

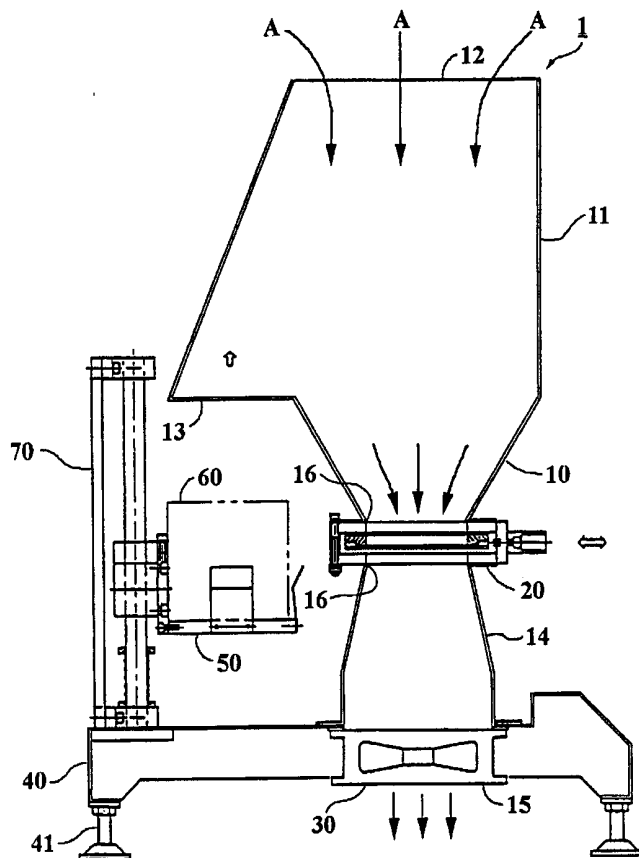


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>7</sup> :</b>  <b>G01N 1/22</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 00/63669</b>  <b>(43) International Publication Date:</b> 26 October 2000 (26.10.00)
<b>(21) International Application Number:</b> PCT/KR00/00351  <b>(22) International Filing Date:</b> 15 April 2000 (15.04.00)  <b>(30) Priority Data:</b> 1999/13645      16 April 1999 (16.04.99)      KR  <b>(71) Applicant (for all designated States except US):</b> YUHAN-KIMBERLY, LTD. [KR/KR]; Haesung Building, 942 Daechi 3-dong, Kangnam-ku, Seoul 135-283 (KR).  <b>(72) Inventors; and</b> <b>(75) Inventors/Applicants (for US only):</b> AHN, Chan, Kyu [KR/KR]; 3-1001 Ginheung Apt., Seocho 4-dong, Seo- cho-ku, Seoul 137-074 (KR). YEOM, Eun, Seok [KR/KR]; 202 Younripjuteak, 616 Bugok-dong, Kimcheon-shi, Kyungsangbuk-do 140-110 (KR).  <b>(74) Agent:</b> CHU, Sung, Min; Seoul Building, 114-31 Uni-dong, Chongro-ku, Seoul 110-350 (KR).		<b>(81) Designated States:</b> AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i>

**(54) Title:** DUST TESTER**(57) Abstract**

The invention relates to a dust tester for measuring the dust content which is generated when tissue sheets are pulled up from a carton comprising a suction means for forcibly suctioning air containing the dust generated from the carton and a filtering means for filtering the dust of the air suctioned by said suction means.



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DUST TESTER

## BACKGROUND OF THE INVENTION

## 5 Field of the Invention

The invention relates to a dust tester for measuring the dust content which is generated when tissue sheets are pulled up from a carton.

## Description of the Prior Art

10 In carton-type high grade tissue products, the dust which is generated when tissue sheets are pulled up is one of the greatest cause for dissatisfaction to the consumer. Thus, the reduction of such dust has become an important issue for tissue manufacturers. However, in order to reduce dust, the dust content which is generated when the tissue sheets are pulled up must first be accurately measured.

15 In the prior art, a measuring vessel called a "Plexiglas Box" was used to measure dust content. As shown in Fig. 8, plexiglass box 100 is in the form of rectangular hexahedron, with the material of the plexiglass box being composed of transparent aryl. A rectangular aperture 101 is formed on one side of Plexiglas Box 100. To measure the dust content by using the prior art measuring vessel, the carton  
20 is inserted into Plexiglas Box 100 through a rectangular aperture 101, and then the tissue sheets are pulled up one by one within Plexiglas Box 100. The dust which is generated during the above testing accumulates on the wall of Plexiglas Box 100. The dust also accumulates on the carton itself. The dust accumulated on the carton are shaken off, with the window of the carton being downwardly directed. The  
25 operator gathers the dust accumulated on Plexiglas Box 100 using metal ruler 110 and places the dust on weight measurement paper, and then measures the gathered dust with a balance.

