



- (51) International Patent Classification:
B65F 3/02 (2006.01)
- (21) International Application Number:
PCT/AU2016/050906
- (22) International Filing Date:
28 September 2016 (28.09.2016)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
2015903950 29 September 2015 (29.09.2015) AU
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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

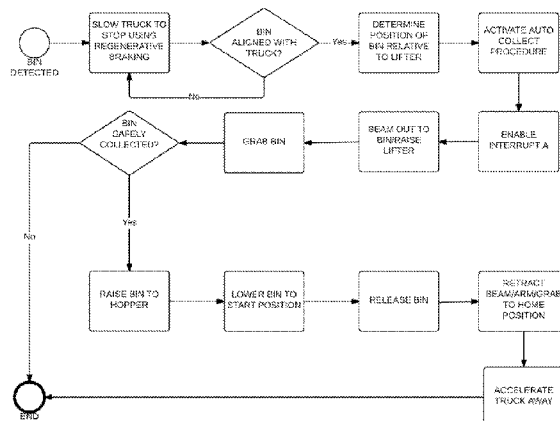
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: SIDE LOADING AUTOMATED RUBBISH BIN COLLECTION SYSTEM

Fig. 1



(57) Abstract: An automated rubbish bin collection system for a garbage truck having a detection means to detect the presence of a rubbish bin, a control means to receive input from the detection means and process the input to control the collection of a rubbish bin, and an actuation means to actuate the movement of the lifting arm to grab, lift and empty the rubbish from the rubbish bin into a hopper of the rubbish collection vehicle, wherein from the detection of the presence of the rubbish bin a coordinated sequence of steps automatically occurs to collect the rubbish bin, move the rubbish bin, empty the rubbish into the hopper and return the rubbish bin to the initial position.

SIDE LOADING AUTOMATED RUBBISH BIN COLLECTION SYSTEM

FIELD OF INVENTION

5 The present invention relates to the collection of rubbish bins and in particular to the collection of rubbish bins by rubbish collection vehicles. The invention has broad application to the repetitive collection of items by vehicles and the invention is not limited to the collection of rubbish bins by rubbish collection vehicles.

BACKGROUND OF THE INVENTION

10 The rubbish from a rubbish bin is collected by a rubbish collection vehicle which uses a lifting arm that extends, grabs the bin and lifts the bin to empty the rubbish into the vehicle's hopper and then return the bin to its original position. The lifting arm is controlled with a joystick and buttons by the driver. The alignment of the lifting arm with the rubbish bin is manually controlled by the driver and the efficiency
15 of alignment and rubbish collection depends on the experience and skill competency of the driver.

Within a group of drivers there is a range of efficiencies in the collection of rubbish. It is desirable to increase the efficiency of rubbish collection and have reproducible efficiencies in the collection of rubbish from rubbish bins. With current
20 methods the efficiency of rubbish collection is variable and inconsistent.

Drivers also suffer from repetitive strain injuries with the continual use of the joystick and buttons. Consequently a driver's efficiency in collecting rubbish from a rubbish bin decreases when they suffer from a repetitive strain injury to their hand and often the drivers require leave to rest the hand and recover from the injury.
25 Consequently there is always a need to employ more drivers and work with them to improve their skill level in collecting rubbish while minimizing their risk of injury.

OBJECT OF THE INVENTION

It is an object of the present invention to provide an automated rubbish bin
30 collection system for a rubbish collection vehicle that overcomes at least in part one or more of the above mentioned problems.

SUMMARY OF THE INVENTION

In one aspect the present invention broadly resides in an automated rubbish bin collection system including

detection means to detect the presence of a rubbish bin;

5 control means to receive input from the detection means and process the input to control the collection of a rubbish bin; and

actuation means to actuate the movement of the lifting arm to grab, lift and empty the rubbish from the rubbish bin into a hopper of a rubbish collection vehicle, wherein from the detection of the presence of the rubbish bin a coordinated
10 sequence of steps automatically occurs to collect the rubbish bin, move the rubbish bin, empty the rubbish into the hopper and return the rubbish bin to the initial position.

