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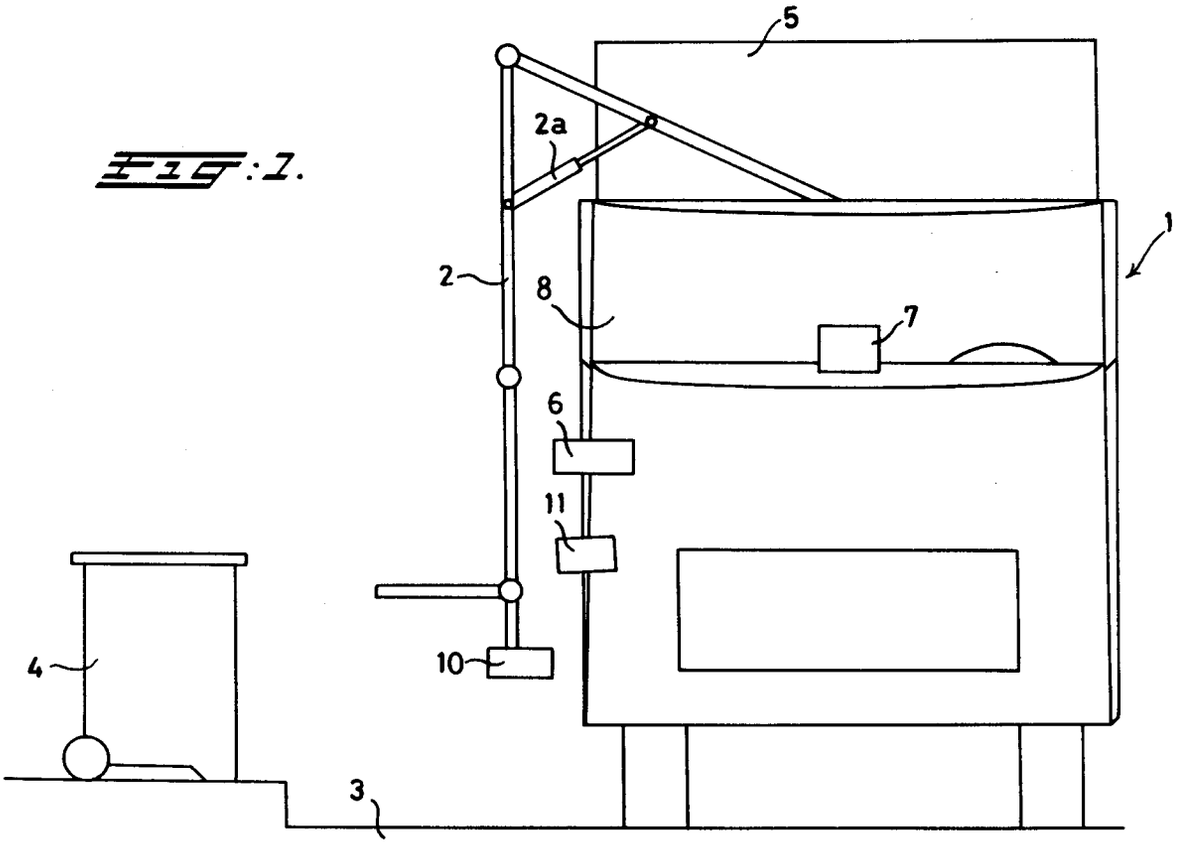
(54) **Device for emptying a waste container into a receiving container of a refuse collection vehicle.**

(57) The invention relates to a device mounted on a refuse collection vehicle (1) for emptying waste containers (4) into a receiving container (5) of the refuse collection vehicle (1). By means of an image sensor (6), one or more ready waste containers (4) are detected and displayed on a viewing screen (7) in the driver's cab (8). With means provided in the driver's cab (8), one of the waste containers (4) can then be selected for emptying by means of the image displayed on the viewing screen (7), following which a jib (2) mounted on the refuse collection vehicle (1) moves towards the selected waste container (4) on the basis of control signals generated by the device, lifts said waste container up and moves it into a position in which it can be emptied.

The device also comprises means for reading out information provided on a waste container (4) to be emptied, as well as recording means for storing information.

EP 0 647 574 A1

Fig. 1.



