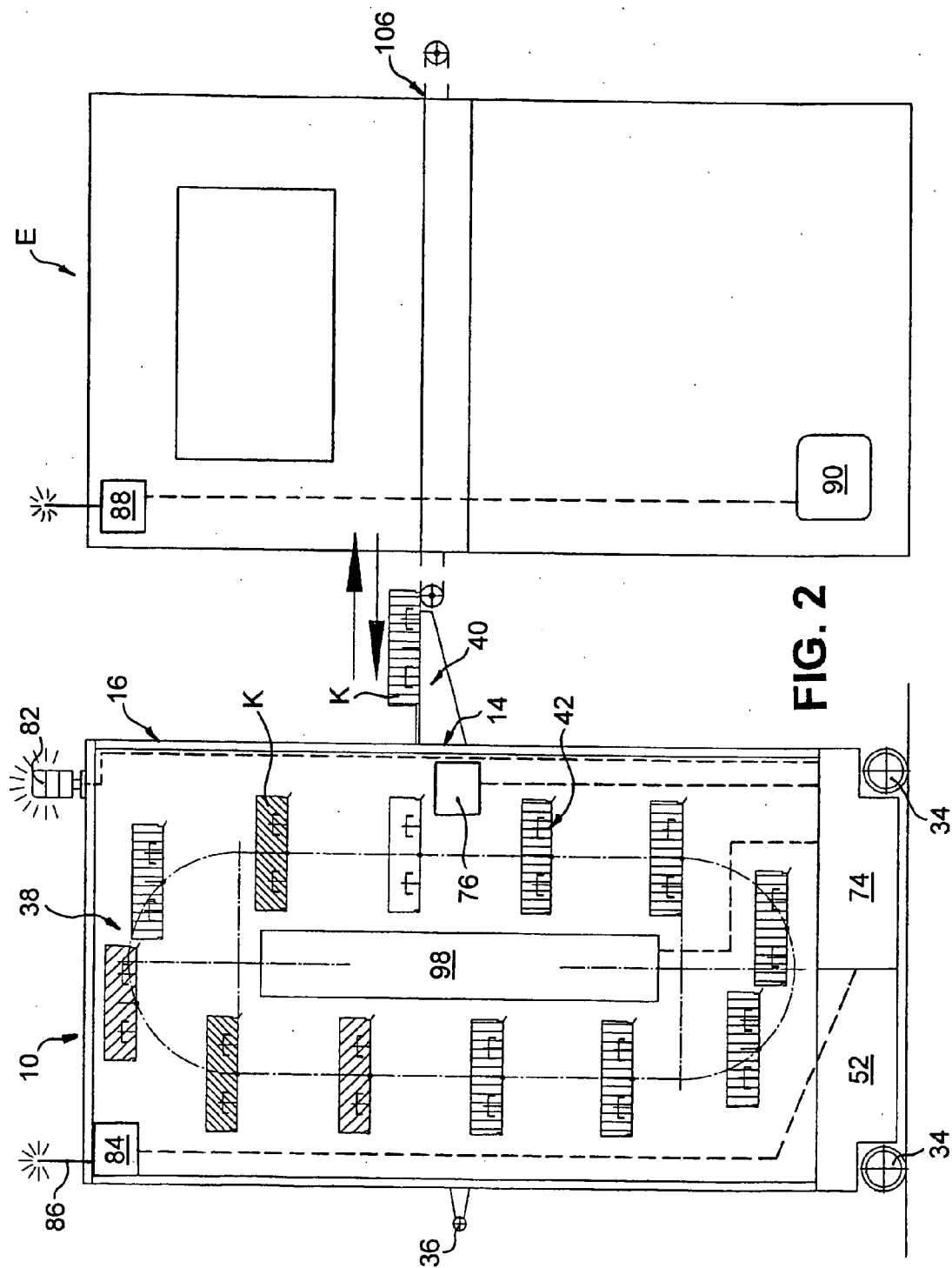


FIG. 1



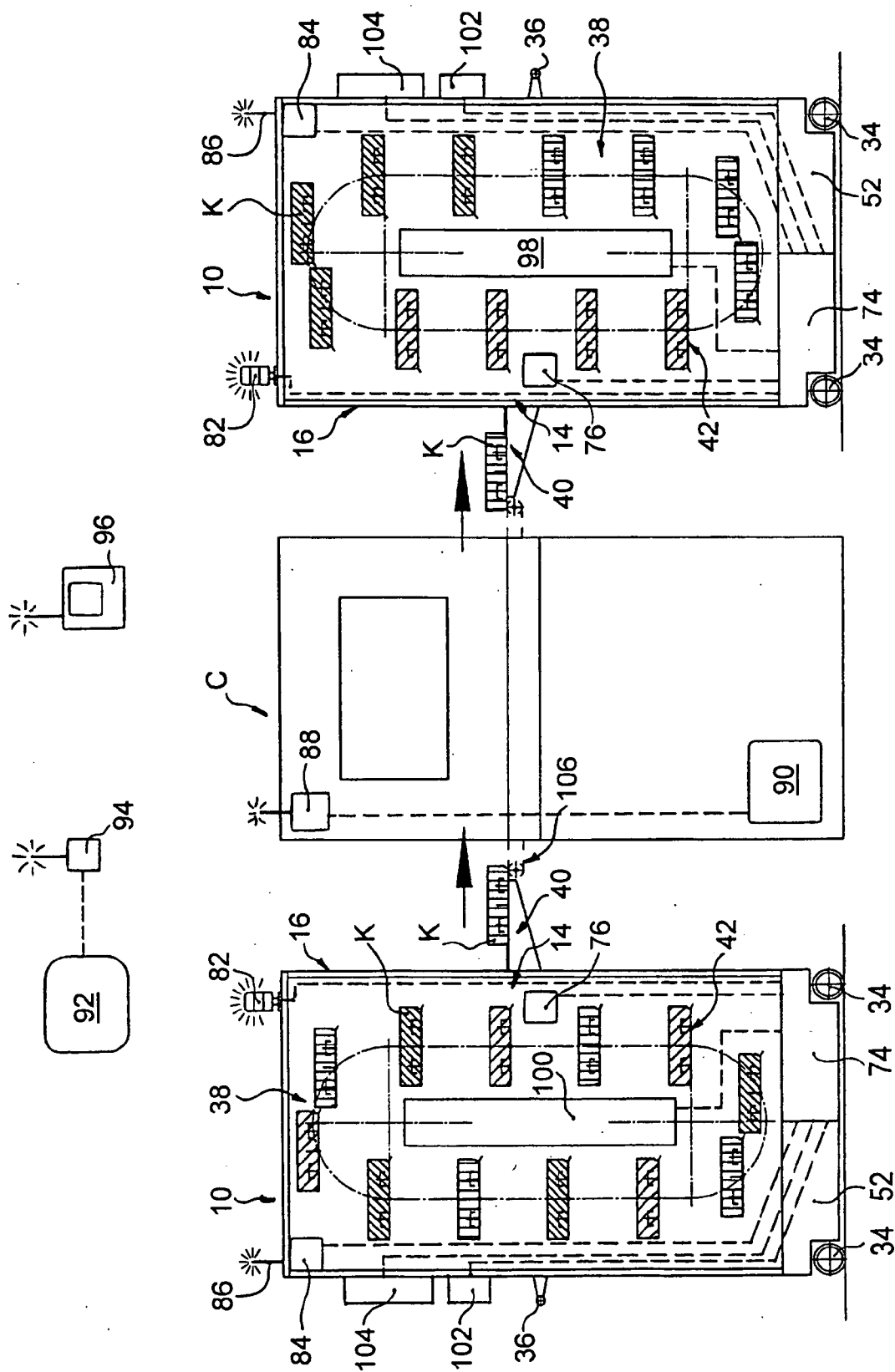


FIG. 3

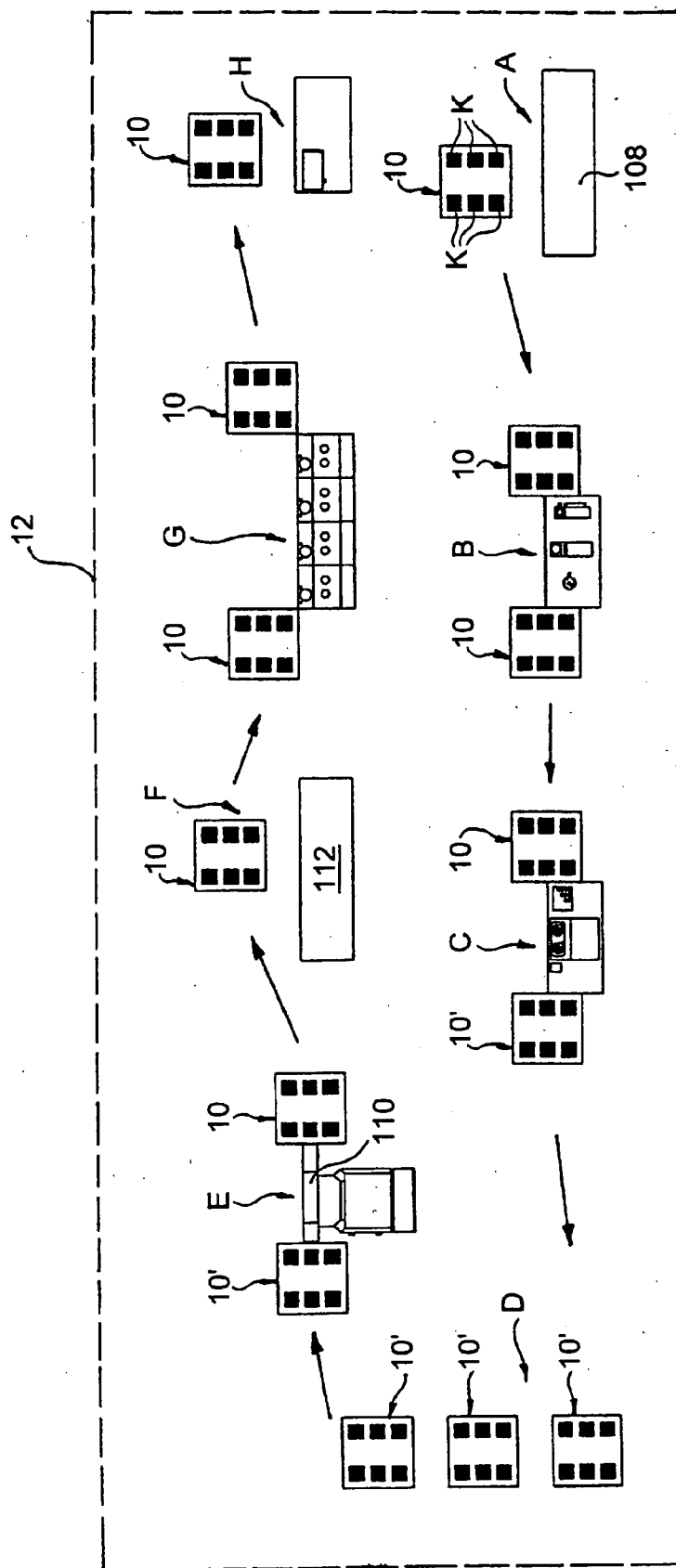


FIG. 4

CONTAINER FOR AND USE OF THE LATTER IN A PRODUCTION CENTER FOR MANUFACTURING INDIVIDUAL SPECTACLE LENSES ON PRESCRIPTION

BACKGROUND OF INVENTION

[0001] The present invention relates to a container for a production center for manufacturing individual spectacle lenses on prescription, according to the preamble portion of claim 1. The invention also relates to a method of manufacturing individual spectacle lenses on prescription, according to the preamble portion of claim 15.

[0002] The workstations or processing stations in production centers for manufacturing individual spectacle lenses from conventional materials (polycarbonate, mineral glass, CR 39, Hi-index, etc.) on prescription, also referred to as prescription workshops, are usually highly automated, with transport boxes being used as transport medium during manufacture. These transport boxes, also known as prescription boxes or "job trays", form the subject for example of the German standard DIN 58763.

[0003] Accommodated in the transport boxes are in each case the right and the left spectacle lens of an order and possibly the associated precision-grinding or polishing tool for the respective spectacle lens. Moreover, such a transport box has a compartment for the written, internal order. This usually bears a marking in the form of a barcode or the like. The transport boxes themselves are often also equipped with so-called "transponders", i.e. semiconductor elements for storing and transmitting information, by means of which identification of the respective order and of the current processing status of the spectacle lenses is possible.

