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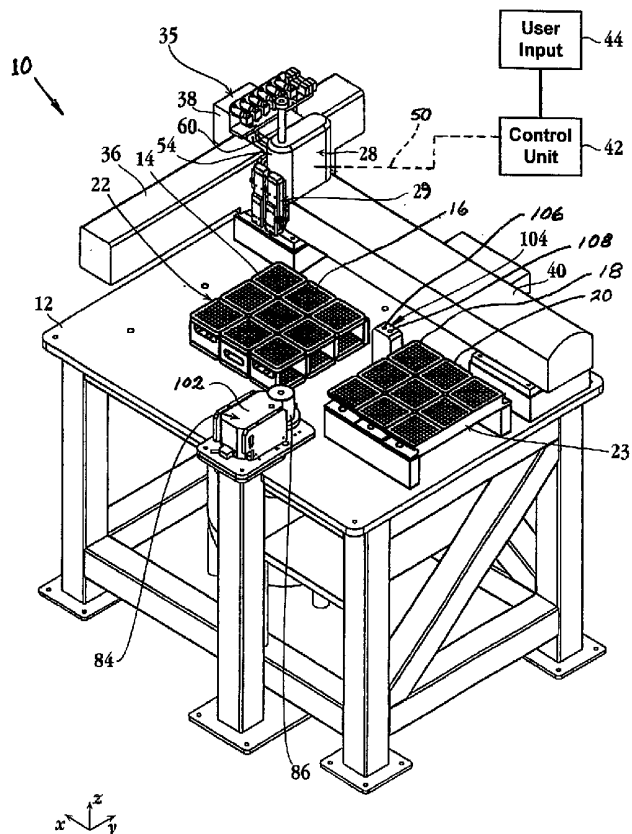
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[Continued on next page]

(54) Title: ROBOTIC SEED-HANDLING APPARATUS AND METHODS



(57) Abstract: Robotic apparatus for transferring and distributing small particles, such as seeds, contained in covered or uncovered containers, such as capped jars, are disclosed. An exemplary apparatus includes a vacuum-activated probe (24) configured to pick up a selected number of seeds from a donor container (18, 20) and to deposit the seeds in a selected recipient container (14, 16). The seeds being transferred may be weighed during the transfer process by depositing the seeds in a crucible (96) of a microgram balance (102) or analogous device. After weighing, the seeds are picked up using a second probe (26) that transfers the seeds to a recipient container (14, 16). Also disclosed are automated methods for transferring and weighing particles, such as seeds.

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 01/41885

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 A01C1/00 B25J15/06 B25J9/02

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)
 IPC 7 A01C G01N B65G B25J

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 practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 97 20209 A (DU PONT; BUSH CAROL L (US); CASPAR TIMOTHY (US); BHIDE ARVIND KRIS) 5 June 1997 (1997-06-05) figures 4,5A,5B,6 page 18, line 6 -page 19, line 21 page 20, line 16 - line 29	1,2,5,8, 9,16,17, 19,22, 25-27,37
A	---	41
A	US 2 546 838 A (TASCHE CARL H) 27 March 1951 (1951-03-27) figures 1-4 column 2, line 19 -column 3, line 57 -----	1,2,8,9, 16-19, 22, 25-27, 37,38,41

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
 "E" earlier document but published on or after the international filing date
 "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)"
 "O" document referring to an oral disclosure, use, exhibition or other means
 "P" document published prior to the international filing date but later than the priority date claimed

"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
 "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
 "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.
 "&" document member of the same patent family

Date of the actual completion of the international search

18 December 2001

Date of mailing of the international search report

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Name and mailing address of the ISA

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INTERNATIONAL SEARCH REPORT

International application No.
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Box I Observations where certain claims were found unsearchable (Continuation of item 1 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:

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 II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

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

see additional sheet

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 an additional fee, this Authority did not invite payment of any additional fee.

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.:

1-5, 8, 9, 16-20, 22, 25-27, 37, 38, 41

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-5,8,9,16-20,22,25-27,37,38,41

A robotic apparatus and a method for picking up particles, such as seeds.

2. Claims: (1+6),10-15,(16+21),(22+23),41

A robotic apparatus for moving particles from a first container to a second container comprising a cover-removal manipulator.

3. Claims: (1+7),(22+24),28-36,(37+39),(37+40),41

An apparatus for weighing and for transferring articles

INTERNATIONAL SEARCH REPORT

Information on patent family members

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PCT/US 01/41885

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
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