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**Storage unit**

The invention relates to a storage unit comprising at least one drawer with an associated drawer guide.

It is known to store tools in tool cabinets and drawers, etc., wherein the tool is preferably arranged in a defined fashion in tool inserts. There are, for example, tool inserts for open-end wrenches or screwdrivers in which open-end wrenches or screwdrivers of multiple different sizes are arranged in a defined fashion, i.e., the tool inserts assign a specific place in the tool insert to each element of such a tool set.

It is also known to check, using optical methods, whether a corresponding tool is arranged in its receptacle of a tool insert. For this purpose, there is a hole in the tool insert in the place for a tool, the hole extending from the top side to the bottom side of the tool insert. An LED and a matching optical sensor is then arranged on the bottom side of the tool insert. When the LED is in operation and the tool is in its place in the tool insert, the tool reflects the light from the LED to the sensor and the current generated by this reflection is interpreted to mean that the tool is in its place in the tool insert. Conversely: if no light arrives at the sensor, the tool is not in its place and is missing in the tool insert.

The inventory of tools in tool inserts of a storage unit, for example a tool cabinet or a shelf, is recorded using an associated data processing system having corresponding programming which assigns to each LED-sensor unit exactly one tool.

Such an arrangement is well suited for stationary applications, i.e., for applications in which the tool insert is stationary at a fixed location in the storage unit. However, if the tool insert is movably arranged in the storage unit, for example because the tool insert is located in a drawer, the arrangement is not suitable, or is only poorly suitable, since, for example, cables which reach into the drawer must be carried along between the open and closed positions of the drawer. A generic storage unit is known from WO 2009/024750 A1, for example.

The object of the present invention is therefore to provide a simple optical arrangement for monitoring the inventory of storing units in a storage unit, wherein the storing units are displaceably stored in the storage unit, for example arranged in a drawer.

The object is achieved according to the invention by an arrangement having the features of claim 1.

The arrangement according to the invention makes it possible to electronically monitor the inventory of storing units stored displaceably in a storage unit without having to carry along cables for electronic monitoring during a displacement of the storing units. The

arrangement according to the invention makes it possible to hold the electronic components stationary in the storage unit and to hold the storage units themselves in the storage unit displaceably. In the process, it is important that the position of the storage units is coordinated with the position of the electronic components and an assignment of the storage units to the electronic components is defined such that the presence or absence of a storage unit can be displayed in a data processing system.

The storage unit may consist of a cabinet, a tool trolley, a toolbox, a roll container or a shelf.

The storing unit can be a tool, for example a hammer or a screwdriver, a machine, for example a drill, an aerosol can, for example a paint can, a cardboard box, for example containing screws or nuts, a storage box, for example for screws and nuts, in particular a storage box whose bottom has at least one transillumination area, or be a tool insert for a tool.

A transillumination area is preferably a through-hole in the drawer bottom but may also be a region in the drawer bottom which is transparent to the light of the lighting-sensor unit.

According to the invention, the transillumination areas and/or the lighting-sensor units are arranged in a regular structure, in particular in rows and columns.

Preferably, at least one transillumination area is assigned a lighting-sensor unit, particularly preferably each transillumination area is assigned a lighting-sensor unit, more preferably the transillumination areas and the lighting-sensor units are congruently arranged, i.e., the number of transillumination areas corresponds to the number of lighting-sensor units.

Advantageously, the drawer comprises the drawer bottom as a receiving space, thereby creating a laterally unrestricted receiving space. Preferably, the drawer comprises the drawer bottom and at least one side wall, in particular four side walls perpendicular to each other, creating a receiving space which is restricted on at least one side.

A tool insert can be arranged on the drawer bottom and/or the drawer bottom can have at least one compartment, in particular subdivided into a plurality of stationary compartments, and/or at least one storage box can be arranged on the drawer bottom, the storage box in particular having least one transillumination area, and/or holding devices are provided on the drawer bottom, for example in the form of protruding bolts, in order to assign a defined storage area on the drawer bottom to certain storing units.

