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(71) Applicant: **Chang, Wen-Chen**  
**Pi-Tou Hsiang, Chang-Hua Hsien (TW)**

(72) Inventor: **Chang, Wen-Chen**  
**Pi-Tou Hsiang, Chang-Hua Hsien (TW)**

(74) Representative:  
**King, James Bertram**  
**Herbert J.W. Wildbore**  
**73 Farringdon Road**  
**London EC1M 3JB (GB)**

(54) **Electrostatic precipitators**

(57) An electrostatic precipitator including an ionization means (1), a precipitation means (2) and a cleaning means (3) is disclosed. Greasy particles in a gas are ionized and charged with high-voltage direct currents by the ionization means (1). The charged greasy particles are precipitated on at least one band type positive electric sheet (21) turning in a cyclical manner. The greasy particles deposited on the moving positive electric sheet (21) are scraped off by the cleaning means (5). Therefore, it can remove greasy particles contained in gases quickly.

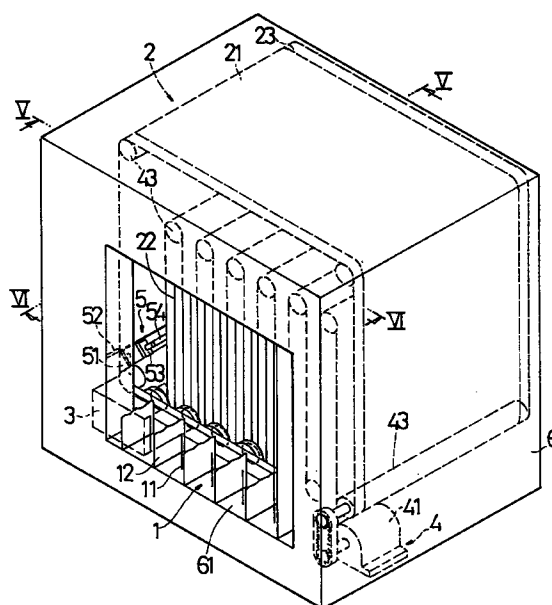


FIG. 3

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## Description

### BACKGROUND OF THE INVENTION

#### (a) Field of the Invention:

The present invention relates to an electrostatic precipitator, and more particularly to an electrostatic precipitator in which floating particles are charged with electricity and the charged particles are moved and collected in an electric field.

#### (b) Description of the Prior Art:

In prior electrostatic precipitators, dust particles adhered to electric metal plates are removed by means of vibration or washing. For greasy particles that stick to electric metal plates, utilizing a prolonged vibration is ineffective in removing them. If a detergent is used to wash away the greasy particles, it will be necessary to allow the electric metal plates to be completely dry before they can be used again, which generally takes a long time.

With reference to Fig. 1, there is shown an electrostatic precipitator adapted for use in removing greasy smoke. The electrostatic precipitator utilizes a circular scraper for scraping off the greasy particles stuck on a circular electric plate. However, as the scraper of the electrostatic precipitator is circular, it cannot be used for rectangular electric metal plates. In particular, the arrangement of the scraper in the precipitating zone affects the precipitating effects.

Fig. 2 shows another prior electrostatic precipitator, in which scrapers capable of reciprocating in a linear manner to scrape off greasy particles stuck on rectangular electric metal plates. But such a construction requires a great number of scrapers and rails and is therefore complicated.

### SUMMARY OF THE INVENTION

Accordingly, a primary object of the present invention is to provide an electrostatic precipitator of a simple construction for quickly removing greasy particles contained in gases.

Another object of the present invention is to provide an electrostatic precipitator in which it is possible to scrape greasy particles off the electric metal plates during precipitating without the need to stop the electrostatic precipitator, and the scrapers may be located at the corners of the precipitating zone in order not to affect the precipitating effects.

### BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other features and advantages of the present invention will be more clearly understood from the following detailed description and the accom-

panying drawings, in which,

- Fig. 1 is a schematic view of a conventional electrostatic precipitator for removing greasy particles;
- Fig. 2 is a schematic view of another conventional electrostatic precipitator for removing greasy particles;
- Fig. 3 is an elevational view of a first preferred embodiment of the electrostatic precipitator of the present invention;
- Fig. 4 is a sectional view taken along line IV-IV of Fig. 3;
- Fig. 5 is a sectional view taken along line V-V of Fig. 3;
- Fig. 6 is a schematic view of a cleaning means of the electrostatic precipitator of the present invention;
- Fig. 7 is a schematic view of a first example of band type positive electric sheet and a drive wheel of the electrostatic precipitator of the first preferred embodiment of the present invention;
- Fig. 8 is a schematic view of a second example of a band type electric plate and a drive wheel of the electrostatic precipitator of the first preferred embodiment of the present invention; and
- Fig. 9 is an elevational view of the second preferred embodiment of the electrostatic precipitator of the present invention.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to Figs. 3 and 5, the electrostatic precipitator according to the first preferred embodiment of the present invention comprises an ionization means 1, a precipitation means 2, a collecting means 3, a drive means 4, a cleaning means 5 and a housing 6 enclosing the above components.

The ionization means 1 is provided to supply charge to particles in the gas and is comprised of a plurality of metal wires 11 for supplying high voltages direct currents and a plurality of parallel metal plates 12 for grounding purposes.

The precipitating means 2 is located to the rear of the ionization means 1 for precipitating particles in the current of gas flowing past from the ionization means 1. In this preferred embodiment, the precipitation means 2 includes at least one band type positive electric plate 21 having predetermined bends and a plurality of negative electric plates 22 distributed between every two adjacent sections of the positive electric sheet 21. The positive electric sheet 21 is a flexible laminated metal sheet connected to the positive pole so that they carry positive electric charges. On both sides of the positive electric sheet 21 are provided an insulated portion 23. The insu-

lated portions 23 are coated with a layer of non-electric conductive film so that they do not carry positive electric charges.

The drive means 4 includes a motor 41 and a plurality of guide wheels 43 pivotally provided on a frame 42 at predetermined positions. The motor 41 drives a drive wheel 44.

Fig. 7 shows an example of the band type positive electric sheet 21. The insulated portions 23 thereof pass over the guide wheels 43 and the drive wheel 44 and enable the surface of the positive electric sheet 21 to have a certain tensile force. By utilizing the frictional force generated between the drive wheel 44 driven by the motor 41 and the insulated portions 23 of the positive electric sheet 21, the entire positive electric sheet 21 may turn cyclically by means of the guide wheels 43.

The negative electric plates 22 located between adjacent sections of the positive electric sheet 21 are mounted on the frame 42 of the drive means 4 and are arranged not to be in contact with the guide wheels 43 and the positive electric sheet 21 in order to avoid short circuit. The frame 42 is also made of insulated material.

In the present invention, the cleaning means 5 is located at a predetermined position on the path of the positive electric sheet 21. In this preferred embodiment, the cleaning means 5 is disposed at a corner of the precipitating zone. With reference to Fig. 6, the cleaning means 5 includes an inner scraper 51 and an outer scraper 52, both of which is made of insulated material. The inner and outer scrapers 51, 52 respectively contact the inner and outer surfaces of the positive electric sheet 21 so that they may scrape the greasy particles off the positive electric sheet 21 with a suitable friction. A scraping blade 53 capable of reciprocating in a linear manner is provided on the respective surfaces of the inner and outer scrapers 51, 52. In this preferred embodiment, the scraping blade 53 is driven by a pneumatic cylinder 54 for scraping the greasy particles from the surfaces of the inner and outer scrapers 51, 52.

The collecting means 3 is located below the cleaning means 5 for receiving scraped greasy particles. The collecting means 3 may be removed from one side of the housing 6 for disposal.