The invention relates to a device, mounted on a refuse collection vehicle, for emptying waste containers into a receiving container of the refuse collection vehicle, comprising: detection means for detecting at least one waste container ready for emptying, position determining means for determining the position of a waste container to be emptied relative to the refuse collection vehicle, a jib mounted on the refuse collection vehicle for lifting up a waste container to be emptied and for moving the waste container into a position in which it can be emptied, first jib control means for automatically controlling the jib on the basis of signals generated by the position determining means dependent upon the position of the waste container to be emptied relative to the refuse collection vehicle, in which the detection means comprise a first image sensor, and in which a viewing screen is installed in the driver's cab of the refuse collection vehicle for displaying an image recorded by the first image sensor.

Such a device is known from the European patent application published under number 0 388 618.

In a refuse collection vehicle provided with such a device, an image displayed on a viewing screen in the driver's cab is assessed by operating an activating switch and the jib can automatically lift up and empty any ready waste containers under the control of a computing unit. One disadvantage when using such a device is the fact that, when there is more than one waste container in the image field to be assessed, the selection of a specific waste container by the jib cannot be influenced.

The object of the present invention is to provide a device which does not have this disadvantage and which allows the emptying of the waste containers to be carried out in a more flexible manner. To this end, the device according to the invention is characterized in that the device also comprises selection means arranged in the driver's cab by means of which a waste container to be emptied can be selected from the image displayed on the viewing screen, and in that the position determining means are equipped to determine the position of the selected waste container relative to the refuse collection vehicle.

In this manner, by means of a device according to the invention, waste containers can be lifted up and emptied in a safe manner using a jib.

Some advantageous embodiments of the device according to the invention are defined in subclaims 2-10.

The invention further relates to a waste container suitable for use in combination with the device according to the invention. Said waste container is defined in claims 11-17.

The invention will now be explained in greater detail with reference to the attached drawing, in which:

Fig. 1 diagrammatically shows a front view of a refuse collection vehicle provided with a device according to the invention;

Fig. 2 shows a possible image on a viewing screen in the driver's cab of the refuse collection vehicle; and

Fig. 3 shows an illustrative embodiment of a data carrier for a waste container according to the invention.

In Fig. 1, a refuse collection vehicle or refuse lorry is designated by reference numeral 1 and is equipped with a jib 2, which is intended for lifting up waste containers 4 placed along the side of the street 3 and ready for emptying, and emptying them into a receiving container 5 of the refuse lorry 1. To this end, the jib 2 is provided with controllable motors 2a.

In order to be able to execute the operations involved largely automatically, the refuse lorry 1 is equipped with a camera 6, in particular a CCD camera, the recorded images of which can be displayed on a viewing screen 7 (see also Fig. 2) in the driver's cab 8 of the refuse lorry 1. The camera 6 is directed towards the side of the street 3, in particular when the refuse lorry 1 is moving, in this case the right-hand side, where any waste containers 4 may be placed ready for emptying. In particular, the camera 6 is equipped with a lens having a large angle of aperture, so that a relatively large part of the side of the street 3 is thus covered and can be displayed on the viewing screen 7. Now, if the driver of the refuse lorry 1 sees one or more waste containers 4 on the viewing screen 7, he stops the refuse lorry 1 and activates the jib 2 in order to lift up and empty a specific waste container 4. Means suitable for this purpose are present in the driver's cab 8, by means of which a waste container 4 to be emptied can be selected on the viewing screen. In particular, the viewing screen 7 is designed as a touch screen so that a waste container 4 to be emptied can be selected by pointing at (touching) the viewing screen. By using a touch screen any additional mechanical parts for use in selecting a waste container can largely be ommited. Thereby the occurence of mechanical failure, due to e.g. damage, which is not inconceivable in an environment like a refuse lorry, will be largely reduced.

After the viewing screen 7 has been touched, signals are generated by the position determining means connected to the viewing screen, which signals are related to the coordinates of the position indicated on the viewing screen and thus to the position of the selected/ indicated waste container 4 relative to the refuse lorry 1. The signals

generated by the position determining means are supplied to the jib control means which provide the motors of the jib 2 with control signals. The jib 2 is then moved to the location which corresponds to the position indicated on the viewing screen 7 and which is outside the refuse lorry 1.