Advantageously, the lighting-sensor units are connected to a data processing system, in particular a computer, and in the data processing system the presence of a light detection

signal of a sensor of a lighting-sensor unit or a group of sensors of a group of lighting-sensor units is assigned to the presence of a particular storing unit so that the data processing system indicates the presence or absence of storing units assigned to the sensor or the group of sensors, respectively, in the receiving space.

The data processing system can be a stationary computer, a laptop, a tablet or a mobile phone.

Preferably, the drawer is assigned a switch or a sensor which is actuated or triggered by the drawer when it reaches the closed position, whereby the switch or the sensor sends a switching signal to the data processing system when the drawer latches from the open position into the closed position, and the data processing system, upon receipt of this switching signal, interrogates the sensors of the lighting-sensor units in order to detect the storage units in the receiving space.

The detection carrier is preferably designed, over its entire surface as a compartment bottom, so that it is fixed in place, for example to the walls of the storage unit supporting the drawer guides. Alternatively, the detection carrier is formed from at least two detection carrier strips, for example running between the walls of the storage unit supporting the drawer guides, or parallel to the drawer guides, for example in drawer-like fashion.

The detection carrier or the detection carrier strips can be fixedly connected to the storage unit, for example screwed thereto, or can be connected to the storage unit in drawer-like fashion in order to easily replace the storage unit.

Advantageously, the lighting-sensor units of the detection carrier or the detection carrier strips are connected to electrical lines of the storage unit via electrical lines using an electronic plug connection, the electrical lines in turn being connected to the data processing system, for example wired or wireless, in order to supply power to lighting-sensor units and to control and read out the lighting and the sensor units of the lighting-sensor units; for example, the detection carrier or the detection carrier strip comprises a plug and the storage unit comprises an electronic plug connector coupling.

The lighting unit of the at least one lighting-sensor unit emits visible or invisible light, for example by means of an LED lighting unit or a laser lighting unit, and the sensor of the associated lighting-sensor unit is designed to detect precisely this light.

Other features, details and advantages of the invention will become apparent from the claims and the following description of preferred embodiments and from the drawing.

Shown are:

Fig. 1 a perspective view of an arrangement according to the invention of a drawer having an associated detection carrier and

Fig. 2 an enlarged plan view of a transillumination area and a lighting-sensor unit of the detection carrier.

Figure 1 shows a drawer 1 with associated drawer guide 1SF, wherein the drawer 1 comprises a drawer bottom 1SB and four mutually perpendicular side walls 1SW. The drawer 1 is part of a shelf, not shown, which serves as a storage unit for storing units 3. The drawer guide 1SF is fixedly connected to the shelf, for example to shelf posts of the shelf or to side or intermediate walls of the shelf. The shelf may be in a warehouse of a handicraft business, in the present case an automotive workshop. Accordingly, stored in the shelf as storing units are, for example, tools, machine tools, cardboard boxes of C-parts, etc. The drawer 1 forms a receiving space 5 - as part of the shelf - for storing units 3.

Protruding up from the drawer bottom 1SB are six bolts as holding devices 19 for receiving a tool 13, in this case a screwdriver, between these.

Arranged on the drawer bottom 1SB is a storage box 15 open at the top for C-parts, for example screws or nuts, wherein a bottom of the storage box is transparent.

Arranged on the drawer bottom 1SB is a tool insert 17 for a tool 13, in the present case a screwdriver. The tool insert 17 has a hole extending therethrough, the hole being congruent to a transillumination area 7 which will be described further below.

The drawer bottom 1SB has transillumination areas 7 in the form of through holes. The transillumination areas 7 are arranged regularly, in the present case in rows and columns: in five columns and in six rows.

The drawer 1 is displaceable from the open position shown in Fig. 1 to a closed position using the drawer guide 1SF.

If the drawer is in the closed position, then a detection carrier 9 is arranged below the drawer bottom 1SB. The detection carrier 9 is presently a compartment bottom of the shelf, the bottom being firmly connected to the shelf, for example screwed to shelf posts of the shelf or to side or intermediate walls of the shelf. The detection carrier may be made of metal or plastic.