When greasy smoke or gas enters via an inlet 61 into the ionization means 1, the greasy particles will be ionized so that they carry negative electric charges. They then enter the electrostatic field where the positive electric sheet 21 and parallel negative electric plates 22 are. The charged greasy particles will adhere to the surfaces of the positive electric sheet 21.

As the positive electric sheet 21 is driven by the motor 41 to cyclically turn, it may always slidably contact the inner and outer scrapers 51, 52 to continually scrape the greasy particles off the positive electric sheets 21. The greasy particles will then adhere to the surfaces of the inner and outer scrapers 51, 52. At a set time for removing the greasy particles on the inner and outer scrapers 51, 52, the cylinder 54 will start operation

and drive the respective scraping blades 53 of the inner and outer scrapers 51, 52 to scrape the greasy particles from the respective surfaces of the inner and outer scrapers 51, 52. The scraped greasy particles drop and are collected by the collecting means 3 below. The filtered gas will then be discharged through an outlet 62.

In practice, if the electrostatic precipitator of the present invention is used in environments where greasy smoke or gas is little, the positive electric sheet 21 may be operated to remove greasy particles after the electrostatic precipitator has operated for some time. But if the electrostatic precipitator of the present invention is used in environments where there are lots of greasy smoke or gas, the positive electric sheet 21 may be operated simultaneously with the starting of the fan so that the greasy particles may be quickly removed before they may accumulate on the positive electric sheet 21. This helps to maintain the proper functioning of the positive electric sheet 21.

With reference to Fig. 8, which shows another example of the band type positive electric sheet. A positive electric sheet 7 is provided with an insulated portion 71 at both sides thereof. The insulated portion 71 is provided with a plurality of guide holes 72 equidistantly spaced apart from each other in a linear arrangement. A drive wheel 8 is provided with a plurality of cogs 81 which may engage the guide holes 72 of the insulated portion 71 for driving the positive electric sheet 7.

Reference is made to Fig. 9 showing a second preferred embodiment of the electrostatic precipitator of the present invention. The precipitation means of this embodiment includes a plurality of band type positive electric sheets 9 cycling separately and a plurality of negative electric plates 91 distributed between every two adjacent positive electric sheets 9. A cleaning means 92 is provided at each positive electric sheet 9 at a predetermined position.

Obviously, the grounding metal plates 12 of the ionization means 1 may also be configured to be band type metal plates to achieve effects similar to those obtained by the configuration of band type positive electric sheets of the precipitation means.

Furthermore, at least one nozzle may be provided to eject high-speed air currents to blow away the greasy particles on the inner and outer scrapers 51, 52 of the cleaning means 5.

Although the present invention has been illustrated and described with reference to the preferred embodiment thereof, it should be understood that it is in no way limited to the details of such embodiment but is capable of numerous modifications within the scope of the appended claims.

## Claims

1. an electrostatic precipitator comprising:

an ionization means (1) for charging particles in

a gas with electricity, said ionization means (1) comprised of a plurality of metal wires (11) for supplying high-voltage direct currents and a plurality of parallel grounding metal plates (12); a precipitation means (2) for precipitating particles in the gas; and

a housing accommodating said ionization means (1) and said precipitation means (2);

characterized in that: said precipitation means (2) comprises at least one band type positive electric sheet (21) with a determined number of bends and a plurality of negative electric plates (22) distributed between every two adjacent sections of said at least one band type positive electric sheet (21), said at least one band type positive electric sheet (21) being driven by a drive means (4) to turn cyclically, and a cleaning means (5) is disposed on the path of said at least one band type positive electric sheet (21) at a predetermined position for removing particles adhered to an upper surface and a lower surface thereof.