With the above prior art measurement vessel, dust could leak through aperture 101 during measurement. Further, a portion of the dust could also remain in the  
30 carton, despite careful shaking off of the dust accumulated in the carton. Thus, an accurate measurement of the dust content was not possible. Furthermore, an additional problem existed in that the operation of scraping out the dust accumulated on the inner wall of Plexiglas Box 100 was difficult.

## 35 SUMMARY OF THE INVENTION

The present invention solves the above problems, and it is an object of the present invention to provide an dust tester which can easily and accurately measure the dust content which is generated when tissue sheets are pulled up from a carton.

The dust tester of the present invention for use in measuring the dust content which is generated when tissue sheets are pulled up from a carton comprising:

a suction means for forcibly suctioning air containing the dust generated from the carton; and

a filtering means for filtering the dust contained in the air suctioned by said suction means.

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The invention can be better understood by referring to a preferred embodiment of the invention described below in detail with reference to the accompanying drawings.

## 15 BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front sectional view of the dust tester according to the present invention.

FIG. 2 is a side view of the dust tester of Fig. 1.

20 FIG. 3 is an enlarged sectional view of a carton holder and a carton holder support of the dust tester according to the present invention.

FIG. 4 is a side view of the dust tester showing the adjusted height of the carton.

25 FIG. 5a is a plan view of the filter device of the dust tester according to the present invention.

FIG. 5b is a sectional view of Fig. 5a.

FIG. 6a is a plan view of a filter cartridge.

FIG. 6b is a sectional view of the filter cartridge.

FIG. 7 is a sectional view of the filter.

30 FIG. 8 is a dust measuring vessel of the prior art.

## DETAILED DESCRIPTION OF THE INVENTION

Fig. 1 shows dust tester 1 according to the present invention and flowing direction A of ambient air caused by dust tester 1. Dust tester 1 includes a main

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body 10 and a suction fan 30 as suction means, and a filtering device 20 as filtering means. The main body 10 consists of an upper duct 11 and a lower duct 14 as will be described below, and is installed on a fixing stand 40. If suction fan 30 is energized, the fan is rotated. The suction force generated by such rotating force serves to forcibly convect the ambient air through main body 10 and filtering device 20 from the upstream side to the downstream side of the dust tester. The dust which is generated when tissue sheets are pulled up from a carton 60 retained in a carton holder 50 pass through main body 10 and filtering device 20 by forcible convection. Since filtering device 20 has a fine filter 22 (Fig. 5), device 20 is constructed so that only the air is discharged and the dust remains, thereby enabling the measurement of the amount of paper dust. Although not shown in the drawings, it should be understood that the space utilized for measuring the dust content should be a clean room free of any contamination.

The dust tester according to the present invention is described in detail with reference to Figs. 1 and 2. Fig. 1 is a front sectional view of the dust tester according to the present invention and Fig. 2 is a side view of the dust tester of Fig. 1. Main body 10 consists of upper duct 11 and lower duct 14, with filtering device 20 being installed across the main body between the upper and lower ducts. Upper duct 11 is installed at the upstream side of filtering device 20, so as to suck the upstream air of dust tester 1. Upper duct 11 includes an intake opening 12, through which the ambient air is suctioned, a dust suction opening 13, which is formed by projecting a middle portion of one side of upper duct 11 to be opposite to carton 60 retained in carton holder 50, and mounting opening 16 of the filtering device. Most of the dust which is generated when tissue sheets are pulled up from carton 60 are suctioned into upper duct 11 through dust suction opening 13. The remainder of the un-suctioned dust is suctioned into intake opening 12 through forcible convection by suction fan 30. Lower duct 14 is connected to the downstream side of filtering device 20. Lower duct 14 also includes mounting opening 16 of the filtering device, an air discharging opening 15 at the lower portion thereof, and a suction fan 30 at the center thereof. Fixing stand 40 is supported on the floor surface by four legs 41 provided at the four corners thereof.

Carton 60 is supported by carton holder 50. Carton holder 50 is supported so that its height can be adjusted by carton holder support 70, which is fixed on one side of the fixing stand. Carton holder 50 and carton holder support 70 will be described in detail with reference to Figs. 3 and 4.

Fig. 3 is an enlarged sectional view of a carton holder and a carton holder support of the dust tester according to the present invention. Carton holder 50 comprises a holder base 51 on which carton 60 is placed, a side holder plate 52 connected perpendicularly at one end of holder base 51, a carton side supporting plate 53 fixed by bolts on the opposite sides of holder base 51, and a carton back supporting plate 54 connected by bolts at the other end of holder base 51. Carton holder 50 supports the carton opposite to dust suction opening 13 so that the paper dust generated by pulling up the tissue sheets from the carton can be suctioned through dust suction opening 13. Since carton side supporting plate 53 and carton back supporting plate 54 are made of an elastic material, the carton supporting plates will become slightly diverged when carton 60 is inserted into carton holder 50 and can elastically surround the carton after its insertion.

