

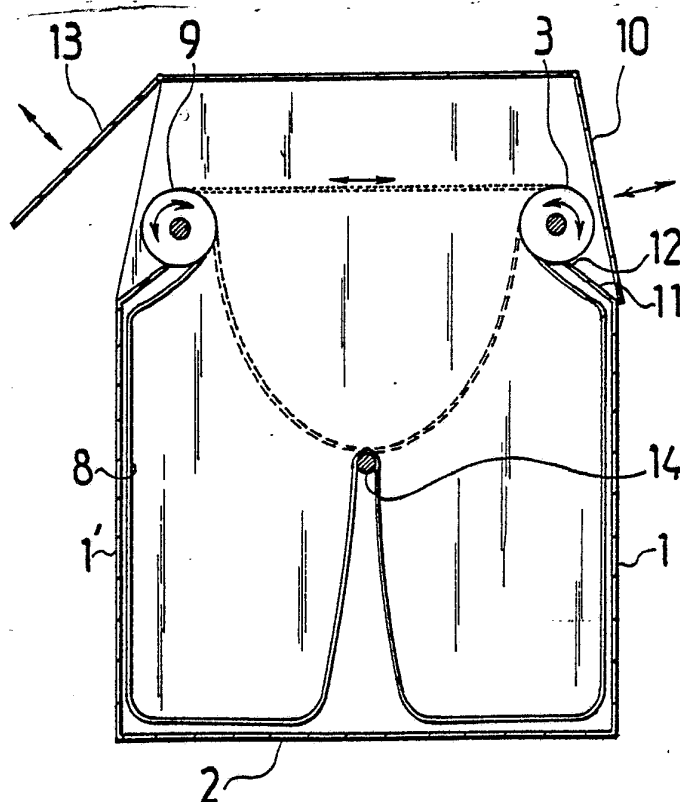
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: CONTAINER FOR TRANSPORTATION, DISCHARGE AND DOSAGE OF GRANULAR AND FLOURY MATERIAL

(57) Abstract

The container comprises a container part, whose opposite ends (15) are parallel to each other, a mat (8) fitted inside the container, which mat is flexible in the longitudinal direction and rigid in the lateral direction and which is at both ends attached to parallel rolls (3, 9) placed at opposite sides in the top portion of the container, as well as gates (10) for filling and discharge of the material. By, by means of a drive gear (6), rotating one of the rolls, e.g. the roll (3), it is possible to wind the mat (8) onto the roll (3) and to discharge material out of the container from the side of the roll (3) that is being rotated. At the final stage of the discharge, the mat (8) can be wound onto the second roll (9), whereby a conveyor belt operation is obtained and even the last remaining quantity of material can be discharged out of the container.



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Container for transportation, discharge and dosage of granular and floury material

The present invention is concerned with a
5 container in accordance with the preamble of claim 1.

Such a container construction is suitable mainly for the transportation and storage of granular and floury material, and out of such a container, it is easy to discharge and dose the material. Generally
10 speaking, the container comprises a container part, whose opposite ends are parallel to each other, a mat or belt fitted between the ends of the container, one end of the said mat or belt being, by means of an appropriate attaching member, attached to the wall at the
15 top portion of the container, as well as a gate at the top portion of the container for discharging and filling of the material..

In prior art, several systems of equipment intended for the transportation and storage of granular
20 and floury material are known. These usually comprise a cylindrical or cubic container, of rigid construction and in most cases made of steel. The granular or floury material is fed into the container through the top, and it is usually discharged from the container through an
25 opening in the bottom. Since many granular and floury materials form clods and lumps by the effect of moisture and heat, such containers are often provided with particular members in order to facilitate the emptying. Thus, the German published patent application 2,351,425
30 describes a container provided with inflatable films inside the container for the purpose of emptying the container. On the other hand, in the German announcement publication DE-OS 1,943,940, an embodiment of equipment is described in which the shape of the wall
35 of the container is changed by mechanical means from cylindrical form to conical form.