2. The electrostatic precipitator as claimed in Claim 1, wherein said at least one band type positive electric sheet (21) is a flexible metal sheet and is provided with an insulated portion (23) at both sides thereof.
3. The electrostatic precipitator as claimed in Claim 1, wherein said precipitation means (2) comprises a plurality of band type positive electric sheets (21) and a plurality of negative electric plates (22) distributed between every two adjacent positive electric sheets (21), each of said positive electric sheets (21) being driven by a drive means (4) to turn cyclically and separately, and a cleaning means (5) being disposed along the path of each of said positive electric sheets (21) at a predetermined position.
4. The electrostatic precipitator as claimed in Claim 1, wherein said drive means (4) has a motor (41) and a predetermined number of guide wheels (43) pivotally mounted on a frame (42), and said at least one band type positive electric sheet (21) is passed over said guide wheels (43).
5. The electrostatic precipitator as claimed in Claim 1, wherein said cleaning means (5) is comprised of an inner scraper (51) and an outer scraper (52) for contacting said at least one band type positive electric sheet (21), said inner scraper (51) and said outer scraper (52) being respectively provided with a scraping blade (53) capable of reciprocating in a linear direction, the respective scraping blades (53) of said inner scraper (51) and said outer scraper (52) capable of contacting the respective surfaces of said inner scraper (51) and said outer scraper

(52).

6. The electrostatic precipitator as claimed in Claim 1, wherein said cleaning means (5) is comprised of an inner scraper (51) and an outer scraper (52) for contacting said at least one band type positive electric sheet (21), and at least one nozzle is provided on said inner scraper and said outer scraper respectively for ejecting high-speed air currents.
7. The electrostatic precipitator as claimed in Claim 1, wherein said insulated portion (71) at both sides of said at least one band type positive electric sheet (7) is provided with a multiplicity of guide holes (72) that are equidistantly spaced apart from each other and arranged in a linear manner, said guide holes (72) capable of engaging a multiplicity of cogs (81) of a drive wheel (8) of said drive means.
8. The electrostatic precipitator as claimed in Claim 1, wherein said positive electric sheet (21) is an insulated fabric with two side portions, said positive electric sheet (21) being coated with a layer of electrically conductive coating between said two side portions.
9. The electrostatic precipitator as claimed in Claim 1, wherein grounding metal plates (12) of said ionization means (1) are band type metal plates.