[0004] By means of the transport boxes, spectacle lenses made of various materials must be fed to various workstations or machines, at which the spectacle lenses are processed using various auxiliaries and fuels (e.g. polishing agents, polishing pads) and various process parameters. The following process steps are usually carried out when manufacturing individual spectacle lenses on prescription:

[0005] (A) removing a suitable right and left spectacle lens blank from a semi finished product store and placing it in a transport box ("blank picking"). Semi finished means that the usually round or oval, as seen in plan view, spectacle lens blanks which have not yet been rimmed have already been processed on one of their two optically active surfaces.

[0006] (B) Then, the spectacle lens blanks are prepared for the blocking process, namely by applying a suitable protective tape ("taping") or a suitable protective lacquer ("protective lacquering") to protect the already processed optically active surface.

[0007] (C) The next step is the so-called "blocking" of the spectacle lens blanks. Here, each spectacle lens blank is associated with a suitable block, for example a block according to the German standard DIN 58766. For this purpose, the block is firstly brought into a predefined position with respect to the protected, already processed surface of the spectacle lens blank and then, in this position, the space between block and spectacle lens blank is filled with molten material (Wood's metal or wax).

[0008] (D) Following the blocking process, there is a cooling phase for solidifying the filling material. Following solidification of the filling material, the block forms a seat for processing the respective spectacle lens blank.

[0009] (E) Only then can the spectacle lens blanks be preprocessed, depending on the material, by means of grinding, milling or turning ("generating"), with the previously unprocessed optically active surface of the respective spectacle lens blank being given its macro geometry according to the prescription.

[0010] (F) After this preprocessing at the latest, the corresponding tool for precision-grinding or polishing of the respective spectacle lens is placed in the transport box ("tool picking").

[0011] (G) The fine processing of the spectacle lenses ("finishing") then takes place, in which the preprocessed optically active surface of the respective spectacle lens is given the desired micro geometry. Depending on, inter alia, the material of the spectacle lenses, the fine processing is subdivided into a precision-grinding process and a polishing process that follows on therefrom, or comprises, if a polishable surface has already been produced during preprocessing, merely a polishing process.

[0012] (H) After the polishing process, each spectacle lens is removed from the respective block ("deblocking").

[0013] (I) This is finally followed by cleaning steps and possibly further refining steps, e.g. an antireflection coating or hard coating of the spectacle lenses.

[0014] The process steps described above are usually carried out in a largely automated mode of operation, according to the "first in/first out" principle in which a transport box arriving at a workstation first also leaves the latter first. The workstations are fixedly linked to one another via conveyor belts, transverse roller devices for the transverse transfer out of the material flow, lifting devices, shunts and the like. Only for the cooling phase following blocking are suitable buffer zones provided, for instance in the form of automated shelves with bent-arm robots or linear drives, in which the transport boxes await their further processing.

[0015] One disadvantage of the rigid linking of the workstations by means of belts or similar transport devices for the transport boxes is in particular that these stationary transport devices have to be adapted individually to the size of the prescription workshop and to the structural conditions thereof. Changes in the predefined material flow, for instance if further workstations, e.g. new or other processing machines, are to be used to expand the capacity or to process spectacle lenses made of different materials, are always associated with a considerable outlay.

[0016] The alternative of manual transport of the transport boxes, on the other hand, in which the transport boxes are stacked and carried by one person from one workstation to the next workstation, in particular has the disadvantages that it is very staff-intensive and thus cost-intensive and is also dangerous on account of the high degree of strain on the staff.

[0017] There are known from the prior art separate devices for delivering articles (e.g. DE 34 24 988 A1), in which the articles are received in boxes that are stacked on top of one another or are placed on trays that are stacked on top of one another, individual devices for receiving and conveying collecting boxes for series parts that are to be gathered into batches (e.g. DE 41 21 844 C2), in which there are successive consoles between endless conveyors in the flow direction, said consoles having horizontal bearing surfaces for receiving the collecting boxes, and also separate intermediate workpiece stores (e.g. DE 197 49 396 A1) having receiving troughs guided in a paternoster-like manner for workpieces arriving at timed intervals; however, these are not suitable for a prescription workshop, i.e. a production center for manufacturing individual spectacle lenses, but rather only for series- and mass-produced parts.

SUMMARY OF THE INVENTION

[0018] It is an object of the invention to provide a logistic system by means of which a material flow of the transport boxes in a prescription workshop that is as optimal as possible can be ensured in a flexible manner and largely independent of the size of the prescription workshop and the structural conditions thereof.

[0019] This object is achieved by the features given in claims 1 and 15. Advantageous and/or expedient developments of the invention form the subject of claims 2 to 14.

[0020] According to one aspect of the invention, a container for a production center for manufacturing individual spectacle lenses on prescription, which production center has a number of workstations between which the spectacle lenses can be transported by means of transport boxes which are each designed to receive one right and one left spectacle lens and possibly associated processing tools, is designed to receive a number of transport boxes in order to transport the latter between at least two workstations of the production center, the container having an insertion and output device for the transport boxes, by means of which the transport boxes can be inserted into the container and a specific transport box can be output from the container when selected.

[0021] According to a further aspect of the invention, there is furthermore provided a method of manufacturing individual spectacle lenses on prescription in a production center having a number of workstations, in which the spectacle lenses, possibly together with associated processing tools, are transported between the workstations by means of transport boxes which are each designed to receive one right and one left spectacle lens and possibly the associated processing tools, wherein the transport boxes are transported between at least two workstations of the production center by means of a container according to the invention.

[0022] By means of the container according to the invention, or by means of the use thereof according to the invention in a prescription workshop, the transport boxes known for example from the German standard DIN 58763 can be transported between the individual workstations of the prescription workshop either individually or in batches in a manner that is simple, easy for the staff, cost-effective, space-saving and in particular very flexible, without the transport being subjected to greater restrictions on account

of the size and/or the structural conditions of the prescription workshop. Because the containers in this case are equipped with an insertion and output device for the transport boxes, by means of which the transport boxes can be inserted into the containers and a specific transport box can be output from the container when selected, the container may optionally operate in a "first in/first out" mode or in any other operating mode, depending on what is necessary for an optimized material flow, so that the container can be used in a very varied and multifunctional manner. Moreover, when using the containers according to the invention, there is no need for the high outlay in terms of individual planning, set-up and change that is necessary in the case of the rigid conveying systems described above. As a result, the container according to the invention is particularly suitable for prescription workshops which have to date not automated their manufacturing operations on account of the above-described disadvantages of the rigid conveying systems, which have been subject to limitations with regard to the use of conventional conveying systems on account of the size and/or structural conditions of their workshop area, which already use universally rigid conveying systems, but want to or have to expand manufacture by further workstations in as cost-effective a manner as possible, or which have to date only automated part of their manufacture (or wish to do so in the future) because, for example, relatively old processing machines that cannot be automated or can be automated only with difficulty are used (and are to continue to be used). One particular advantage of the use of containers according to the invention is also in this case that the logistic system of a prescription workshop can easily "grow" with the output of spectacle lenses it produces, simply by using additional containers. Finally, the container according to the invention, on account of its modular character, can be made in an outstandingly standardized manner and/or to form the subject of a container modular products system, which helps to considerably lower the costs of the logistic system for a prescription workshop.