Carton holder support 70 comprises two longitudinal shafts 71, shaft supports 72 provided on the opposite ends of shafts 71, a support 73 supporting shaft supports 72, and a fixing plate 74 fixed movably up and down along shafts 71 by bolts. On the lower part of shaft 71, compression springs 75 and seats 76 are provided. Since side holder plate 52 is fixed on fixing plate 74 of carton holder support 70 by bolts, carton holder 50 will be displaced along with the movement of fixing plate 74. As shown in Fig. 4, fixing plate 74 can be moved by releasing fixing bolts 81 and then fixing the fixing plate at a desired position.

A cartridge type filter device 20 according to the present invention will be described hereinafter in more detail with reference to the Figs. 5 to 7. Mounting opening 16 for receiving filtering device 20 is provided between upper duct 11 and lower duct 12. Filtering device 20 comprises a filter box 25 as a cartridge holder, a filter cartridge 21 which is detachably mounted in filter box 25, a filter 22 which is fixed in filter cartridge 21, and filter fixing means 24 for fixing the filter 22. Filter box 25 is a square shaped double layered assembly comprised of upper and lower layers bolted with a plurality of bolts. One side of the box is not bolted, so that filter cartridge 21 can be inserted or moved away between the two layers of the assembly.

Filter 22 is inserted into filter box 25 after being fixed onto filter cartridge 21 together with filter base 23 and filter fixing means 24. After the desired number of tissue sheets are pulled up, filter cartridge 21 will be removed from filter box 25 and the dust content filtered by filter 22 is measured. The preferred mesh of the filter is 150 to 300. The filter cartridge and filter are shown in detail in Figs. 6 and 7.

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In this embodiment, filter device 20 is mounted across main body 10 and suction fan 30 is provided on the lower side of lower duct 14. In the present invention, any type of mounting structure for the filtering device can be allowed, insofar as the filtering device is provided between the upstream side and the downstream side of the air flow in the main body. The suction fan can also be mounted at an arbitrary position of the downstream side on the main body.

The procedure for measuring the dust content is as follows:

- prepare an accurate balance adapted to measure up to 0.0001 g.
- weigh initial weight of the filter before testing and record the weight in units of 0.0001 g.
- switch on the dust tester and confirm that air convection is established within the main body of the dust tester.
- open the carton and place it into the carton holder of the dust tester.
- fix the filter to the filter cartridge and insert the cartridge to the filter box.
- pull the tissue sheets straight up one by one from the carton at intervals of 0.5 seconds.
- after the above tissue-pulling step is completed, wait 30 seconds (so that dust would settle down on the filter completely).
- remove the filter cartridge from the filter box and separate the filter.
- weigh the separated filter and record this weight in units of 0.0001g .
- remove the dust from the filter.
- For additional testing, repeat the above procedure.

The formula for the calculation of paper dust is as follows

- dust content per one sheet (mg) =  $((B-A)/C) \times 1000$
- total dust content (mg) = dust content per one sheet (mg) x K

A: initial weight of filter (g)

B: last weight of filter (g)

C: number of sheet counts per carton tested.

K: factor of number of sheet counts (to be 300)

- (all data should be convert into 300 sheet counts)

Through the above paper dust measuring device, accurate and easy measurement of the paper dust generated when pulling out tissues from a carton can be made.