The detection means preferably includes one or more sensors to determine the presence of the rubbish bin. More preferably the detection means includes one
15 or more sensors to determine the relative position of the rubbish bin and provide input to the control means. In one form the one or more sensors include a laser distance sensor and or a camera system. Where there is a camera system preferably there is a viewing screen within the vehicle cabin.

In one embodiment there are also one or more sensors to determine the type
20 of rubbish bin so that the correct hopper can be selected automatically for the rubbish of that bin type. For example, where the rubbish bin has a yellow lid, the detection means sensor detects the yellow lid and the input from the detection means sensor is processed to coordinate the opening of the correct hopper for the collection of recyclable rubbish.

25 The control means preferably includes processor means that receives the input from the one or more sensors, processes the input in accordance with programming of the processor means and sends actuation signals to the actuation means. Preferably the control means provides one or more audible or visual signals to the driver to advise of the stage of the rubbish collection.

30 The actuation means preferably includes extension and retraction of a lifting arm, grabbing and release of a rubbish bin by the lifting arm, and raising and lowering of the lifting arm. The actuation means preferably includes moving the lifting arm in any suitable position to empty the rubbish from the rubbish bin in the preferred hopper. More preferably the control means coordinates the movement of

the lifting arm to sequentially reach for the rubbish bin, lift the rubbish bin, empty the rubbish from the rubbish bin, lower the lifting arm, release the rubbish bin and retract the lifting arm.

Preferably the driver can initiate the collection process when the vehicle is in an appropriate position relative to the target rubbish bin. The appropriate position relative to the target rubbish bin can be any position where the prescribed parameters are met for the commencement of the operation of the collection process. The prescribed parameters can include distance from bin and braking of the vehicle.

In one embodiment, the prescribed parameters may only be met when the lifting arm is opposite the bin. In another embodiment, the automated collection process may be initiated when the vehicle commences braking or when it is within a set distance from the target bin. In this embodiment the target bin may be recognized by lid colour or detection of an electronic tag such as an RFID tag.

The automated collection process can preferably be initiated and continue after the target bin has been emptied if the next target bin is within a predetermined distance from the last target bin. Alternatively, the function of continuous bin pickup may be optional and at the discretion of the driver or operator. By way of example, target bins are generally spaced within 20 meters of each other in the city while in the country the target bins are generally spaced further apart from each other, thereby providing different conditions for bin pick up and possible use of different continuous pick up options.

In one form, initiation is achieved by pressing a button or switch that is on the floor, dashboard, console, or steering wheel. Pressing the button or switch electronically actuates the automated rubbish bin collection system.

Preferably the automated system is not engaged or disengaged when the driver uses the joystick or associated buttons, or if the automated system has been paused longer than for a predetermined period.

In another aspect the invention broadly resides in an automated rubbish bin collection system for a rubbish collection vehicle as described above and includes:

vehicle control means which controls the movement of the vehicle when the presence of the rubbish bin is detected to position the vehicle so that the lifting arm aligns with the rubbish bin so the rubbish bin can be raised and lowered to empty rubbish into the hopper.

Preferably the vehicle control means is automatically initiated and controls the vehicle when the presence of the rubbish bin is detected. Preferably the control of the vehicle by the vehicle control means is not engaged or is disengaged when the vehicle exceeds a predetermined speed, if the brake is applied by the driver, if the rubbish bin is beyond a predetermined distance from the vehicle and or if the driver accelerates the vehicle.

In a further aspect the present invention broadly resides in a method of collecting rubbish using a rubbish collection vehicle and employing the abovementioned automated rubbish bin collection system, including the steps of:

positioning the rubbish collection vehicle adjacent the rubbish bin to align the lifting arm with the rubbish bin;

moving the lifting arm to grab and lift the rubbish bin to empty the rubbish and then lower the rubbish bin; wherein the steps occur in an automatic and sequential manner after the presence of the rubbish bin has been detected.