[0023] Preferably, the insertion and output device of the container has a store for the transport boxes. The store may be, for instance, shelves fitted in a fixed position in the container, on which shelves the transport boxes can be placed in a defined manner by means of a lifting device that is provided. Nevertheless, a design is preferred in which the store is formed by a tray conveyor, by means of which a number of receiving trays for in each case at least one transport box are circulated in a paternoster-like manner.

[0024] It is further preferred when the insertion and output device of the container has a conveying device by means of which a transport box can be moved from an outer position on the container to an inner end position in the store of the container and vice versa. Advantageously, for this purpose the conveying device may have a longitudinal conveyor by means of which a transport box can be moved from the outer position on the container to an inner intermediate position in the container and vice versa, and also a gripper device by means of which the transport boxes can be moved from the inner intermediate position in the container to the inner end position in the store of the container and vice versa.

[0025] It may furthermore be provided that the insertion and output device has a recognition device by means of which a marking that is provided on each transport box and identifies the respective transport box can be detected. In one

simple refinement, the recognition device may only have one input option, for instance in the form of a keyboard, via which information regarding the marking on the transport box, which may for example be a written manufacturing order that is placed in a suitable receptacle on the transport box at the start of the prescription manufacturing operation, can be manually input. In one preferred refinement of the container, however, the recognition device is a reader by means of which a marking in the form of a barcode fitted on each transport box in a preferably detachable manner can be detected, preferably automatically. Such a barcode may for example be printed on the written manufacturing order such that it can be seen from outside. It is furthermore conceivable in this case that the recognition device is adapted to recognize, as box marking, a "transponder" that is known per se and is fitted on the transport box, in order to identify the transport box and read information regarding the respective manufacturing order and/or processing status of the spectacle lenses contained in the respective transport box.

[0026] In one advantageous assembly stage, the container may be provided with "intelligence", for which purpose the container has a control device which is effectively connected to the store and the conveying device and which in turn is effectively connected to the recognition device and in which information regarding the marking of the transport boxes that is detected by the recognition device can be stored, the store and the conveying device being controllable by the control device in order to output a specific transport box from the container upon a corresponding request, taking into account the information regarding the marking of the transport boxes that is stored in the control device.

[0027] When the container furthermore has, in an advantageous further assembly stage, a transmitting and receiving device, which is effectively connected to the control device, for communication or data transfer between the container on the one hand and a workstation and/or a possibly present host control system of the prescription workshop on the other hand, firstly information regarding the marking of the transport boxes and thus the respective manufacturing order can be forwarded for manufacturing purposes to the respective workstation or processing machine and/or the host control system of the prescription workshop. Secondly, a workstation or processing machine and/or the host control system of the prescription workshop can transmit in a simple manner a request signal to output a specific transport box on the container. In principle, the transmitting and receiving device of the container may be formed by a container-side plug or a container-side socket which makes contact with a complementary counterpart on the workstation or processing machine when the container is brought into a defined relative position with respect to the workstation or processing machine. Particularly with regard to a possibility of communication between the container and the host control system of the prescription workshop that is as uncomplicated as possible, however, a transmitting and receiving device is preferred which operates without wires and cables, for example by radio or an infrared interface.

[0028] The container may expediently have a signaling device for the filling level of the container and/or the processing status of the spectacle lenses contained in the transport boxes accommodated in the container, for instance in the form of a multicolored indicator light and/or an indicator unit that operates acoustically, so that the staff in

the prescription workshop can receive information, even from a distance, about the status of the container or of the spectacle lenses stored or transported therein.

[0029] In further assembly stages, the container may advantageously have one or more further functional units which serve to act upon the spectacle lenses contained in the transport boxes accommodated in the container. For instance, the container may be equipped with a cooling unit in order for example to shorten the dwell time following blocking, with it being possible for solidification of the filling material between block and spectacle lens blank to be accelerated by means of the cooling. Furthermore, the container may have a drying unit for drying the spectacle lenses contained in the transport boxes accommodated in the container, whereby for example the protective lacquer applied to the already processed optically active surface prior to blocking can be dried in order that the spectacle lenses can be fed to the blocking process more rapidly. The drying unit may in this case comprise a fan and/or heating.

[0030] It is furthermore advantageous when the container has a dedicated power supply unit for the power consumers present in the container, for instance the drives for the store and/or the conveying device, the recognition, control and/or signaling devices and also possibly the further functional units, so that the container is self-sufficient and does not have to have an external supply by way of power supply lines and/or cables. Expediently, this is an electrical power supply unit having at least one accumulator, for instance a car battery. In this case, electrical connection means are to be furthermore advantageously provided on the container, by means of which the container can be connected to an external power supply and/or can be charged up by the accumulator in buffer zones, so that said container is not subjected to unnecessary load and does not have to be removed for charging purposes.