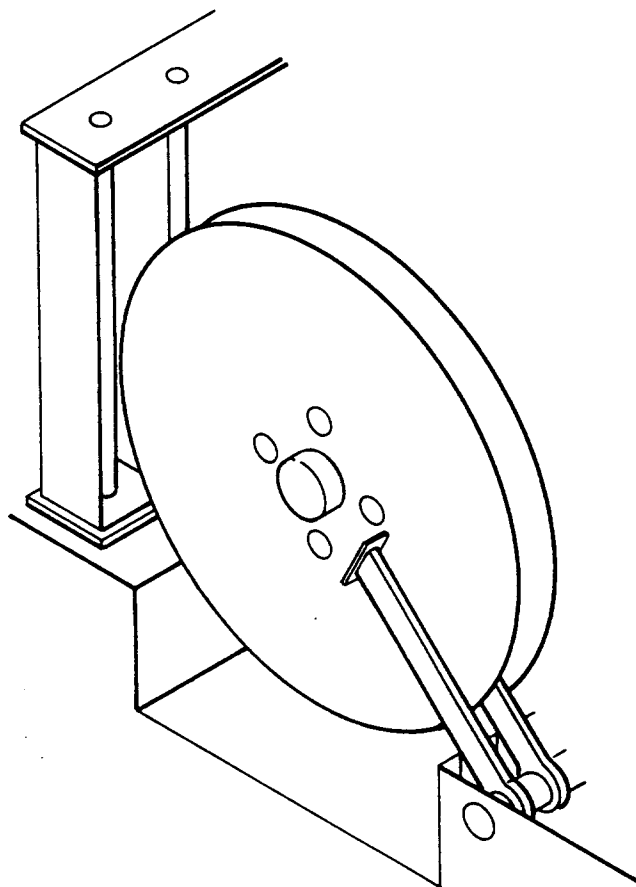


FIG. 1  
PRIOR ART

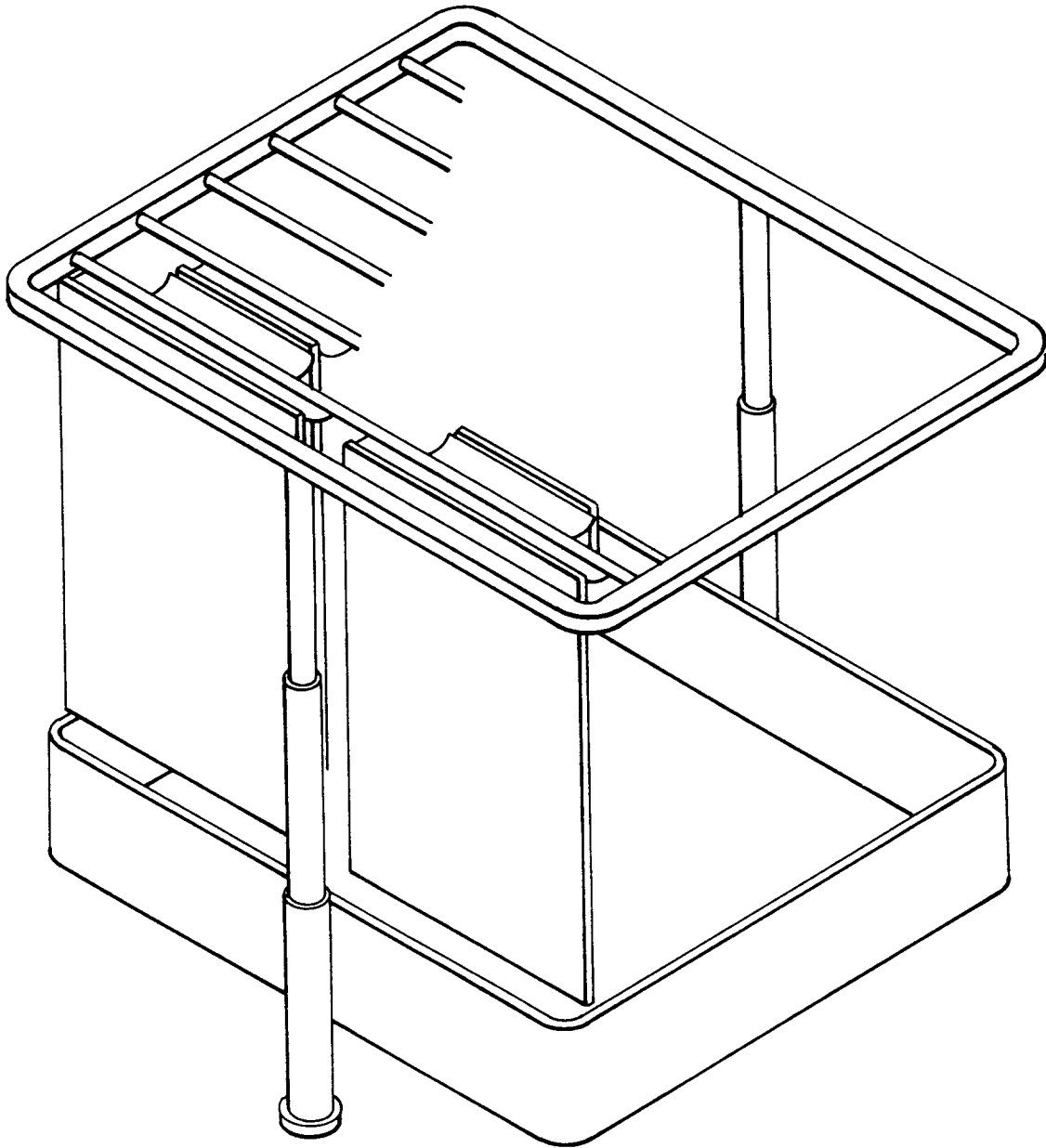