If the granular and floury material is to be shifted out of a container placed, e.g., on a railway wagon and emptied through the bottom onto a road transportation vehicle, such as onto the truckbed of a lorry or onto a tractor trailer, separate equipment is, however, always needed. If the container has been installed stationary, a conveyor is required, such as a belt or screw conveyor, in order to carry the material out of the discharge opening to the loading point. If the container is shifted out of its position in order to facilitate the loading, this may take place either in the lateral direction or in the vertical direction. In order to shift the container in the lateral direction to above the loading platform, in which case the material can be discharged straight to the desired point, an auxiliary bridge is required above the platform, as well as a power gear for shifting the container. On the other hand, in order to shift the container in the vertical direction, a particular lifting device is required, e.g., a hydraulic lifting device. By means of lifting the container in the vertical direction, it is achieved that it is possible to place a glide chute between the discharge opening and the loading point, along which chute the granular or floury material can be made to flow to the desired point. Owing to the said auxiliary and additional equipment, the whole of the solutions of equipment of the containers emptied through the bottom becomes quite expensive and complicated.

On the other hand, systems of equipment are also known in which the discharge of the material takes place through the top end of the container. Thus, in these cases, the entire container is tilted or partly turned over. In this way, the load can be discharged straight to the desired point, but at the same time, it is considerably more difficult to dose the material than in the case of containers emptied through the



bottom. Owing to the weight of the container, which is frequently rather high, the tilting equipment used also becomes quite expensive.

The object of the present invention is to
5 eliminate the drawbacks present in the prior-art solutions and to provide a container of an entirely novel type for the transportation, discharge and dosage of readily clodding granular and floury material.

The invention is based on the idea that the
10 material is enclosed, in the container, from the bottom and from two opposite sides, by a flexible mat or belt. When the mat is being raised out of the container, the material in the container is carried along with the mat, and it can be discharged readily through the
15 top portion. It is important that the mat is all the time pressed definitely tightly against the other two sides, whereby a leakage of the material between the edges of the mat and the said sides is prevented.

The above can be accomplished so that a mat
20 is fitted between the ends of a relatively narrow container, the width of the mat being substantially the same as the distance between the ends of the container and the mat being, at the same time, flexible in the longitudinal direction and rigid in the lateral direc-
25 tion. One end of the mat is attached to a roll fitted at the top portion of the container between the ends of the container and rotated by means of a drive gear. The other end of the mat is attached to the wall of the container in the top portion of the container at
30 the opposite side, by means of an appropriate attaching member. In a preferred embodiment of the invention, such an attaching member consists of a second rotatable roll. The mat is coated with a material or material layer promoting the friction. When the container is
35 filled with a granular or floury material, the mat is pressed by the effect of the weight of the material against the side and bottom walls of the container



structure. By rotating the roll by means of the drive gear, the granular or floury material is carried, by the effect of friction between the mat and the material, along with the mat into the top portion of the container, from where it can be passed out of the container, e.g., by means of a glide chute.

More specifically, the container in accordance with the invention is mainly characterized in what is stated in the characterizing part of claim 1.

The equipment is suitable for bulk fertilizer, grain, talc, etc. inconvenient granular and floury materials.

By means of the invention, considerable advantages are obtained. Thus, the equipment in accordance with the invention is simple, and it can be accomplished in practice by using inexpensive solutions of equipment. The equipment can be used in most varying objects of use, its construction is very well suitable, e.g., for the dosage of fertilizers straight onto the field. In accordance with the principle of operation of the container construction, the material in the container cannot be clodded, but it is mixed automatically when the material is being discharged from the container. The requirement of cleaning of the container is low, because, in use, the mat automatically cleans the glide faces at the ends of the container.

In the construction in accordance with a preferred embodiment of the invention, in which both ends of the mat are attached to rolls, the material can be discharged to both sides of the container, even simultaneously if so desired. The mixing of the material in the container is in this case even more efficient. In this embodiment it is also possible to make sure that the container is emptied completely. It is, viz., possible to remove the quantity of material last remaining in the container by converting the unit



consisting of the rolls and the mat to a belt conveyor by simply reversing the sense of rotation of one of the rolls, e.g., by disconnecting this roll from the drive gear.