[0031] Finally, if the container is equipped with a number of wheels or rollers so that it can be rolled, the container may be moved to the various workstations of the prescription workshop without any problems by one person. In further assembly stages, an automotive drive of the container would also be conceivable in this case, so that the container may be moved from workstation to workstation by remote control. Rail systems on the floor or ceiling of the prescription workshop are likewise possible, on which it may also be possible for the containers to be moved automatically, which allows for the structural conditions of the prescription workshop and is also desired despite the restricted flexibility of movement in the case of rail systems with respect to a free mobility of the containers.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] Hereinbelow, the invention is described in more detail on the basis of preferred embodiments with reference to the attached drawings that are shown in a partially schematic manner, where identical or similar parts bear the same reference signs. In the drawings:

[0033] FIG. 1 shows a partially cut-away, perspective illustration of a container for receiving and transporting the prescription boxes in a prescription workshop according to a first embodiment of the invention,

[0034] FIG. 2 shows a schematic illustration of a container for receiving and transporting the prescription boxes

in a prescription workshop according to a second embodiment of the invention, where the container is docked at a processing machine of the prescription workshop, said processing machine likewise only being shown schematically,

[0035] FIG. 3 shows a schematic illustration of two containers for receiving and transporting the prescription boxes in a prescription workshop according to a third embodiment of the invention, where the containers are docked at a blocking station of the prescription workshop, said blocking station likewise only being shown schematically, and

[0036] FIG. 4 shows the layout of a prescription workshop, in which containers according to the invention for transporting the prescription boxes between the individual workstations of the prescription workshop are used.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0037] FIGS. 1 to 3 show details of containers 10 for use in a production center, shown by way of example in FIG. 4, for manufacturing individual spectacle lenses L on prescription, referred to as prescription workshop 12, which has a number of workstations A to H and possibly I that are known per se and were discussed in the introduction. Between the workstations A to I, the spectacle lenses L are transported by means of transport boxes K that are known per se, as described for example in the German standard DIN 58763. Each transport box K is designed to receive one right and one left spectacle lens L and possibly associated processing tools. It is essential that, as will be described in more detail below, the container 10 is designed to receive a number of transport boxes K in order to transport the latter between at least two of the workstations A to I of the prescription workshop 12, the container 10 having an insertion and output device 14 for the transport boxes K by means of which the transport boxes K can be inserted into the container 10 and a specific transport box K can be output from the container 10 when selected.

[0038] As shown in FIG. 1, the container 10 has a basic frame 16 which is made up of rack profiles in the manner of a framework, said rack profiles preferably being made of an aluminum alloy. The base of the container 10 is formed by an essentially square lower rack consisting of a front and a rear lower rack profile 18 and two lateral lower rack profiles 20, in which there is fixedly inserted a flat base plate 22 with sufficient inherent rigidity, made for example of sheet steel. The top of the container 10 is in turn formed by an essentially square upper rack which consists of a front and a rear upper rack profile 24 and two lateral upper rack profiles 26 and on which there is fastened a flat top plate 28 with sufficient inherent rigidity, which may likewise be made of sheet steel. The base and the top of the container 10 are fixedly connected to one another by means of four longitudinal struts 30, one longitudinal strut 30 being fitted at each corner of the upper and lower racks. Furthermore, the basic frame 16 is reinforced about halfway up the longitudinal struts 30 by transverse struts 32, only one of which is in each case provided at the sides and in the rear region of the container 10, whereas in the front region of the container 10 there are provided two transverse struts 32 that are spaced apart in the vertical direction and delimit a kind of window for the insertion and outputting of the transport boxes K into and from the container 10. The upper of the front transverse

struts 32 is shown in a broken manner in FIG. 1. All the transverse struts 32 run perpendicular to the longitudinal struts 30 and are attached to the latter in a suitable manner. Not shown in FIG. 1, in order to make it possible to see into the container 10, are further casing parts and doors that are preferably made of aluminum sheet or plastic, which are fastened to the basic frame 16 in a manner such that they can be detached or opened for assembly and repair purposes and in the assembled state of the container 10 largely screen off the interior of the container 10 from the surrounding environment. In accordance with the requirements in each case, the further casing parts and doors may possibly be isolated from one another and sealed off from one another and from the basic frame 16 in a particular way in order where necessary to allow use of the container 10 in a clean-room environment, said container being essentially cuboid-shaped as seen from outside. In this case, filters or the like may also be provided in the container 10, although these are not shown in the present case.

[0039] In the embodiment shown, the container 10 is designed such that it can be rolled, for which purpose four wheels or rollers 34 are provided, two of which are in each case fitted on each lateral lower rack profile 20, namely in each case in a front and a rear region of each lateral lower rack profile 20, in a manner such that they can rotate. The rollers 34 may be conventional rollers, e.g. those having a plastic hub covered with a hard rubber tire. In order to be able to move the container 10 by hand, there is fitted on the rear side of the container 10 a U-shaped sliding or grab rail 36 which extends from longitudinal strut 30 to longitudinal strut 30 at the level of and parallel to the rear transverse strut 32 and is attached to the longitudinal struts 30 in a suitable manner.

[0040] Inside the container 10, there are fitted on the basic frame 16, in a manner not shown in any more detail here, as parts of the insertion and output device 14, a store 38 for the transport boxes K and a conveying device 40 by means of which a transport box K can be moved from an outer position on the container 10 to an inner end position in the store 38 of the container 10 and vice versa. In the embodiment shown, the store 38 is formed by a tray conveyor by means of which a number of receiving trays 42 for in each case at least one transport box K, in this case for in each case four transport boxes K, are circulated or guided in a loop in a paternoster-like manner. For this purpose, the store 38 has, on both sides of the receiving trays 42, guides 44 for the receiving trays 42, which guides run in a looped manner and extend almost over the entire height of the container 10, in which the receiving trays 42 are connected in a suitable manner, for example by means of a chain drive that is not shown in any more detail, to one another and to a drive, of which there is shown in FIG. 1 a drive motor 46, an angular gear 48 and a drive pinion 50 that can be driven by the drive motor 46 via the angular gear 48. In the embodiment shown, the drive motor 46 is an electric motor which is supplied with electrical power by an accumulator 52 arranged on the base plate 22—said accumulator being formed, in the embodiment shown, by two car batteries connected in parallel or in series, depending on requirements—as power supply unit for the power consumers present in the container 10.

[0041] At each longitudinal end, each receiving tray 42 has a side flank 54 on which there is fastened a pin 56 or the

like which in turn is guided in the associated guide 44 and is connected for drive purposes, in a suitable manner, to the chain drive that is not shown in any more detail here. The side flanks 54 of each receiving tray 42 are connected by means of a bearing plate 58 for the transport boxes K, said bearing plate having sufficient inherent rigidity or being suitably reinforced, which bearing plate extends almost over the entire width of the container 10 while leaving enough space for the drive and guiding elements of the store 38. On the upper side of each bearing plate 58 there are fitted, at regular spacings, guide beads 60 for the transport boxes K, which guide beads extend transversely over the bearing plate 58. The spacings of the guide beads 60 with respect to one another and with respect to the side flanks 54 can be found for example in the German standard DIN 58763, which in particular forms the standard regarding the dimensions of transport boxes K.