The features described with respect to one aspect also apply where applicable to all other aspects of the invention. Furthermore different combinations of described features are herein described and claimed even when not expressly stated.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the present invention can be more readily understood reference will now be made to the accompanying drawings which illustrate a preferred embodiment of the invention and wherein:

Figure 1 is a flow diagram of the system to collect a rubbish bin by a rubbish collection vehicle; and

Figure 2 is a flow diagram of part of the system to collect a rubbish bin by a rubbish collection vehicle as shown in Figure 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to Figures 1 and 2, there is a rubbish collection vehicle with an automated rubbish bin collection system.

In a preferred embodiment, the driver initiates a collection process when the vehicle is in an appropriate position relative to the target rubbish bin. Initiation is

achieved by pressing a button on the cabin floor. Pressing the button electronically actuates the automated rubbish bin collection system.

5 In a preferred embodiment, the driver of the rubbish collection vehicle drives the vehicle so that the lifting arm on the side of the vehicle is aligned with rubbish bin. The driver uses a mounted camera system with a viewing screen inside the cabin to assist the driver with the alignment. Selection of the bins to be collected can be automatic by for example, lid colour or manually by driver selection. The driver then activates the collection system.

10 In an alternate embodiment, the movement of the vehicle is controlled by a vehicle control system working operatively and in conjunction with the collection system. The bins can be selected automatically by lid colour or similar criterion or manually by the driver. The vehicle control system moves the vehicle so that the lifting arm aligns with the rubbish bin. The vehicle control system is activated by the driver when the vehicle is within a predetermined distance from the rubbish bin (for
15 example 10 meters) and the vehicle is travelling below a predetermined speed (for example 10 km per hour). The collection system is automatically initiated when the vehicle stops and the lifting arm is aligned with the rubbish bin.

In both embodiments the collection system as shown in Figure 1 automatically performs sequential steps to extend the lifting arm, grab the rubbish bin, raise the
20 lifting arm and move the bin to at least partially invert thereby emptying the rubbish bin, lower the rubbish bin, release the rubbish bin and retract the lifting arm. These steps occur without driver assistance or intervention. These steps occur at the same reproducible pace (consistent efficiency). The driver at any stage can interrupt the process and resume the process providing a predetermined period has not expired
25 when paused (Figure 2).

With the initial stage of rubbish bin detection, the collection system can determine the type of rubbish bin and coordinate with the rubbish collection vehicle to open the appropriate collection hopper so that recyclable rubbish is collected in the recyclable rubbish hopper and general rubbish is collected in the general rubbish
30 hopper.

After the collection system has performed all its steps, the collection system turns off and the driver drives to the next rubbish bin and repeats the process.

In the alternate embodiment the vehicle control system returns the vehicle to its previous acceleration and then disengages. The process is then repeated.

Having a deliberate step of activating the initiation of the collection system prevents the unintentional collection of bins while in transit or in areas where there are bins but no schedule to collect at that time. These areas include depot, transfer station and residential areas where there is no scheduled collection.

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VARIATIONS

It will of course be realised that while the foregoing has been given by way of illustrative example of this invention, all such and other modifications and variations thereto as would be apparent to persons skilled in the art are deemed to fall within the broad scope and ambit of this invention as is herein set forth.

10

Throughout the description and claims of this specification the word “comprise” and variations of that word such as “comprises” and “comprising”, are not intended to exclude other additives, components, integers or steps.

CLAIMS

1. An automated rubbish bin collection system for a garbage collection vehicle including
5 detection means to detect the presence of a rubbish bin;
control means to receive input from the detection means and process the input to control the collection of a rubbish bin; and
actuation means to actuate the movement of the lifting arm to grab, lift and empty the rubbish from the rubbish bin into a hopper of the rubbish collection
10 vehicle, wherein from the detection of the presence of the rubbish bin a coordinated sequence of steps automatically occurs to collect the rubbish bin, move the rubbish bin, empty the rubbish into the hopper and return the rubbish bin to the initial position.
- 15 2. An automated rubbish bin collection system wherein the detection means includes one or more sensors to determine the presence of the rubbish bin and provide input to the control means.
- 20 3. An automated rubbish bin collection system as claimed in claim 2, wherein the one or more sensors include a laser distance sensor and or a camera system.
4. An automated rubbish bin collection system as claimed in any one of the preceding claims, wherein there are one or more sensors to determine the type of rubbish bin so that the correct hopper can be selected automatically for the rubbish
25 of that bin type.
5. An automated rubbish bin collection system as claimed in any one of the preceding claims, wherein the control means includes processor means that receives the input from the one or more sensors, processes the input in accordance
30 with programming of the processor means and sends actuation signals to the actuation means.