In order that they can be identified by the driver and to enable automatic control of the jib 2 which is to be described in more detail below, the waste containers 4 are expediently provided with a mark, in particular a sticker 9 affixed to one of the side walls of the waste container 4. Said sticker 9 has a colour which contrasts with that of the waste container 4, in particular insofar as the frequency application range of the camera 6 is concerned, which frequency application range is likewise still to be described. Thus, the sticker 9 is clearly visible on the viewing screen 7 by means of a camera 6, and possibly also with the naked eye. If a waste container 4 is to be easily identifiable, it is obviously important that said waste container 4 faces the street 3 with the side wall which is provided with the sticker 9.

In order to ensure that the subsequent operations of lifting up and emptying the waste container 4 run smoothly, a second camera 10, which is mounted on the jib, is directed at the identified and selected waste container 4, after the jib 2 has been moved into a position corresponding to the location indicated on the viewing screen 7, and tries to establish the exact location of the sticker 9 on the waste container 4. To this end, the image formed by the camera 10 is supplied to a computing element which tries to identify the specific shape or one or more other features of the sticker 9 by means of pattern identification techniques on the basis of the image. When the sticker 9 has been identified as such, new control signals for the jib 2 are generated so as to position the latter more accurately relative to the waste container 4. In this case, it is important that the position of the stickers 9 on the waste containers 4 is the same for all waste containers. A distance measuring element which is not specified in more detail, nor shown, and which is also mounted on the jib 2, likewise provides signals to the jib control means, which signals are a measure for the distance between the jib 2 and the selected waste container 4. The jib 2 can thus be moved accurately towards the waste container 4 in order subsequently to lift and empty the latter. Preferably, camera 10 is provided with a lens having a small angle of aperture.

After the waste container 4 has been emptied, it is again placed along the side of the street 3, preferably in such a manner that the side wall provided with the sticker 9 faces away from the road, so that a waste container is not lifted up again for emptying once it has been emptied.

Advantageously the sticker 9 affixed to a waste container 4, in addition to serving as a means for aligning the jib 2 relative to the waste container 4, may also contain information relating among other things to the provenance of the waste container 4. By providing this information and any other information in a machine-readable form on the sticker 9, and providing the refuse lorry 1 with means for reading this information and processing it, for example, the progress of the refuse collection can be registered, which may be important in determining the efficiency with which it is carried out. However, if the refuse lorry 1 and in particular the jib 2 thereof are provided with a weighing element, it is likewise possible to weigh the waste container 4 to be emptied and to store the weight of the refuse from the waste container 4 together with the information relating to the provenance thereof, in order thereby to provide a logistic system which may be suited for various purposes.

Preferably, the information of interest is provided on the sticker 9 in an encoded form. With the sticker 9 shown in fig. 3 by way of example, the code is a so-called dot code. A dot code consists of a number of dots which are positioned in an imaginary matrix raster. The format (the rank) of the matrix is selectable. The minimum format is determined by the amount of information which has to be encoded. The combination of dots missing and dots present represents a binary number. Said number may represent an arbitrary combination of letters and figures. By adding a number of redundant dots, the code becomes error-correcting to a certain degree. This means that it is permissible for a number of dots to be erroneously removed or added. The redundancy also offers the possibility of a verifying calculation, which makes it virtually impossible to obtain false readings. The example of fig. 3 shows a dot code by means of which 2^{52} (approximately 4.5×10^{15}) different identifications can be encoded. Said code has 32 redundant dots with which a maximum of 4 false dots can be corrected.

The dot code on the sticker 9 can be read, for example, after the aforementioned camera 10 has identified the specific pattern of the sticker, in this example an oval shape. The dot code can be read in and decoded as soon as the dot code fills the viewing screen, to which end the camera 10 zooms in or is moved towards the code.

Around the dot code there is a band which is unprinted. Outside said band, anything may be added. This may be, for example, the address of provenance of the waste container 4 in conventional writing, so that the owner can collect his own waste container 4 after it has been emptied.

In addition to information relating to the provenance, such as the street, postcode and house

number, the code may also contain information relating to the type of waste container, for example glass, VFG (vegetable, fruit and garden) or other waste, and also to its contents. Using this information, optional waste container-specific control signals can be sent to the motors 2a of the jib 2 and, for example, the waste container 4 can be emptied into a compartment of the receiving container 5 intended for the specific type of waste, provided the refuse lorry is a multi-compartment refuse lorry.