[0042] In the embodiment shown, the conveying device 40 has a horizontally aligned longitudinal conveyor 62 in the form of a commercially available, preferably electrically driven conveyor belt, which extends through between the front transverse struts 32 so that a transport box K can be moved from an outer position on the container 10 to an inner intermediate position in the container 10 and vice versa. Furthermore, the conveying device 40 has a gripper device 64 which serves to move the transport boxes K from the inner intermediate position on the longitudinal conveyor 62 in the container 10 to the inner end position in the store 38 of the container 10 and vice versa.

[0043] In the embodiment shown, the gripper device 64 has a horizontal portal 66 which is aligned parallel to the front transverse struts 32 of the basic frame 16 and to the receiving trays 42 and is formed by a commercially available, preferably electrically operated linear unit. A commercially available, preferably electric gripper drive 68 comprising two parallel grippers 70 for the transport boxes K can be moved along the portal 66 in the horizontal, i.e. lateral, direction, as shown by the associated double arrow in FIG. 1. The grippers 70 may be moved towards and away from one another, as shown by the double arrows in FIG. 1, in order to grasp/clamp a transport box K and release the latter, respectively. Furthermore, the portal 66 is mounted at each of its longitudinal ends on in each case a commercially available, preferably electrically operated linear unit 72. By means of the linear units 72 which extend parallel to one another and to the lateral transverse struts 32 of the basic frame 16 in the horizontal direction, the portal 66 and thus the gripper drive 68 can be moved forwards and backwards in a horizontal direction, i.e. between two end positions, as shown by the associated double arrow in FIG. 1.

[0044] The linear unit forming the portal 66, the gripper drive 68 and the lateral linear units 72 and also the longitudinal conveyor 62 are also supplied with electrical power by the accumulator 52. The drive motor 46 of the store 38, by means of which the receiving trays 42 of the store 38 can be moved predominantly in the vertical direction, as shown by the associated double arrow in FIG. 1, and also the linear units 66, 72, the gripper drive 68 and the longitudinal conveyor 62 of the conveying device 40 are coupled to one another for control purposes via a control device 74 in the form of a PC which has appropriate control plug-in cards (SPS, CNC, etc.) and is likewise arranged on the base plate 22 of the basic frame 16. It is obvious to the person skilled

in the art that the transport boxes K can thus be placed in the store 38 at a specific location on a specific receiving tray 42 by suitable horizontal movement by means of the conveying device 40 and by suitable vertical movement of the receiving trays 42. In the same way, by means of the conveying device 40, a specific transport box K can be removed from the store 38 and output from the container 10.

[0045] As electric drives for the store 38 and the conveying device 40, it is also possible to use cost-effective electric drives from the automobile sector (windscreen wiper motor, window opening drives, etc.), provided that this is technically possible. It is also conceivable, although this is not shown here, that a small compressor with air accumulator is provided in the container 10, as a result of which pneumatic drives could also be used for the store 38 and the conveying device 40.

[0046] As shown in FIG. 1, the insertion and output device 14 of the container 10 furthermore has a recognition device 76 which in this case is arranged on the longitudinal conveyor 62 of the conveying device 40, by means of which recognition device a marking that is provided on each transport box K and identifies the respective transport boxes K can be detected. In the embodiment shown, the recognition device 76 is a commercially available reader (barcode scanner), by means of which a barcode 78 placed on each transport box K as marking can be detected. More specifically, in this case each transport box K has a suitable receptacle in which there may be placed a written manufacturing order 80 that bears the barcode 78 among other things.

[0047] Like the store 38 and the conveying device 40 of the container 10, the recognition device 76 is also effectively connected in a suitable manner, not shown in FIG. 1, to the control device 74, so that information regarding the marking of the transport boxes K, in this case effected by means of the barcode 78, that is detected by the recognition device 76 can be stored in the control device 74. As a result, the store 38 and the conveying device 40 of the container 10 can be controlled by the control device 74 in order to output a specific transport box K from the container 10 upon a corresponding request, which is input into the control device 74 for example manually by an operator via a keyboard (not shown here) on the container 10 or automatically by a workstation or processing machine of the prescription workshop 12, taking account of the information regarding the marking 78 of the transport boxes K that is stored in the control device 74.

[0048] In FIGS. 2 and 3, containers 10 are shown schematically in further assembly stages. These too have an insertion and output device 14 in a suitably designed basic frame 16, e.g. as shown in FIG. 1, which can be moved by means of rollers 34, which insertion and output device 14 has a store 38 and a conveying device 40 that may be designed as described with reference to FIG. 1. Store 38 and conveying device 40 are in this case, along with a recognition device 76 for identifying the transport boxes K, connected to one another for control purposes via a control device 74. In these examples of embodiments too, these components are supplied with electrical power by an accumulator 52 in the container 10.

[0049] Compared to the container 10 shown in FIG. 1, the container 10 shown in FIG. 2 has three additional functional components, whereas the container shown in FIG. 3 has a

further two compared to the latter. Before describing these functional components in more detail, it should be pointed out at this point that these functional components may be provided individually or in any desired combination on a container 10, depending on requirements.

[0050] Firstly, the containers 10 shown in FIGS. 2 and 3 have a signaling device 82 which can output for example a signal that is representative of the filling level of the container 10 and/or of the processing status of the spectacle lenses L contained in the transport boxes K accommodated in the container 10. In the embodiment shown, the signaling device 82 is a multicolored indicator light that is connected to the control device 74.

[0051] Furthermore, the containers 10 shown in FIGS. 2 and 3 have a transmitting and receiving device 84 with associated antenna 86, which transmitting and receiving device is effectively connected to the respective control device 74. In the embodiment shown in FIG. 2, the container 10 can communicate, by means of the transmitting and receiving device 84, with the respective workstation of the prescription workshop 12, in this case the processing machine E for preprocessing the spectacle lenses L, for instance in order that the workstation can request a specific order, i.e. transport box K, from the container 10 or else that the container 10 can inform the workstation about processing data in respect of a specific transport box K that is yet to be output or has already been output, said processing data relating to the spectacle lenses L contained therein. The respective workstation accordingly likewise has a transmitting and receiving device 88 which is connected to a control device 90 of the workstation. Besides communication between container 10 and respective workstation, the container 10 shown in FIG. 3 can also communicate with a host control system 92 of the prescription workshop 12 for further manufacturing control purposes, which host control system is likewise equipped for this purpose with a transmitting and receiving unit 94. In this connection, FIG. 3 finally also shows an optional item of hand-held equipment (PDA) 96 which can communicate with the containers 10, the workstations of the prescription workshop 12 and the host control system thereof for control and/or monitoring purposes.