5 The invention will be examined in the following in more detail by means of the exemplifying embodiments in accordance with the attached drawings.

Figure 1 is a sectional view of one embodiment of the container construction in accordance with
10 the invention.

Figure 2 is a side view of the container construction shown in Fig. 1.

Figure 3 is an enlarged and more detailed view of the end of roll, drive gear, and the connecting
15 mechanism and locking means between them, for the container construction shown in Fig. 1.

Figure 4 is a sectional view of a second, preferred embodiment of a container in accordance with the invention.

20 The construction of the container shown in Fig. 1 is as follows: The container part consists of parallel plane walls 1 and 1', of ends 15, and of a bottom 2. Between the end 1 and the opposite end 1', in the top portion of the container, a rotary roll 3 is
25 mounted. The end 4 of the roll is connected to the drive gear 6 by means of a suitable mechanism 5. The drive gear 6 may be a hydraulic cylinder, hydraulic motor, or an equivalent motor. The end 4 of the roll is also provided with an appropriate locking device 7,
30 by whose means it can be ensured that the roll revolves in the desired direction only. A flexible mat 8, which is, at the same time, rigid and robust in the transverse direction, is attached to the roll 3, the said mat being coated with a layer increasing the friction.
35 The other end of the mat 8 is connected to the opposite wall 1' by means of an attaching member 9. In this embodiment, the attaching member 9 may consist, e.g.,



of a metal bar attached to the wall. In the container, at the roll 3, there is a gate 10 opening upwards, for the filling and discharge of the material. At the bottom portion of the gate 10, a plate 11 of a width equal to the wall is mounted, which plate is directed diagonally upwards towards the roll 3 and at whose end there is a scraper edge 12, which may be, e.g., similar to a rubber rib or brush and which is pressed against the roll diagonally from underneath.

10 In an example case, a container as described above, of a volume of about 5 m^3 , was made of plywood boards reinforced by means of appropriate steel frameworks. The length of the container was 2.5 m, width 1.2 m, and its height from the bottom to the top level of the roll 2 m. As the mat was used a rubber mat with canvas reinforcement, of a thickness of 5 mm. The end walls were coated with a rubber layer in order to improve the sealing between the mat and the walls. As the drive gear was used a hydraulic cylinder, and as the connection between the hydraulic cylinder and the roll end was used a ratchet device.

The container operates as follows: When the container is empty, the mat 8 is advantageously completely wound on the roll 3 over its entire length, except for the portion remaining between the roll 3 and the attaching member 9. When the container is being filled with a granular or floury material, such as bulk fertilizer, the roll 3 is disconnected from the drive gear 6 and from the locking device 7, whereat the mat 8 is unwound off the roll 3 and pressed by the weight of the material to be filled towards the bottom 2 and the walls 1 and 1'. Owing to the construction of the mat 8, rigid in the transverse direction, no material can flow between the edges of the mat 3 and the ends 15 onto the bottom 2. When the quantity of the material to be loaded rises to the level of the roll 3, filling is stopped and the locking system 7 is switched on the



roll 3.

When material is to be discharged from the container, the drive gear 6 is connected to the roll 3, the gate 10 is opened, and the mat 8 starts being wound onto the roll 3 by means of the drive gear 6. Thereat material follows along with the mat onto the roll 3, from where it can be guided to the desired point via the plate 11 and by means of a possible additional glide chute, if any. The scraper edge 12 removes any material possibly adhering to the mat 3 off the mat. By dosing in this way, any desired quantity of granular or floury material can be discharged from the container. When the entire length of the mat 8, except the portion between the roll 3 and the attaching member 9, is wound on the roll, even the last remaining quantity of the material can be discharged out of the container and off the mat 8 if the attaching member 9 is placed at a higher level than the roll 3, whereat the mat 8 is in an inclined position as compared with the horizontal plane. The flowing of the material off the mat 8 can be promoted by coating this portion of the mat 8 with an appropriate film, e.g. PVC or equivalent slippery plastic film.

Figure 4 shows an alternative, preferred embodiment of the container construction in accordance with the invention.