In order to enable the camera 6 or 10 readily to identify the sticker 9 and the dots on the sticker 9, the refuse lorry 1 can be provided with a lighting device 11 which illuminates the sticker 9 during recording by the camera by means of a short flash in order to record the dot pattern, or which radiates a continuous light beam. By using light having a narrow frequency band around a peak frequency and providing the camera with a filter set to this frequency, disturbing influences, such as shadows and direct sunlight, and also dirt, can be overcome as far as possible. Preferably, the (flash) light has a peak frequency in the infrared range.

When the vehicle is being driven, the cameras and lighting units are (mechanically) screened from the environment so as to prevent the occurrence of reading errors as a result of contamination. In order to prevent reading errors resulting from corrosion and/or condensation in extreme conditions (widely varying temperatures), the image recording equipment is filled with a neutral gas (for example nitrogen gas) which is at a slight overpressure. Condensation of the exterior of the image recording equipment is prevented by heating the glass surfaces thereof.

Although the selection means in the above-described illustrative embodiment of the device according to the invention comprise a touch screen 7, the selection can also be effected by means of a light pen or a joystick indicating a position on the screen 7.

In the embodiment of the device according to the invention described in the example, camera 6 is mounted on the refuse lorry 1, while camera 10 is attached to the jib 2. However, it is likewise possible to mount camera 6 on the jib 2 as well, or to combine the functions of both cameras in one camera.

Furthermore, the invention is not limited to a 10 $\times$ 10 matrix, but it is also possible to use larger or smaller matrices, depending on the amount of information to be encoded, while other dot configurations or entirely different codes, such as bar codes, are also conceivable.

In addition to its use as a data carrier, the dot matrix can also be used to generate control signals for the motors 2a of the jib 2. In particular, when the jib 2 has not yet been accurately positioned in front of the selected waste container 4, the image formed by the camera 10 will show a matrix, the mutual distance between the dots of which is smaller than the actual mutual distance, which information can, in turn, serve as a measure for the control signals.

Although the invention has been described with reference to an example of a device for automatically lifting up and emptying a waste container, it is also conceivable for it to be possible for the jib 2 to be operated manually by means of suitable operating means provided for this purpose in the driver's cab 8 or on the exterior of the refuse lorry 1.

It will be obvious that the invention is not limited to the illustrative embodiment described above and shown in fig. 1, in which the jib 2 lifts up the waste containers 4 on the right-hand side of the refuse lorry 1. It is likewise possible for the jib 2 to be arranged to lift up the waste containers on the left-hand side of the refuse lorry 1, in which case the cameras 6, 10 are also directed to the left. In addition, a jib 2 suitable for loading from the rear is conceivable, the arrangement of the cameras being modified accordingly.

Claims

1. Device, mounted on a refuse collection vehicle, for emptying waste containers into a receiving container of the refuse collection vehicle, comprising:

- detection means for detecting at least one waste container ready for emptying,
- position determining means for determining the position of a waste container to be emptied relative to the refuse collection vehicle,
- a jib mounted on the refuse collection vehicle for lifting up a waste container to be emptied and for moving the waste container into a position in which it can be emptied,
- first jib control means for automatically controlling the jib on the basis of signals generated by the position determining means dependent upon the position of the waste container to be emptied relative to the refuse collection vehicle,

in which the detection means comprise a first image sensor, and in which a viewing screen is installed in the driver's cab of the refuse collection vehicle for displaying an image recorded by the first image sensor, characterized in that the device also comprises selection means arranged in the driver's cab (8) by means of which a waste container to be emptied can be selected from the image displayed on the viewing screen (7), and in that the

position determining means are equipped to determine the position of the selected waste container (4) relative to the refuse collection vehicle (1).

2. Device according to claim 1, characterized in that the viewing screen (7) is a touch screen by means of which a waste container (4) to be emptied can be selected from the image displayed on the viewing screen.

3. Device according to claim 1 or 2, characterized in that the device comprises reading means for reading out information provided on a waste container (4) to be emptied, as well as recording means for storing information.

4. Device according to claim 3, characterized in that the reading means comprise a second image sensor (10) mounted on the jib.

5. Device according to one of the preceding claims, characterized in that the device comprises second jib control means for manually operating the jib (2).

6. Device according to one of the preceding claims, characterized in that the device comprises pattern identifying means for aligning the jib (2) relative to the waste container (4) to be emptied prior to the gripping thereof.