In Fig. 1, the detection carrier 9 comprises slot blades offset downward (not shown) into which drawer-like printed circuit boards 29 are pushed. Each printed circuit board 29 is thus inserted into a "drawer slot" formed by the bottom of the detection carrier 9 and the slot blades. Lighting-sensor units 11 are printed on each printed circuit board 29, in the present case each unit having an LED light with associated light sensor, as well as lines for supplying power for controlling or reading out same, the lines leading to a plug 23S of a plug connector.

When a printed circuit board 29 is inserted into its drawer slot under the detection carrier 9 up to a stop, which is not shown, then the lighting-sensor units 11 of the circuit board 29 align with the transillumination areas 7 of the detection carrier, and when the drawer 1 is in the closed position, they align with the transillumination areas 7 of the drawer bottom 1SB.

Fig. 2 shows an enlarged section of the detection carrier 9 of Fig. 1: this figure shows the detection carrier 9 (the compartment bottom) and its transillumination area 7 (in this case the through hole), and the lighting-sensor unit 11 in the middle of the transillumination area 7.

The plugs 23S of the printed circuit boards 29 are plugged into couplings 23K which in turn are fixedly connected to the shelf, for example mounted to a back wall of the shelf. The plugs 23S and the couplings 23K form an electronic connector. Electrical lines 27 proceed from the coupling 23K to a data processing system 25, in this case a stationary computer of the workshop manager of the automotive workshop.

In Fig. 1, a switch 21 is located above the left rear corner of the detection carrier 9. When the drawer 1 is moved from the open position to the closed position, the switch 21 switches when the drawer 1 latches into the closed position, the switch then sending a signal via the line 27 to the data processing system 25.

When the signal reaches the data processing system 25, the lighting-sensor units 11 are aligned with the transillumination areas 7 of the detection carrier 9 and with the transillumination areas 7 of the drawer bottom 1SB, and the data processing system 25 sends a signal to each lighting-sensor unit 11 of the printed circuit boards 29, respectively, so that light from the lighting unit of each lighting-sensor unit 11 can shine through the corresponding transillumination area 7 of the detection carrier 9 and the corresponding transillumination area 7 of the drawer bottom 1 into the receiving space 5.

If the light emitted in this way is reflected off of a storing unit 3, then it takes the opposite path through the two transillumination areas 7 to the sensor of the associated lighting-sensor unit 11, which in turn generates a signal that lands at the data processing system 25. The data processing system evaluates the presence of this signal to mean that the storing unit assigned to this lighting-sensor unit 11 is in its place in the receiving space 5 of the drawer 1. In this way, the data processing system recognizes, for example, that the screwdriver 13 is being held in the drawer 1 by the holding devices 19.

If the light thus emitted is not reflected off of a storing unit 3 because it is missing in the drawer 1, no light returns to the sensor of the associated lighting-sensor unit 11, and the absence of a signal from this sensor of the lighting-sensor unit is interpreted by the data

processing system 25 to mean that the corresponding storage unit 3 is missing in the drawer 1.

The data processing system 25 includes an assignment system for assigning each lighting-sensor unit 11 to a storing unit 3. A lighting-sensor unit 11 is thus able to be assigned to a storage unit 3. However, it is also possible for a plurality of lighting-sensor units 11 to be assigned to the same storing unit 3, see for example the screwdriver 13 located between holding devices 19: two lighting-sensor units 11 are arranged under the screwdriver 13 in the inserted state of the drawer 1. The data processing system 25 may indicate the presence of the screwdriver 13 when one or both of the lighting-sensor units send a signal to the data processing system 25, depending on the selected programming of the data processing equipment 25.

The tool insert 17 in the drawer has a through hole in the tool receptacle, the hole being aligned with a transillumination unit 7 of the drawer bottom 1SB. In this way it can be detected whether the screwdriver 13 is arranged in its tool receptacle of the tool insert 17. The data processing system 25 may be programmed in such a way that the evaluation of adjacent lighting-sensor units 11 indicates the absence or presence of the tool insert 17. In this way, both the presence or absence of the tool insert 17 and the presence or absence of the tool 13 in the tool insert 17 can be detected by means of the lighting-sensor units 11.