The construction of the container part is substantially similar to the embodiment described above, but the attaching member now consists of a second roll 9, which is similar to the said first roll 3 and parallel to the said latter roll. The second roll 9 is installed in a way corresponding to the first roll 3 and is preferably placed at the same level with it. At the roll 9, there is a gate 10 corresponding to the gate 13. The second roll 9 may be provided with a separate drive gear, or the same drive gear may be used for rotating it as is used for rotating the



first roll 3. The distance between the rolls is here preferably approximately equal to their length, i.e. the opening defined by the opposite ends 15 and by the rolls 3 and 9 fitted between them is substantially of square shape.

Between the ends 15, a rigidifying member 14, in the present case a metal bar, is fitted in order to reinforce the construction of the container.

The operation of the embodiment shown in Fig. 4 is by and large similar to the operation of the preceding embodiment, described with reference to Figs. 1 to 3. At the beginning, before filling, the mat 8 is, however, wound on the rolls 3 and 9 so that there is an equal length of mat on both rolls. The filling and emptying of the container take place in a way corresponding to that described above, but the material can now be discharged to either side of the container, always by rotating the roll at the side concerned. If the second roll 9 has a drive gear of its own, the emptying of the container can take place to both sides at the same time.

After almost all of the material that was in the container has been discharged and the entire length of the mat, except the portion remaining between the rolls 3 and 9, has been wound onto the rolls 3 and 9 (horizontal position marked with dotted line), even the remaining rest of the material can be discharged from the container by disconnecting one of the rolls from its drive gear and locking means and by rotating the other roll by means of the drive gear, whereby a belt conveyor is obtained by whose means the material can be discharged to one side of the container. In such a case, the length of the mat must be so large that at least a length corresponding to the distance of the rolls 3 and 9 is at all times wound on any one of the rolls.



In practice, it has been noticed that, by means of the rigidifying member 14 fitted between the ends 15, mentioned above, it can be ensured that the ends of the container are not pressed outwards by the weight of the material to be loaded. Such bulging outwards might, viz., have the result that the edges of the mat 8 are no longer pressed definitely tightly against the ends 15, in which case material could flow down between the walls and the edges of the mat.

By using such rigidifying members, it is possible to achieve the required sealing at the same time as the material thickness of the walls and the ends can be kept relatively low. In this embodiment, like in the preceding one, it is advantageous to coat the faces of the ends with an appropriate layer of material increasing the friction, such as rubber.

In an example case, a container in accordance with the invention was prepared, whose dimensions were equal to those of the preceding example. The second roll (diameter 14 cm) was placed at the same level as the first roll, so that the distance between them was equal to their length, i.e. 1.2 m.

Finally, it should be noted that the edges of the belt can be provided with packing means known per se in order to keep the edges constantly in contact with the end walls of the container during operation. Such means may comprise resilient hoses filled with a gas, such as pressurized air, or an uncongealable liquid, such as hydraulic oil.



WHAT IS CLAIMED IS:

1. Container for the transportation, dosage and discharge of a granular and floury material, the
5 said container comprising

- a container part, whose opposite ends (15) are parallel to each other,
- a mat (8) or belt, which is flexible in the longitudinal direction and preferably rigid
10 in the lateral direction and one of whose ends is connected to the wall (1') between the ends (15) in the top portion of the container by means of appropriate attaching members (9), and
- 15 - a gate (10) in the top portion of the container for filling and discharge of the material,

c h a r a c t e r i z e d in that

- 20 - the width of the mat (8) is substantially equal to the width of the container,
- the other end of the mat (8) is, in the top portion of the container, attached to a roll (3), whose axis is preferably parallel to the walls (1, 1') of the container and
25 whose length is substantially equal to the width of the walls (1, 1'), and
- for the purpose of rotating the roll, the container comprises drive gear (6) and locking members (5 to 7).

30 2. Container as claimed in claim 1, c h a r -
a c t e r i z e d in that the attaching members (9) are placed at a higher level than the roll (3) (Fig. 1).

3. Container as claimed in claim 1, c h a r -
a c t e r i z e d in that the attaching members con-
35 sist of a second roll (9), whose axis is parallel to the first roll (3) and whose length is substantially equal to the width of the walls (1, 1') (Fig. 4).