[0052] Furthermore, the container 10 shown in FIG. 2 and the container 10 shown in the right in FIG. 3 have a commercially available cooling unit 98 for cooling the spectacle lenses L contained in the transport boxes K accommodated in the container 10, by cooling the air inside the container 10. This may shorten, for example, the dwell time following blocking of the spectacle lenses L, by accelerating, by means of the cooling, the solidification of the filling material between block and spectacle lens blank. The cooling unit 98 may be designed so that it can be regulated such that the cooling times and/or temperatures can be selected to be different for different filling materials or spectacle lens materials.

[0053] Instead of a cooling unit, the container 10 shown on the left in FIG. 3 has a drying unit 100 for drying the spectacle lenses L contained in the transport boxes K accommodated in the container 10. As drying unit 100, use may be made for example of a commercially available electrical heater comprising fans. The drying unit 100 serves for example to dry the protective lacquer that is applied to the

already processed optically active surface of the spectacle lens L prior to blocking. It should also be noted here that the cooling unit 98 and the drying unit 100 are advantageously arranged within the paternoster loop of the store 38.

[0054] As further functional components, the containers 10 shown in FIG. 3 also have an input device 102, for instance in the form of a keyboard, and a display device 104, for example an LCD display, which are connected to the control device 74 of the container 10 and by means of which for example processing data in respect of the orders, i.e. transport boxes K, that are placed in or are to be placed in the container 10 can be input, requested and displayed.

[0055] FIGS. 2 and 3 finally also illustrate how the containers 10 can be used at the workstations of the prescription workshop 12. Whereas in FIG. 2 the horizontal arrows show that the respective order, i.e. transport box K, is removed from the container 10 via a conveying device 106 of the workstation E and after processing of the spectacle lenses L at the workstation this transport box K is placed back into the same container 10, FIG. 3 shows (cf. once again the horizontal arrows) that the respective order, i.e. transport box K, is removed from the container on the left in FIG. 3 via the conveying device 106 of the workstation C and this transport box K is then placed into the container 10 on the right in FIG. 3 following processing of the spectacle lenses L at the workstation C.

[0056] FIG. 4 shows, by way of example, the layout of a prescription workshop 12 in which the above-described containers 10 are used. In terms of the function of the individual workstations A to H of the prescription workshop 12, for the sake of clarity reference may firstly be made at this point to the introduction to the description. The main material flow between the workstations A to H is shown by arrows in FIG. 4.

[0057] In the layout example shown here, two different container types are used: firstly a container without a cooling unit—referenced 10—and secondly a container with a cooling unit—referenced 10'. Whereas the containers 10 are used in almost all areas of the prescription workshop 12, the containers 10' are used only in the area between the blocking station C and the preprocessing station E in order to allow rapid cooling of the blocked spectacle lenses L. These containers 10', which are somewhat more complex, therefore circulate between the finished part side of the blocking station C and the unfinished part side of the preprocessing station E. In order to ensure sufficient solidity of the blocking material, a buffer zone D is provided between the blocking station C and the preprocessing station E, in which buffer zone the containers 10' can dwell and cool.

[0058] The individual workstations A to H of the prescription workshop 12 are then linked flexibly by means of the containers 10, 10' as follows:

[0059] At A, transport boxes K are filled from a semi finished product store with semi finished spectacle lenses L in accordance with the prescription order. These transport boxes K are placed in a container 10.

[0060] As soon as a container 10 has been filled, said container is docked at the unfinished part side of the protective tape station B (taping), which may be designed as described for example in DE 199 25 087 C2. Alternatively, a protective lacquer station may be provided here. There is

an empty container **10** for receiving the transport boxes **K** comprising coated spectacle lenses **L** at the opposite side of the protective tape station **B**. The protective tape station **B** itself operates completely automatically and for this purpose has a dedicated charging device comprising tape (not shown).

[0061] As soon as this container **10** containing transport boxes **K** comprising coated spectacle lenses **L** has been filled, it is brought by an operator to the unfinished part side of the blocking station **C**. Blocking is effected either manually or completely automatically. On the finished part side of the blocking station **C** there is an empty container **10'** with integrated cooling unit, for receiving the transport boxes **K** comprising the blocked spectacle lenses **L**.

[0062] When this container **10'** is completely full, the container **10'** is fed, following some intermediate storage in the buffer zone or waiting zone **D**, to the unfinished part side of the preprocessing station **E**. The preprocessing station **E** usually operates completely automatically and for this purpose has a dedicated charging system **110** comprising a conveyor belt for the supply and discharge of the transport boxes **K**. An empty container **10** is docked on the finished part side of the preprocessing station **E**, for receiving the transport boxes **K** comprising the preprocessed spectacle lenses **L**.

[0063] Again, as soon as this container **10** has been filled, it is brought by an operator to the making-ready station **F**, in which the appropriate tools for fine processing, i.e. precision-grinding and/or polishing, from a tool store **112** are placed in each transport box **K**.

[0064] Once all transport boxes **K** have been equipped with the necessary processing tools, this container **10** is brought to the unfinished part side of the finishing station **G**, which in the layout example shown comprises a number of polishing machines. The transport boxes **K** are fed in succession to the polishing machines. The operator places tool and spectacle lens **L** into the polishing machine and starts the latter. The placing of the spectacle lenses **L** and tools into the precision-grinding or polishing machines is usually not automated, although this is also possible in principle. The finished spectacle lenses are then placed back in their transport box **K** together with the tools and said transport box is placed into an empty container **10**.

[0065] As soon as this container **10** has in turn been filled, it is brought to the deblocking station **H**, in which the spectacle lenses **L** are removed from the blocks. From here, the spectacle lenses **L** are fed to the further cleaning and refining processes. The blocks, tools and transport boxes **K** are finally briefly cleaned before they are taken back to their starting station (blocking station **C**, tool store **112** and transport box shelf, respectively).

[0066] A container for a production center for manufacturing individual spectacle lenses on prescription, known as a prescription workshop, is disclosed, which prescription workshop has a number of workstations between which the spectacle lenses can be transported by means of transport boxes which are each designed to receive one right and one left spectacle lens and possibly associated processing tools. According to the invention, the container is designed to receive a number of transport boxes in order to transport the latter between at least two workstations of the prescription

workshop, the container having an insertion and output device for the transport boxes, by means of which the transport boxes can be inserted into the container and a specific transport box can be output from the container when selected. The invention also comprises the use of the container according to the invention in a prescription workshop. As a result, a logistic system for a prescription workshop is provided by means of which an optimized material flow of the transport boxes can be ensured in a flexible manner and largely independent of the size of the prescription workshop and the structural conditions thereof.