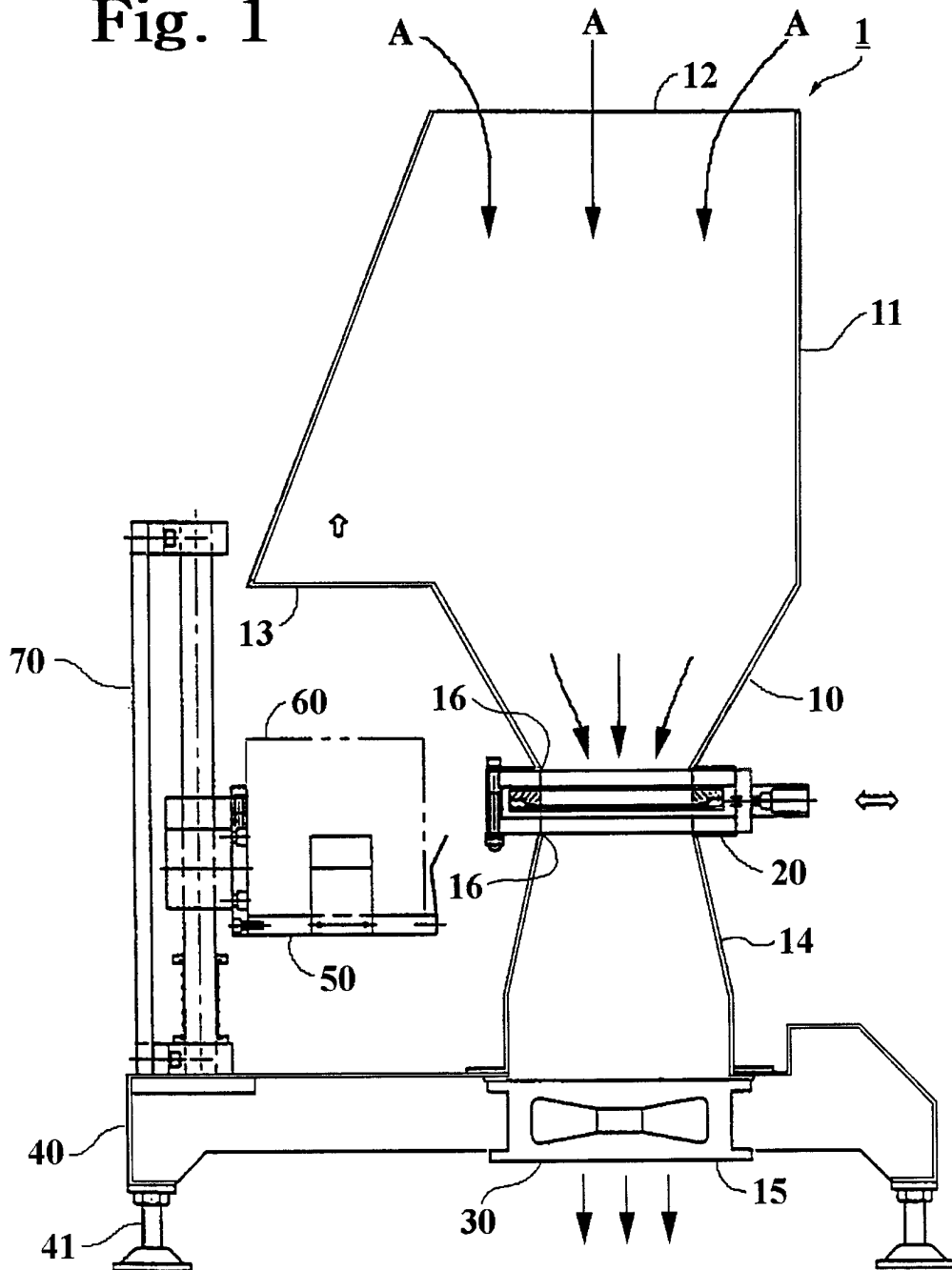
WHAT IS CLAIMED IS:

1. A dust tester for use in measuring the dust content which is generated when tissue sheets are pulled up from a carton comprising:
  - 5 a suction means for forcibly suctioning air containing the dust generated from the carton; and
  - a filtering means for filtering the dust of the air suctioned by said suction means.
- 10 2. The dust tester of claim 1, wherein said suction means comprises an upper duct installed on the upstream side of said filtering means and having an intake opening through which ambient air is suctioned, a dust suction opening and a mounting opening of said filtering means; a lower duct connected to the downstream side of said filtering means and having a coupling opening of said filtering means and  
15 an air discharging opening; and a suction fan installed on the air discharging opening side of said lower duct.
3. The dust tester of claim 1, wherein said filtering means comprises a filter box, a filter cartridge detachably mounted in said filter box, a filter fixed to said  
20 filter cartridge, and a filter fixing means for fixing said filter to said filter cartridge.
4. The dust tester of claim 3, wherein the mesh of said filter is 150 to 300.
- 25 5. The dust tester of claim 1, further comprising a carton holder for supporting a carton oppositely to said dust suction opening for suctioning dust so that the dust which is generated when tissue sheets are pulled up from the carton is suctioned into said dust suction opening of said upper duct.
- 30 6. The dust tester of claim 5, wherein said carton holder is supported so that its height can be adjusted by a carton holder support.