6. An automated rubbish bin collection system as claimed in any one of the preceding claims, wherein the control means provides one or more audible or visual signals to the driver to advise of the stage of the rubbish collection.
- 5 7. An automated rubbish bin collection system as claimed in any one of the preceding claims, wherein the actuation means includes extension and retraction of a lifting arm, grabbing and release of a rubbish bin by the lifting arm, and raising and lowering of the lifting arm.
- 10 8. An automated rubbish bin collection system as claimed in any one of the preceding claims, wherein the actuation means includes moving the lifting arm in any suitable position to empty the rubbish from the rubbish bin in the preferred hopper.
9. An automated rubbish bin collection system as claimed in any one of the
15 preceding claims, wherein the control means coordinates the movement of the lifting arm to sequentially reach for the rubbish bin, lift the rubbish bin, empty the rubbish from the rubbish bin, lower the lifting arm, release the rubbish bin and retract the lifting arm.
- 20 10. An automated rubbish bin collection system as claimed in any one of the preceding claims, wherein automated system is not engaged or disengaged when the driver uses the joystick or associated buttons, or if the automated system has been paused longer than for a predetermined period.
- 25 11. An automated rubbish bin collection system as claimed in any one of the preceding claims, wherein there is a vehicle control means which controls the movement of the vehicle when the presence of the rubbish bin is detected to position the vehicle so that the lifting arm aligns with the rubbish bin so the rubbish bin can be raised and lowered to empty rubbish into the hopper.
- 30 12. An automated rubbish bin collection system as claimed in claim 11, wherein the vehicle control means is automatically initiated and controls the vehicle when the presence of the rubbish bin is detected.

13. An automated rubbish bin collection system as claimed in claim 11, wherein the control of the vehicle by the vehicle control means is not engaged or is disengaged when the vehicle exceeds a predetermined speed, if the brake is applied by the driver, if the rubbish bin is beyond a predetermined distance from the vehicle and or
5 if the driver accelerates the vehicle.

14. A method of collecting rubbish using a rubbish collection vehicle and employing the automated rubbish bin collection system in any one of the preceding claims, including the steps of:

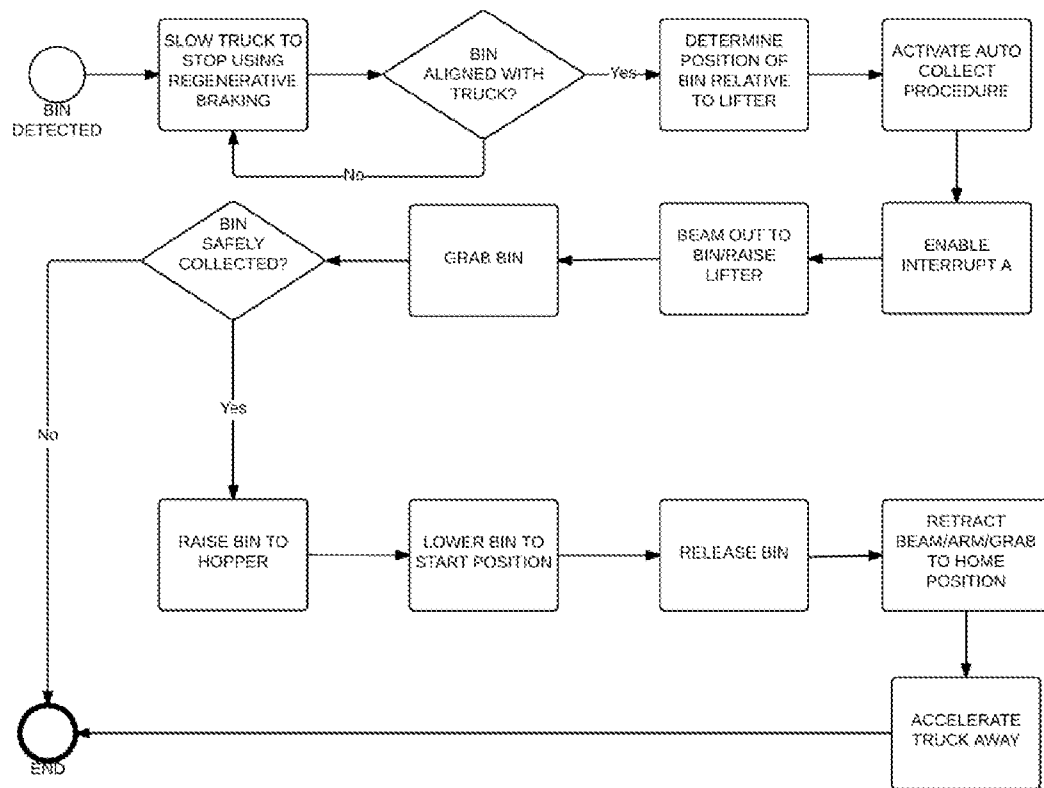
10 positioning the rubbish collection vehicle adjacent the rubbish bin to align the lifting arm with the rubbish bin;