Since the storage box 15 has a transparent bottom, the presence or absence of small parts in the storage box can be detected using the lighting-sensor units 11 associated with the storage box 15.

An inventory query of storing units 3 in the drawer 1 by means of the arrangement selected is only possible when the drawer 1 is in the closed position. In the embodiment described above, the inventory of storage units 3 is always read out using the lighting-sensor units 11 when the drawer 1 latches into the closed position. In this way, the state that was present at the last insertion of the drawer 1 into the closed position is always the state present in the data processing system. In an alternative embodiment, there is no switch 21 and the data processing system 25 only performs a query concerning the inventory of storing units 3 when requested to do so by a user, i.e. immediately once the drawer 1 is in the closed position, or only when the drawer 1 is latched in the closed position if the drawer 1 is not in the closed position at the time of the query by the user.

In the present case, the detection carrier 9 is a compartment bottom into which printed circuit boards 29 that have lighting-sensor units 11 are inserted. Alternatively, the detection carrier may be a self-adhesive foil on which is printed an array of lighting-sensor

units 11 having corresponding lines. The film may then be glued onto a suitable carrier, for example a shelf bottom arranged below the drawer bottom 1SB in the closed state.

The data concerning the inventory of storing units in the storage unit obtained by the arrangement according to the invention can be used for several purposes:

The data of the arrangement according to the invention may be used purely for inventory monitoring: Which storing units are currently in the storage unit.

If the storage unit has an access control system in which a user must be identified before the storage unit opens, the inventory can provide a conclusion, before the opening of the storage unit and after closing the storage unit, as to which user has removed which storing unit.

However, the data concerning the inventory can also be used for an ordering system: If a certain storing unit is missing or if the quantity of available storing units falls below a predefined limit, a reordering process is initiated. This may, for example, involve an e-mail to a vendor that is automatically sent by the data processing system 25, or it may be an e-mail to an order manager to approve the order and then execute the order.

#### List of reference signs

1	Drawer
1SB	Drawer bottom
1SF	Drawer guide
1SW	Drawer side wall
3	Storing units
5	Receiving space
7	Transillumination area
9	Detection carrier
11	Lighting-sensor unit
13	Tool
15	Storage box
17	Tool insert
19	Holding devices (bolts) on the drawer bottom for tools
21	Switch
23	Electronic plug connector
23K	Coupling of the electronic plug connector
23S	Plug of the electronic plug connector
25	Data processing system

- 27 Electrical line
- 29 Printed circuit board

## Lagerenhed

### Patentkrav

1. Lagerenhed, der er udstyret med mindst én skuffe (1) med en forbundet skuffeskinne (1SF) som gør, at skuffen (1) kan flyttes mellem en åben stilling og en lukket stilling, og hvor skuffen (1) har en skuffebund (1SB) til at holde og/eller opbevare lagerenheder (3), hvilket danner et opbevaringsrum (5), hvor skuffebunden (1SB) har en række gennemlysningsområder (7), og når skuffen (1) er lukket stilling vil en bund under skuffebunden (1SB), der er fast forbundet med lagerenheden, fungere som detektionsbærer (9) med en række lys-sensor-enheder (11), hvor et gennemlysningsområde (7) har mindst én tildelt lys-sensor-enhed (11), så lyset fra lysenheden i lys-sensor-enheden (11) kan lyse gennem gennemlysningsområdet (7) ind i opbevaringsrummet (5) og en refleksion af lyset på lagerenheden (3) i opbevaringsrummet kan registreres af lys-sensor-enheden (11), så den kan detektere en lagerenhed (3) på lys-sensor-enheden (11) på den modsatte side af gennemlysningsområdet (7), kendetegnet ved at gennemlysningsområderne (7) og/eller lys-sensor-enhederne (11) er placeret i en regelmæssig struktur i rækker og kolonner.
2. Lagerenhed i henhold til krav 1 kendetegnet ved at lagerenheden består af et skab, en værkstedsvogn, en værktøjskasse, en rullecontainer eller en reol.
3. Lagerenhed i henhold krav 1 eller 2 kendetegnet ved at lagerenheden har et værktøj (13), f.eks. en hammer eller en skruetrækker, en maskine, f.eks. en boremaskine, en aerosoldåse, f.eks. en lakdåse, en æske, f.eks. med skruer eller møtrikker, en lagerboks (15), f.eks. til skrue eller møtrikker, især en lagerboks, hvor bunden har mindst ét gennemlysningsområde (7), eller er et værktøjsindlæg (17) til et værktøj (13).
4. Lagerenhed i henhold til et af de ovenstående krav, kendetegnet ved at et gennemlysningsområde (7) er et gennemgående hul i skuffebunden (1SB) eller et område, der er gennemsigtigt for lys-sensor-enheden (11) i skuffebunden (1SB).