4. Container as claimed in claim 3, c h a r -
a c t e r i z e d in that both of the rolls (3, 9)
are at the same level.

5. Container as claimed in claim 4, c h a r -
5 a c t e r i z e d in that the opening between the rolls
(3, 9) is of substantially square shape.

6. Container as claimed in claims 4 and 5,
c h a r a c t e r i z e d in that the mat (8) can be
wound onto the second roll (9) so as to permit a
10 conveyor belt operation at the final stage of the dis-
charge.



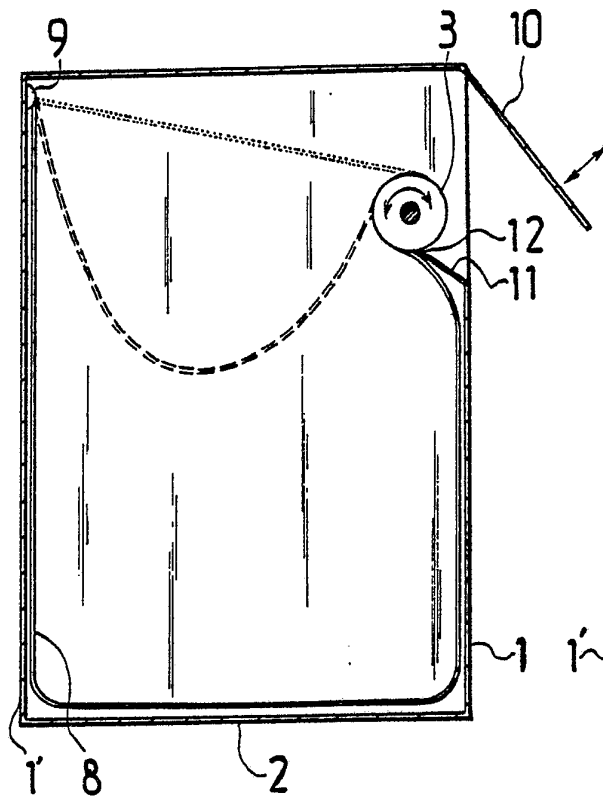


Fig. 1

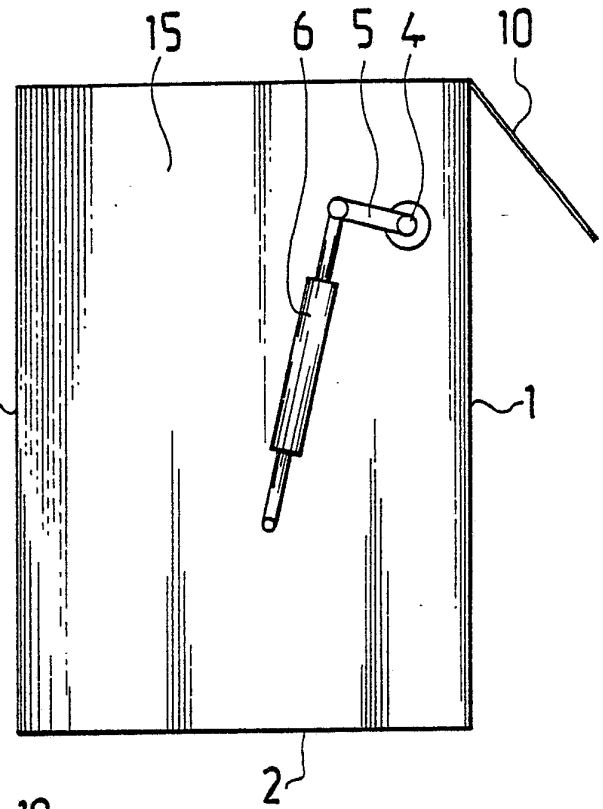


Fig. 2

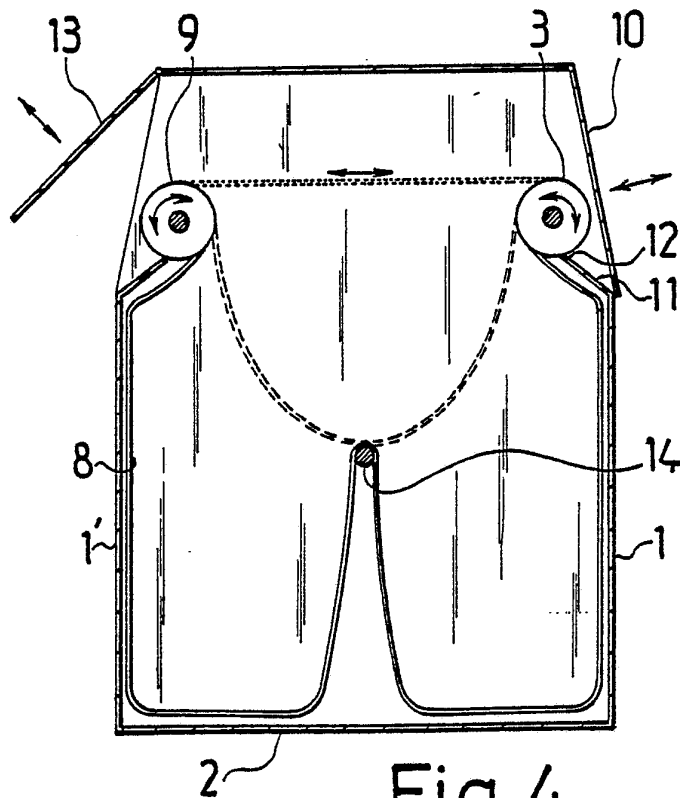


Fig. 4

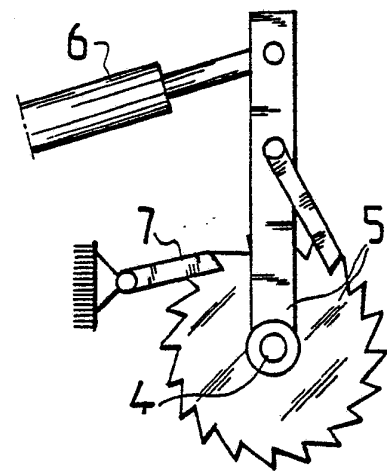
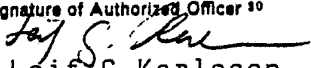


Fig. 3

INTERNATIONAL SEARCH REPORT

International Application No PCT/FI83/00071

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) *		
According to International Patent Classification (IPC) or to both National Classification and IPC ³		
B 65 D 88/54 // B 65 D 83/06		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁴		
Classification System	Classification Symbols	
IPC 3	B 65 D 25/32, 38, 75/58, 77/30, 83/00, 06, 88/54, 58-62; B 65 C 65/00, 20, 69/00, 08	
Nat Cl	81c:27 .../...	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁵		
SE, NO, DK, FI classes as above		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴		
Category ⁶	Citation of Document, ¹⁵ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁸
A	FI, A, 63 723 (HELANDER) 11 July 1981	
A	FR, A1, 2 195 572 (KOBÉ STEEL LTD ET AL) 8 March 1974	
A	FR, A1, 2 398 684 (LAGNEAU) 23 February 1979	
A	US, A, 3 351 235 (PATON) 7 November 1967	
A	WO, A1, 82/03839 (ALL FLOW INC ET AL) 11 November 1982	
* Special categories of cited documents: ¹⁹ "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 "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		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search ¹	Date of Mailing of this International Search Report ²	
1984-02-15	1984-02-23	
International Searching Authority ¹	Signature of Authorized Officer ²⁰	
Swedish Patent Office	 Leif G Karlsson	

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

II

Fields searched (cont)

US C1 206:528, 540
 214:300, 312-317
 222:529, 530, 537, 555, 561
 414:288, 304, 323

V. ☐ **OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE ¹⁰**

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

1. ☐ Claim numbers because they relate to subject matter ¹³ not required to be searched by this Authority, namely:
2. ☐ Claim numbers 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 ¹³, specifically:

VI. ☐ **OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING ¹¹**

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

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.
2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:
3. ☐ 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 claim numbers:
4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

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