moving the lifting arm to grab and lift the rubbish bin to empty the rubbish and then lower the rubbish bin; wherein the steps occur in an automatic and sequential manner after the presence of the rubbish bin has been detected.

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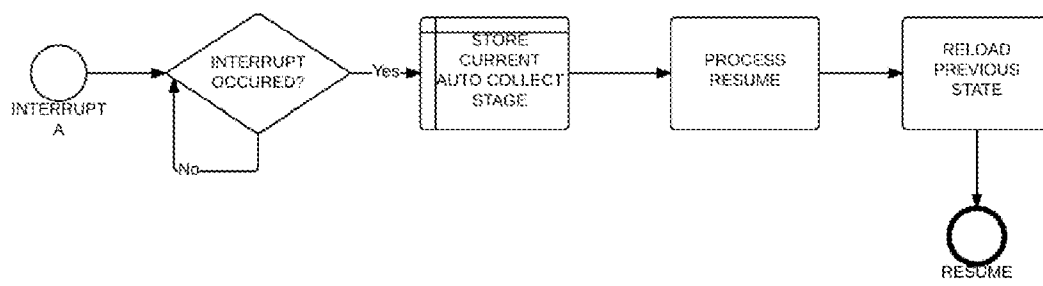
1/2

Fig. 1



2/2

Fig. 2



INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2016/050906

A. CLASSIFICATION OF SUBJECT MATTER

B65F 3/02 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPIAP, EPODOC:

IPC, CPC: (B65F2003/023, B65F2003/0266, B65F3/041, B65F1/1484, B65F2210/[128,138,168], G05D1/0231, G05D1/0246, G01S17/89, G01S17/87, G01S17/88, B65F2003/025, B65F3/02)/LOW & Keywords: AUTOMAT+, PROGRAM+, COMPUTER+, ALIGN+, SYNCHRON+, ARM+, LIFT+, CLAW+, BIN?, RECEPTACLES+, DETECT+, SENS+, IDENTIF+, PRESENC+, LOCATION+, TYPE?, OVER_RID+, PAUS+, INTERRUPT+ and similar terms.

ESPAENET, AUPAT: Inventor/Applicant Name(s) Searched: "SUPERIOR PAK HOLDINGS PTY LTD", "ERRINGTON ROWLAND", "PRONGER MICHAEL"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	



Further documents are listed in the continuation of Box C



See patent family annex

* "A"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier application or patent but published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search
22 December 2016