5. Lagerenhed i henhold til et af de ovenstående krav, kendetegnet ved at mindst ét gennemlysningsområde (7) får tildelt en lys-sensor-enhed (11), især at hvert gennemlysningsområde (7) har en tildelt lys-sensor-enhed (11), især at gennemlysningsområderne (7) og lys-sensor-enhederne (11) er placeret sådan, at de dækker hinanden, dvs. at antallet af gennemlysningsområder (7) er det samme som antallet af lys-sensor-enheder (11).
6. Lagerenhed i henhold til et af de foregående krav, kendetegnet ved at skuffen (1S) omslutter skuffebunden (1SB) som opbevaringsrum (5), hvorved der skabes et opbevaringsrum, der ikke er afgrænset til siderne, eller at skuffen (1) omfatter mindst skuffebunden (1SB) og mindst én sidevæg (1SW), især fire sidevægge, der er lodrette i forhold til hinanden, hvorved der skabes et opbevaringsrum, der er afgrænset til mindst én side.
7. Lagerenhed i henhold til et af de foregående krav, kendetegnet ved at der på skuffebunden (1SB) er placeret et værktøjsindlæg (17) og/eller at skuffebunden (1SB) har mindst ét rum, især hvis det er delt op i flere stationære rum, og/eller at der på skuffebunden (1SB) er mindst én lagerboks (15), især med mindst ét gennemlysningsområde (7), og/eller at der på skuffebunden (1SB) er påtænkt holdeanordninger (19), f.eks. i form af fremstående bolte, så bestemte lagerenheder (3) får tildelt et defineret lagerområde på skuffebunden (1SB).
8. Lagerenhed i henhold til et af de foregående krav, kendetegnet ved at lys-sensor-enhederne (11) er forbundet med et databehandlingsanlæg (25), især en computer, og at der i databehandlingsanlægget (25) er tildelt tilstedeværelsen af et lysdetektionssignal fra sensoren i en lys-sensor-enhed (11), eller en gruppe af lys-sensor-enheder (11) har fået tildelt tilstedeværelsen af en bestemt lagerenhed (3), så databehandlingsanlægget (25) viser at den lagerenhed (3) i opbevaringsrummet (5) har fået tildelt eller mangler sensoren og/eller gruppen af sensorer.
9. Lagerenhed i henhold til krav 8 kendetegnet ved at databehandlingsanlægget (25) er en stationær computer, en bærbar computer, en tablet-pc eller en mobiltelefon.
10. Lagerenhed i henhold til krav 8 eller 9 kendetegnet ved at skuffen (1) har en tildelt kontakt (21) eller en sensor, som aktiveres eller udløses af skuffen (1), hvorved

kontakten (21) eller sensoren sender et koblingssignal til databehandlingsanlægget (25), når skuffen (1) falder i hak fra den åbne stilling til den lukkede stilling, og databehandlingsanlægget (25) afsøger sensorerne i lys-sensor-enhederne (11), når dette koblingssignal modtages, for at detektere lagerenhederne (3) i opbevaringsrummet (5).