[0067] Other variations and modifications are possible without departing from the scope and spirit of the present invention as defined by the appended claims.

I claim:

1. Container (**10**) for a production center (**12**) for manufacturing individual spectacle lenses (**L**) on prescription, claim 22 for which production center has a number of workstations (**A-H**) between which the spectacle lenses (**L**) can be transported by means of transport boxes (**K**) which are each designed to receive one right and one left spectacle lens (**L**) and possibly associated processing tools, characterized in that the container (**10**) is designed to receive a number of transport boxes (**K**) in order to transport the latter between at least two workstations (**A-H**) of the production center (**12**), the container (**10**) having an insertion and output device (**14**) for the transport boxes (**K**), by means of which the transport boxes (**K**) can be inserted into the container (**10**) and a specific transport box (**K**) can be output from the container (**10**) when selected.

2. Container (**10**) according to claim 1, characterized in that the insertion and output device (**14**) has a store (**38**) for the transport boxes (**K**).

3. Container (**10**) according to claim 2, characterized in that the store (**38**) is formed by a tray conveyor, by means of which a number of receiving trays (**42**) for in each case at least one transport box (**K**) are circulated in a paternoster-like manner.

4. Container (**10**) according to claim 3, characterized in that the insertion and output device (**14**) has a conveying device (**40**) by means of which a transport box (**K**) can be moved from an outer position on the container (**10**) to an inner end position in the store (**38**) of the container (**10**) and vice versa.

5. Container (**10**) according to claim 4, characterized in that the conveying device (**40**) has a longitudinal conveyor (**62**) by means of which a transport box (**K**) can be moved from the outer position on the container (**10**) to an inner intermediate position in the container (**10**) and vice versa, and has a gripper device (**64**) by means of which the transport boxes (**K**) can be moved from the inner intermediate position in the container (**10**) to the inner end position in the store (**38**) of the container (**10**) and vice versa.

6. Container (**10**) according to claim 5, characterized in that the insertion and output device (**14**) has a recognition device (**76**) by means of which a marking (**78**) that is provided on each transport box (**K**) and identifies the respective transport box (**K**) can be detected.

7. Container (**10**) according to claim 6, characterized in that the recognition device (**76**) is a reader by means of which a barcode (**78**) fitted on each transport box (**K**) can be detected.

8. Container (10) according to claim 6, characterized by a control device (74) which is effectively connected to the store (38) and the conveying device (40) and which in turn is effectively connected to the recognition device (76) and in which information regarding the marking (78) of the transport boxes (K) that is detected by the recognition device (76) can be stored, the store (38) and the conveying device (40) being controllable by the control device (74) in order to output a specific transport box (K) from the container (10) upon a corresponding request, taking into account the information regarding the marking (78) of the transport boxes (K) that is stored in the control device (74).

9. Container (10) according to claim 8, characterized by a transmitting and receiving device (88), which is effectively connected to the control device (74), for communication between the container (10) on the one hand and a workstation (A-H) and/or a host control system (92) of the production center (12) on the other hand.

10. Container (10) according to claim 9, characterized by a signaling device (82) for the filling level of the container (10) and/or the processing status of the spectacle lenses (L) contained in the transport boxes (K) accommodated in the container (10).

11. Container (10) according to claim 9, characterized by a cooling unit (98) for cooling the spectacle lenses (L) contained in the transport boxes (K) accommodated in the container (10).

12. Container (10) according to claim 9, characterized by a drying unit (100) for drying the spectacle lenses (L) contained in the transport boxes (K) accommodated in the container (10).

13. Container (10) according to claim 9, characterized by a power supply unit (52) for the power consumers that are present in the container (10).

14. Container (10) according to claim 9, characterized in that the container (10) can be rolled, for which purpose the container (10) is equipped with a number of wheels or rollers (34).

15. Container (10) according to claim 2, characterized in that the insertion and output device (14) has a conveying device (40) by means of which a transport box (K) can be moved from an outer position on the container (10) to an inner end position in the store (38) of the container (10) and vice versa.

16. Container (10) according to claim 15, characterized in that the conveying device (40) has a longitudinal conveyor (62) by means of which a transport box (K) can be moved from the outer position on the container (10) to an inner intermediate position in the container (10) and vice versa,

and has a gripper device (64) by means of which the transport boxes (K) can be moved from the inner intermediate position in the container (10) to the inner end position in the store (38) of the container (10) and vice versa.

17. Container (10) according to claim 1, characterized by a signaling device (82) for the filling level of the container (10) and/or the processing status of the spectacle lenses (L) contained in the transport boxes (K) accommodated in the container (10).

18. Container (10) according to claim 1, characterized by a cooling unit (98) for cooling the spectacle lenses (L) contained in the transport boxes (K) accommodated in the container (10).

19. Container (10) according to claim 1, characterized by a drying unit (100) for drying the spectacle lenses (L) contained in the transport boxes (K) accommodated in the container (10).

20. Container (10) according to claim 1, characterized by a power supply unit (52) for the power consumers that are present in the container (10).

21. Container (10) according to claim 1, characterized in that the container (10) can be rolled, for which purpose the container (10) is equipped with a number of wheels or rollers (34).

22. Method of manufacturing individual spectacle lenses (L) on prescription in a production center (12) having a number of workstations (A-H), in which the spectacle lenses (L), possibly together with associated processing tools, are transported between the workstations (A-H) by means of transport boxes (K) which are each designed to receive one right and one left spectacle lens (L) and possibly the associated processing tools, characterized in that the transport boxes (K) are transported between at least two workstations (A-H) of the production center (12) by means of a container (10) having a number of workstations (A-H) between which the spectacle lenses (L) can be transported by means of transport boxes (K) which are each designed to receive one right and one left spectacle lens (L) and possibly associated processing tools, characterized in that the container (10) is designed to receive a number of transport boxes (K) in order to transport the latter between at least two workstations (A-H) of the production center (12), the container (10) having an insertion and output device (14) for the transport boxes (K), by means of which the transport boxes (K) can be inserted into the container (10) and a specific transport box (K) can be output from the container (10) when selected.

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