Date of mailing of the international search report
22 December 2016

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INTERNATIONAL SEARCH REPORT		International application No.
C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		PCT/AU2016/050906
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5762461 A (FROHLINGSDORF) 09 June 1998 Abstract; Fig. 1, 5; col. 2 line 56 – col. 3 line 5, col. 3 line 50 – col. 4 line 18	1-10, 14
X	US 5215423 A (SCHULTE-HINSKEN et al.) 01 June 1993 Abstract; Fig. 1-4; col. 5 lines 5-60	1-10, 14
X	EP 1020375 A1 (GEESINK B.V.) 19 July 2000 Abstract; Fig. 1-3; [0009]-[0017], [0025]-[0032]	1-10, 14
A	US 5967731 A (BRANDT) 19 October 1999 Abstract; Fig. 10; col. 8 lines 17-44	1, 10, 14
A	US 5018929 A (CARSON) 28 May 1991 Abstract; Fig. 7-9; Col. 8 lines 53 - col. 9 lines 44	1, 4, 10, 14
P,X	US 9403278 B1 (VAN KAMPEN et al.) 02 August 2016 Abstract; Fig. 1, 4, 8; col. 4 lines 28 – col. 5 lines 60; col. 8 lines 16-22; col. 9 lines 1-8	1-10, 14

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
the subject matter listed in Rule 39 on which, under Article 17(2)(a)(i), an international search is not required to be carried out, including
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See Supplemental Box for Details

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-10, 14

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

Supplemental Box**Continuation of: Box III**

This International Application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

This Authority has found that there are different inventions based on the following features that separate the claims into distinct groups:

- Claims 1, 2-10, 14 (in part) are directed to an automated rubbish bin collection system including a control means and an actuation means to actuate movement of a lifting arm. The feature of the control means coordinating the movement of the lifting arm is specific to this group of claims.
- Claims 1, 11-13, 14 (in part) are directed to an automated rubbish bin collection system including a vehicle control means in addition to a detection means, a control means and an actuation means as defined in claim 1. The feature of the vehicle control means controlling movement of the vehicle such that the lifting arms are aligned with the rubbish bin detected is specific to this group of claims.

PCT Rule 13.2, first sentence, states that unity of invention is only fulfilled when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features. PCT Rule 13.2, second sentence, defines a special technical feature as a feature which makes a contribution over the prior art.

When there is no special technical feature common to all the claimed inventions there is no unity of invention.

In the above groups of claims, the identified features may have the potential to make a contribution over the prior art but are not common to all the claimed inventions and therefore cannot provide the required technical relationship. The only feature common to all of the claimed inventions and which provides a technical relationship among them is a rubbish bin collection system including detection means for detecting presence of a bin, control means to receive input from the detection means and actuation means to actuate moment of the lifting arm as defined in claim 1.

However this feature does not make a contribution over the prior art because it is disclosed in:

US 5762461 A (FROHLINGS DORF) 09 June 1998

US 5215423 A (SCHULTE-HINSKEN et al.) 01 June 1993

Therefore in the light of this document this common feature cannot be a special technical feature. Therefore there is no special technical feature common to all the claimed inventions and the requirements for unity of invention are consequently not satisfied *a posteriori*.

INTERNATIONAL SEARCH REPORT		International application No.	
Information on patent family members		PCT/AU2016/050906	
This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.			
Patent Document/s Cited in Search Report		Patent Family Member/s	
Publication Number	Publication Date	Publication Number	Publication Date
US 5762461 A	09 June 1998	US 5762461 A	09 Jun 1998
		AU 703536 B2	25 Mar 1999
		AU 4824896 A	03 Oct 1996
		DE 19510359 A1	26 Sep 1996
		EP 0733562 A1	25 Sep 1996
		EP 0733562 B1	22 Sep 1999
US 5215423 A	01 June 1993	US 5215423 A	01 Jun 1993
EP 1020375 A1	19 July 2000	EP 1020375 A1	19 Jul 2000
US 5967731 A	19 October 1999	US 5967731 A	19 Oct 1999
		AU 741909 B2	13 Dec 2001
		AU 7281098 A	12 Apr 1999
		CA 2304768 A1	01 Apr 1999
		EP 1017604 A1	12 Jul 2000
		EP 1017604 B1	29 Jan 2003
		NZ 502594 A	27 Jul 2001
		US 5851100 A	22 Dec 1998
WO 9915439 A1	01 Apr 1999		
US 5018929 A	28 May 1991	US 5018929 A	28 May 1991
		US 5071307 A	10 Dec 1991
US 9403278 B1	02 August 2016	US 9403278 B1	02 Aug 2016
		CA 2918411 A1	19 Sep 2016
End of Annex			