7. Device according to one of claims 3-6, characterized in that the jib (2) comprises weighing means with which the weight of a waste container (4) to be emptied can be determined, and in that the recording means are equipped for storing this weight together with the information provided on the waste container to be emptied.

8. Device according to one of the preceding claims, characterized in that the device is provided with a lighting element intended for illuminating the waste containers.

9. Device according to claim 8, characterized in that the lighting element radiates light at frequencies which lie within a specific narrow frequency band, and in that the image sensors are equipped for sensing light having frequencies lying within the specific narrow frequency band.

10. Device according to claim 9, characterized in that the specific narrow frequency band is around 880 nm.

11. Waste container suitable for use in combination with the device according to one of the claims 1 - 10, characterized in that the waste container is provided with a data carrier in a predetermined fixed location.

12. Waste container according to claim 11, characterized in that the data carrier has a colour which contrasts with that of the waste container.

13. Waste container according to claim 11 or 12, characterized in that the data carrier has a colour which contrasts with that of the waste container for the frequency application range of the image sensors.

14. Waste container according to one of claims 11-13, characterized in that the data carrier has a specific shape.

15. Waste container according to one of claims 11-14, characterized in that the information is present on the data carrier in encoded form.

16. Waste container according to claim 15, characterized in that the information is incorporated in a matrix of dots.

17. Waste container according to claim 16, characterized in that the matrix comprises 10×10 dots.

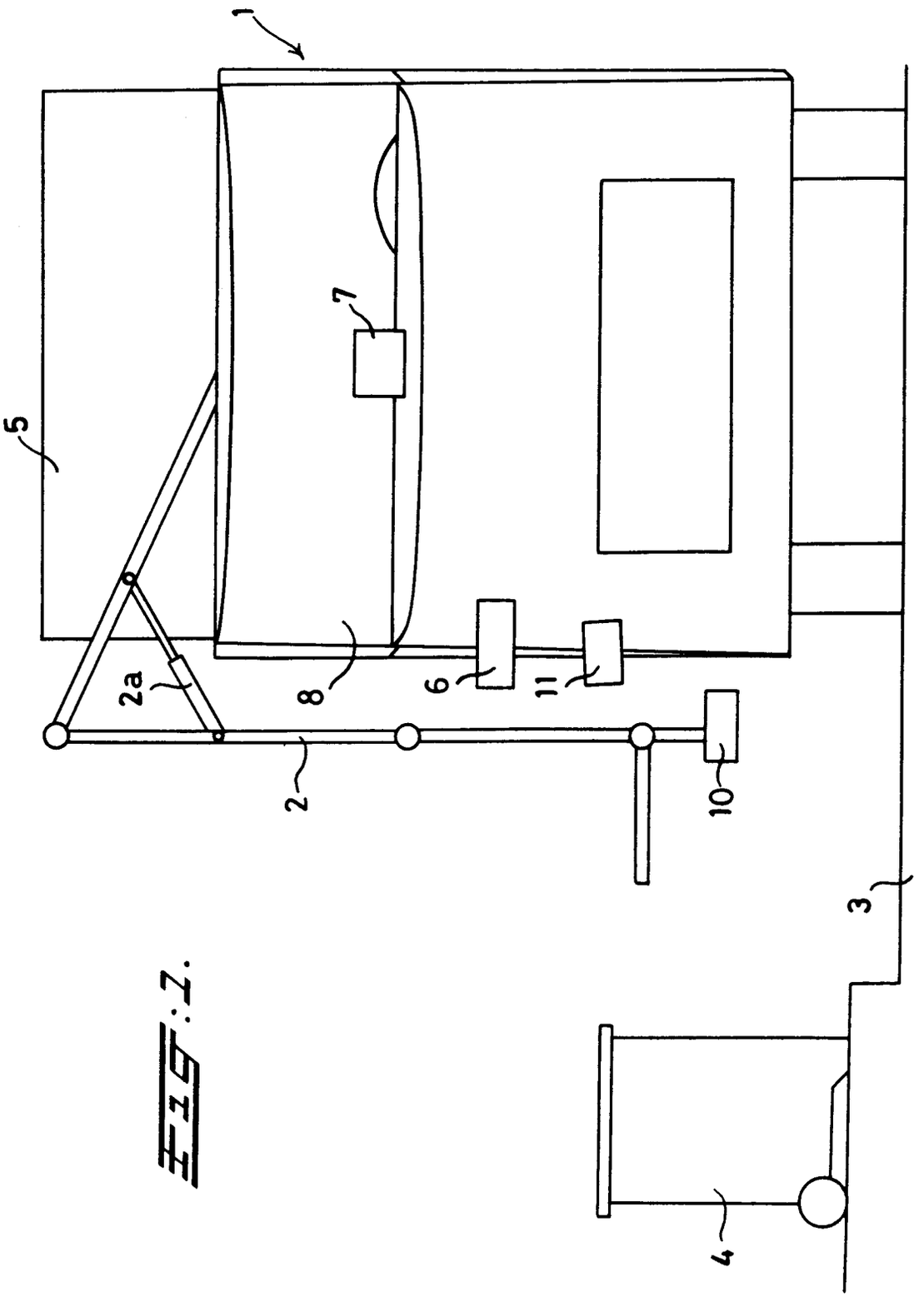


Fig. 2.