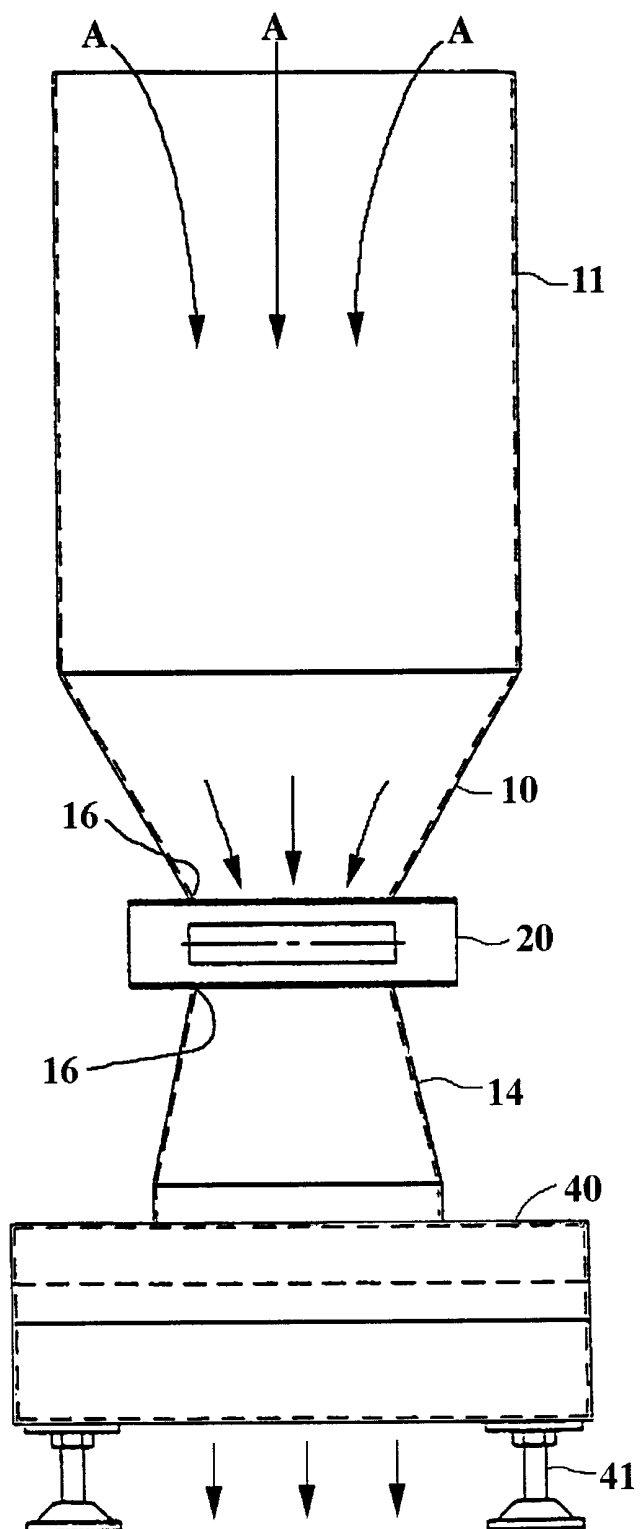
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Fig. 1



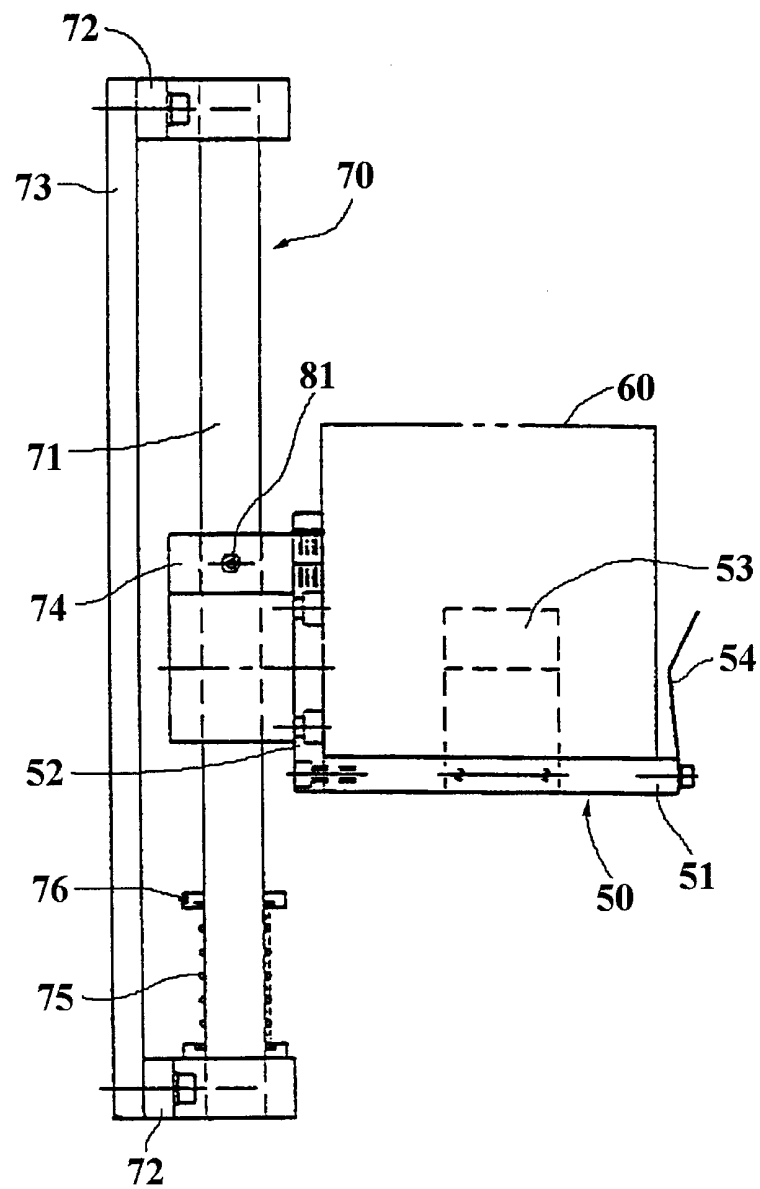
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Fig. 2