11. Lagerenhed i henhold til et af de ovenstående krav, kendetegnet ved at detektionsbæreren (9) er udformet som skuffebund på hele overfladen og er fastgjort på skuffeskinnerne (1SF) på lagerenhedens bærende vægge.
12. Lagerenhed i henhold til et af de foregående krav, kendetegnet ved at lys-sensor-enhederne (11) på detektionsbæreren (9) og/eller detektionsbærerriben er forbundet via elektriske ledninger (27) vha. en elektronisk stikforbindelse (23) med elektriske ledninger (27) på lagerenheden, som så er forbundet med databehandlingsanlægget (25), f.eks. med eller uden kabel, så lys-sensor-enhederne (11) forsynes med strøm, og styrer og aflæser lys- og sensor-enhederne på lys-sensor-enhederne (11), f.eks. detektionsbæreren (9) og/eller detektionsbærerriben omfatter et stik (23S) og lagerenheden omfatter en kobling (23K) på den elektroniske stikforbindelse (23).
13. Lagerenhed i henhold til et af de ovenstående krav, kendetegnet ved at lysenheden på den mindst tilstedeværende lys-sensor-enhed (11) udsender synligt eller usynligt lys, f.eks. via en lysdiodeenhed eller en laserenhed, og at sensoren på den tilhørende lys-sensor-enhed (11) er beregnet til at detektere lige præcis dette lys.



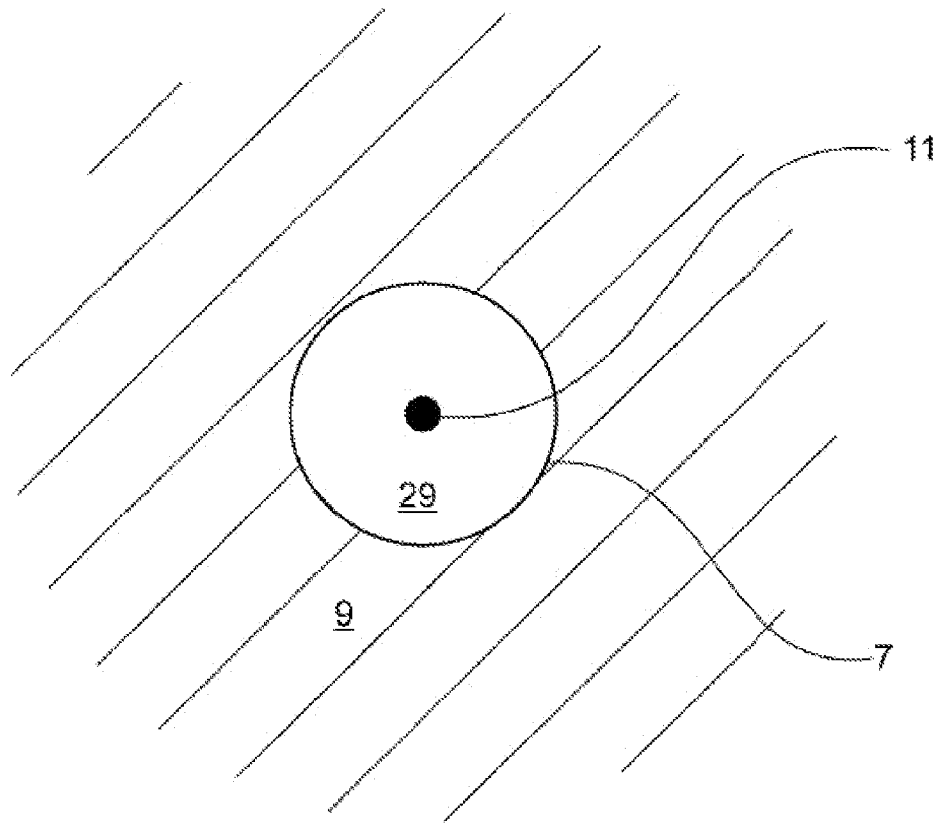


Fig. 2