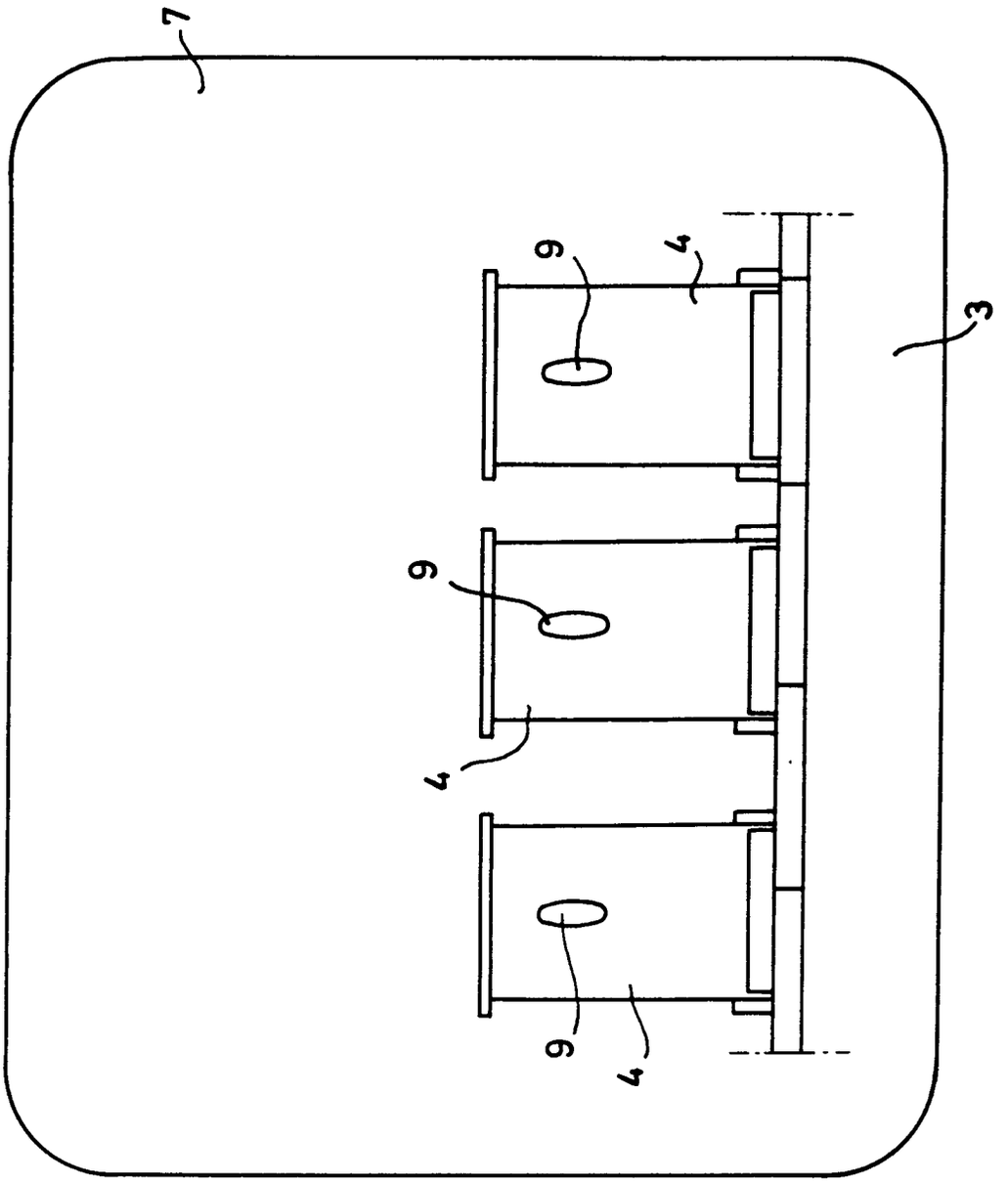


Fig. 2

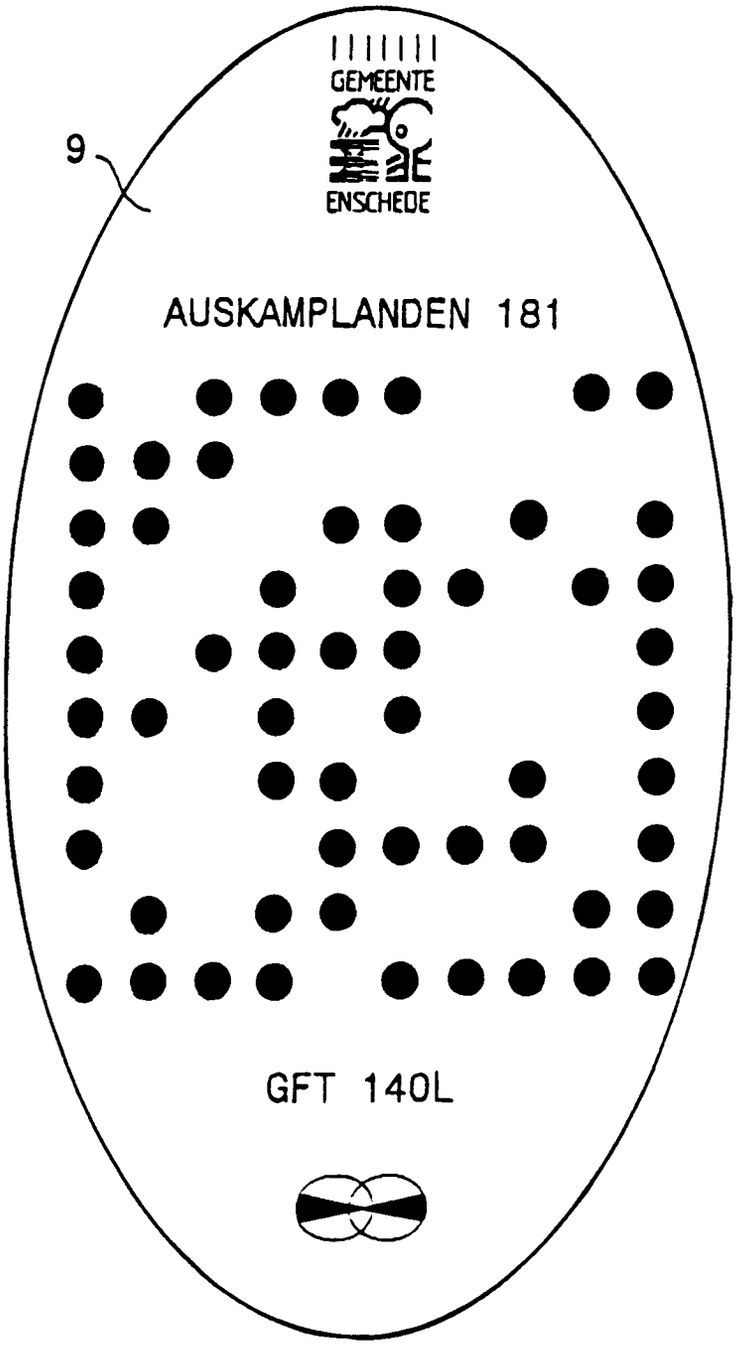


Fig: 3.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 20 2875

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
D,X	EP-A-0 388 618 (EDELHOFF POLYTECHNIK) * claims 1-6 *	11-17	B65F3/02
D,A	---	1	
X	DE-A-39 03 592 (PROTEUS GES. FÜR DATENTECHNIK) * the whole document * ---	11-17	
A	EP-A-0 078 011 (KAMPWERTH) -----		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B65F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	5 January 1995	Deutsch, J-P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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