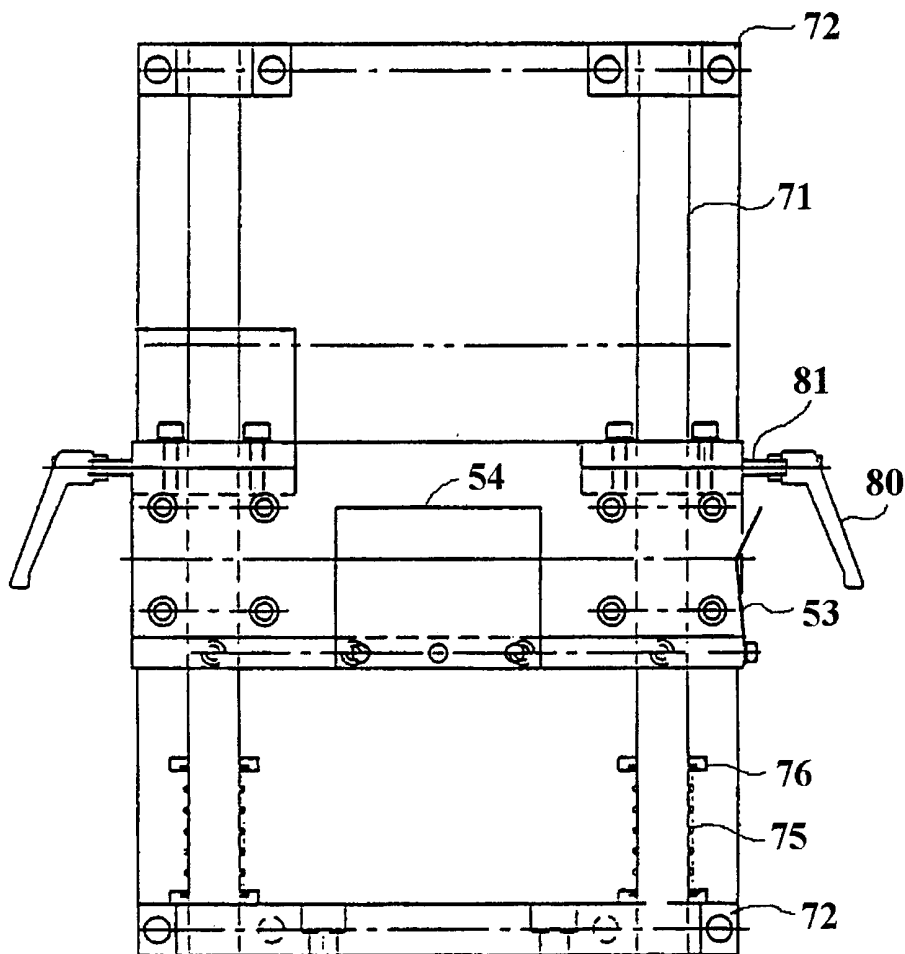
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Fig. 3



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Fig. 4



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Fig. 5a

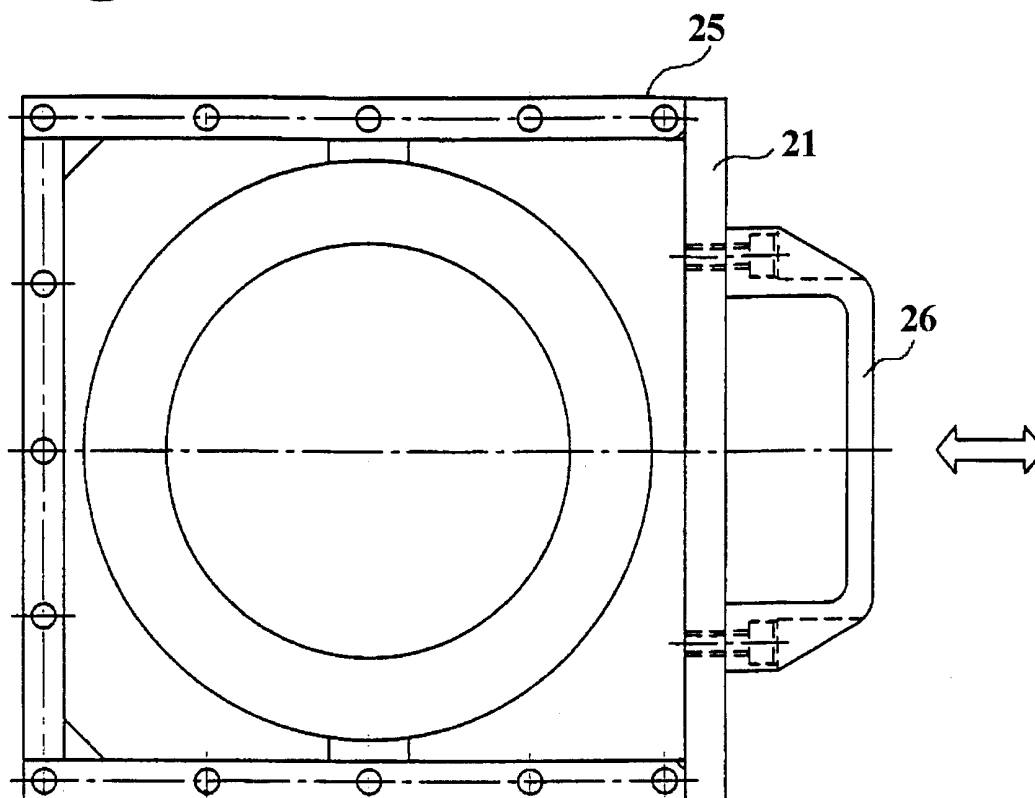
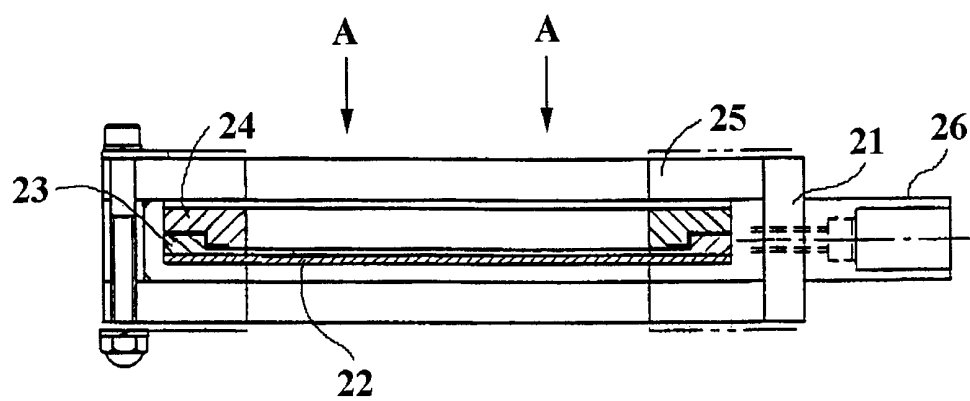


Fig. 5b



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Fig. 6a

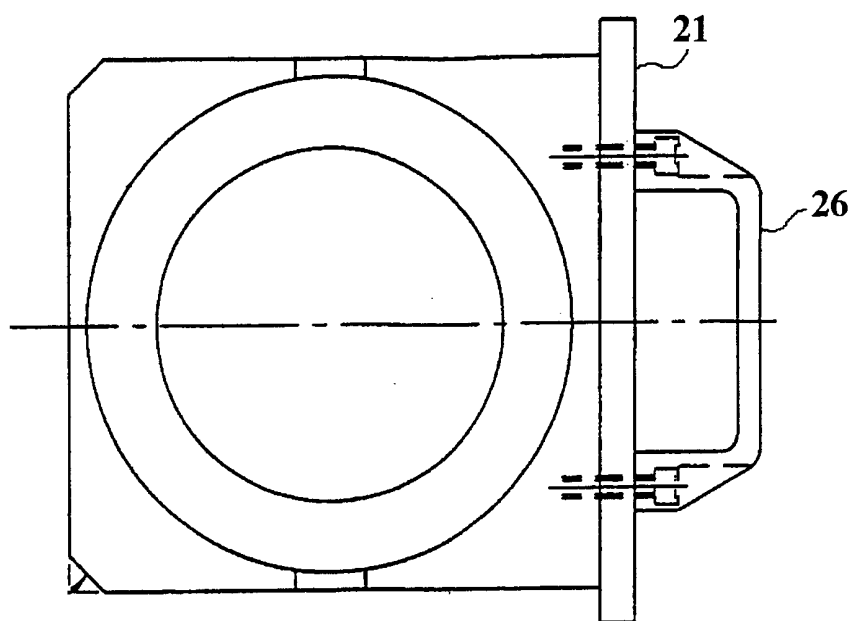


Fig. 6b

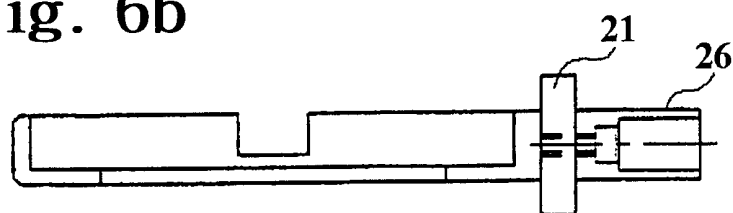
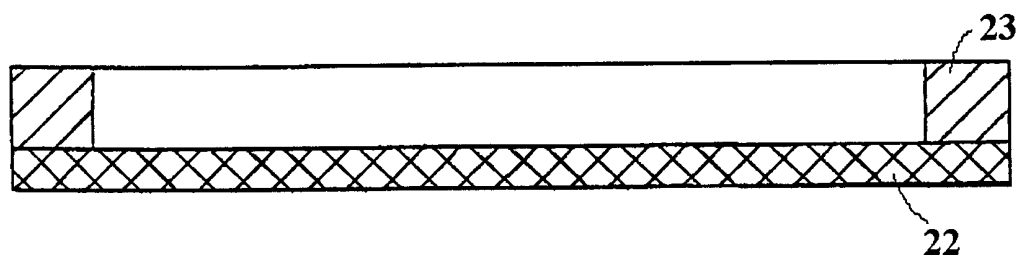
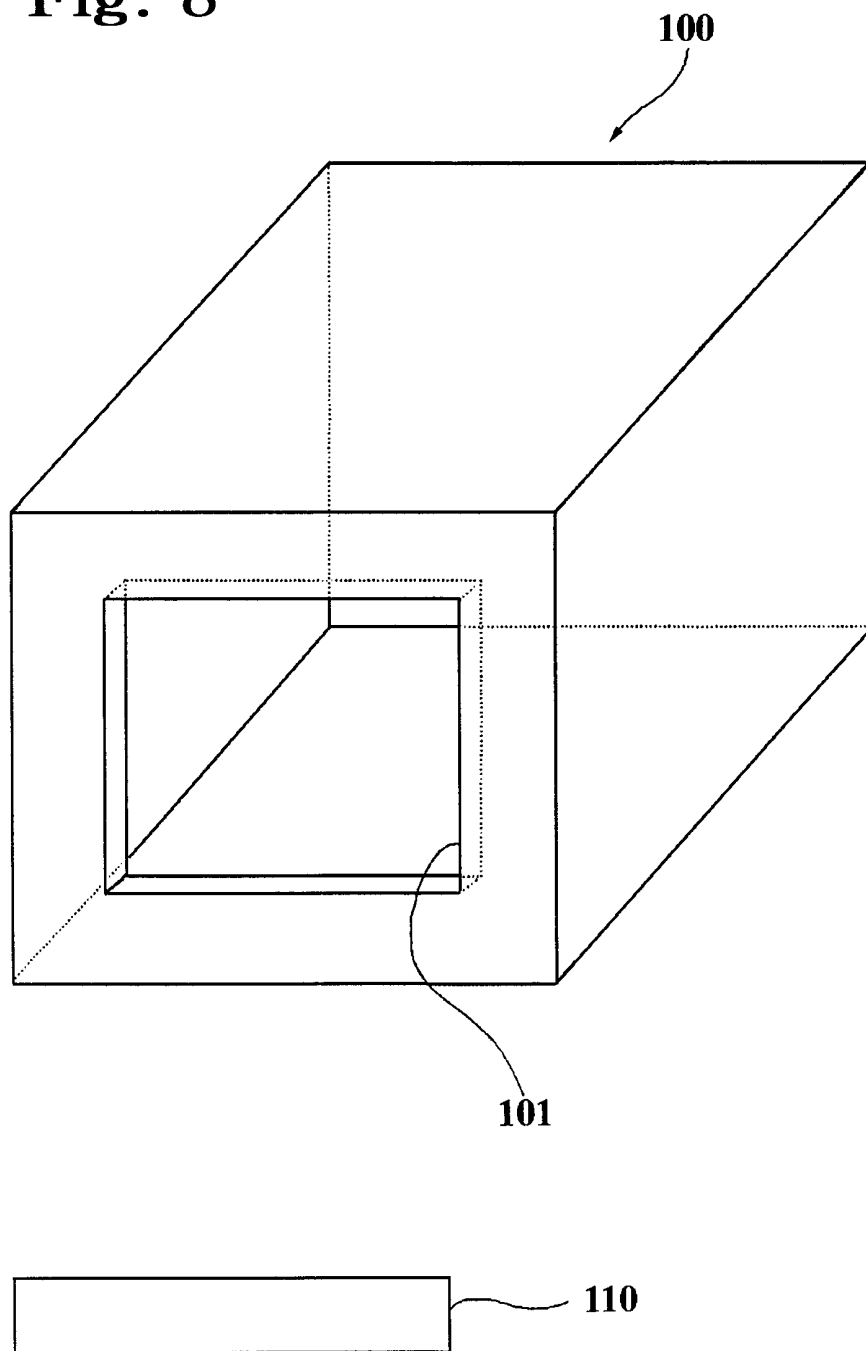


Fig. 7



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Fig. 8



# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/KR 00/00351

## CLASSIFICATION OF SUBJECT MATTER

IPC<sup>7</sup>: G 01 N 1/22

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<sup>7</sup>: G 01 N 1/22

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)

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SU 629502 A (UKR CELLULOSE-PAPER) 19 September 1978 (19.09.78) Soviet Inventions Illustrated, Section R, Week B32, 21.09.79, London: Derwent Publications Ltd. Class R16, AN 1979-59352 B.	1
A	SU 1652908 A (PAPER RES INST) 30 May 1991 (30.05.91) (abstract), Soviet Patents Abstracts, S-X, Week 9218, 17.06.92, London: Derwent Publications Ltd. Class S 03, AN 1992-148472.	1
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☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

30 June 2000 (30.06.2000)

Date of mailing of the international search report

7 August 2000 (07.08.2000)

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Information on patent family members

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Patent document cited in search report			Publication date	Patent family member(s)	Publication date
SU	A1	1652908	30-05-1991	none	
SU	T	629502	25-10-1978	none	