FIG. 2  
PRIOR ART

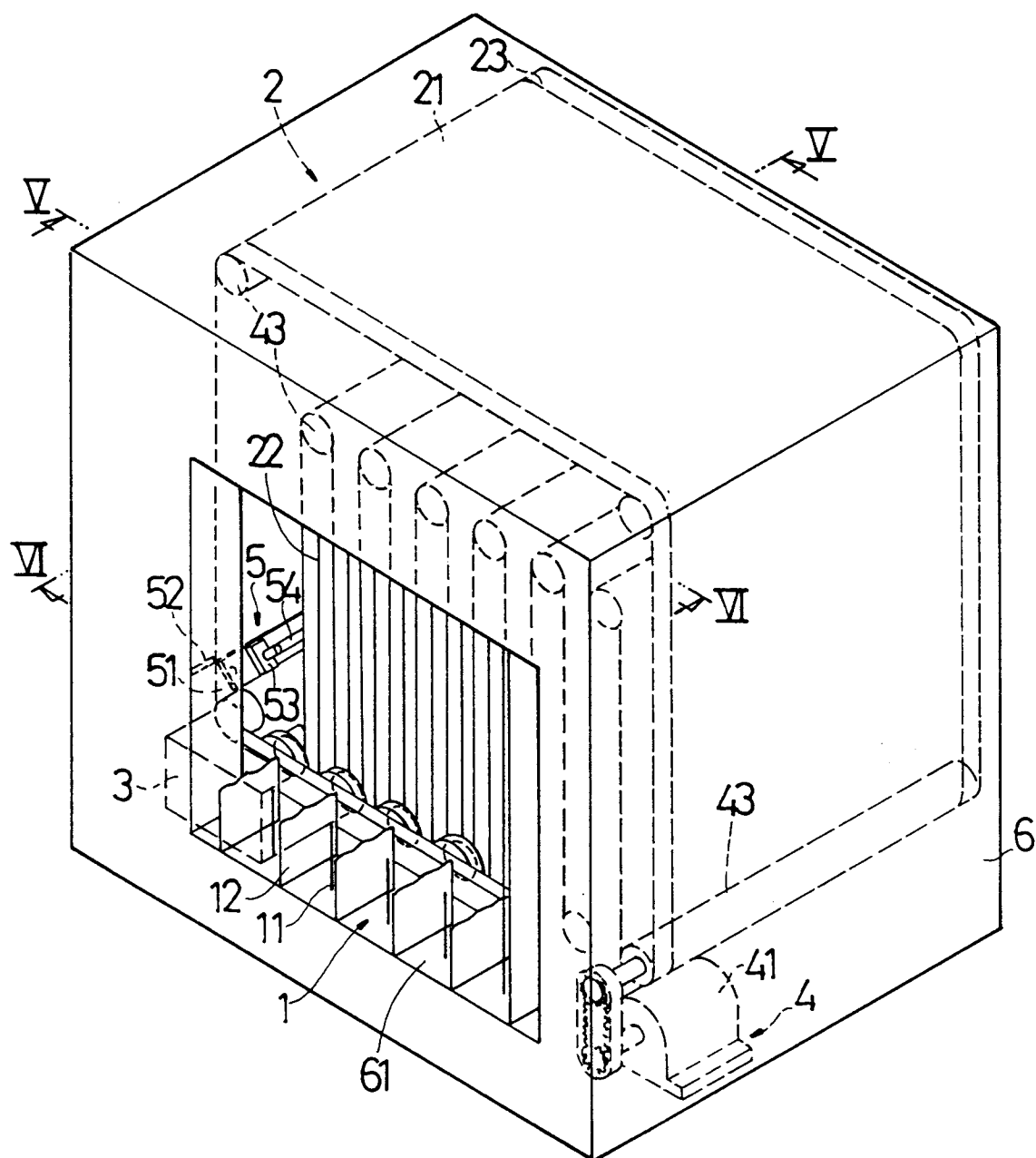


FIG . 3

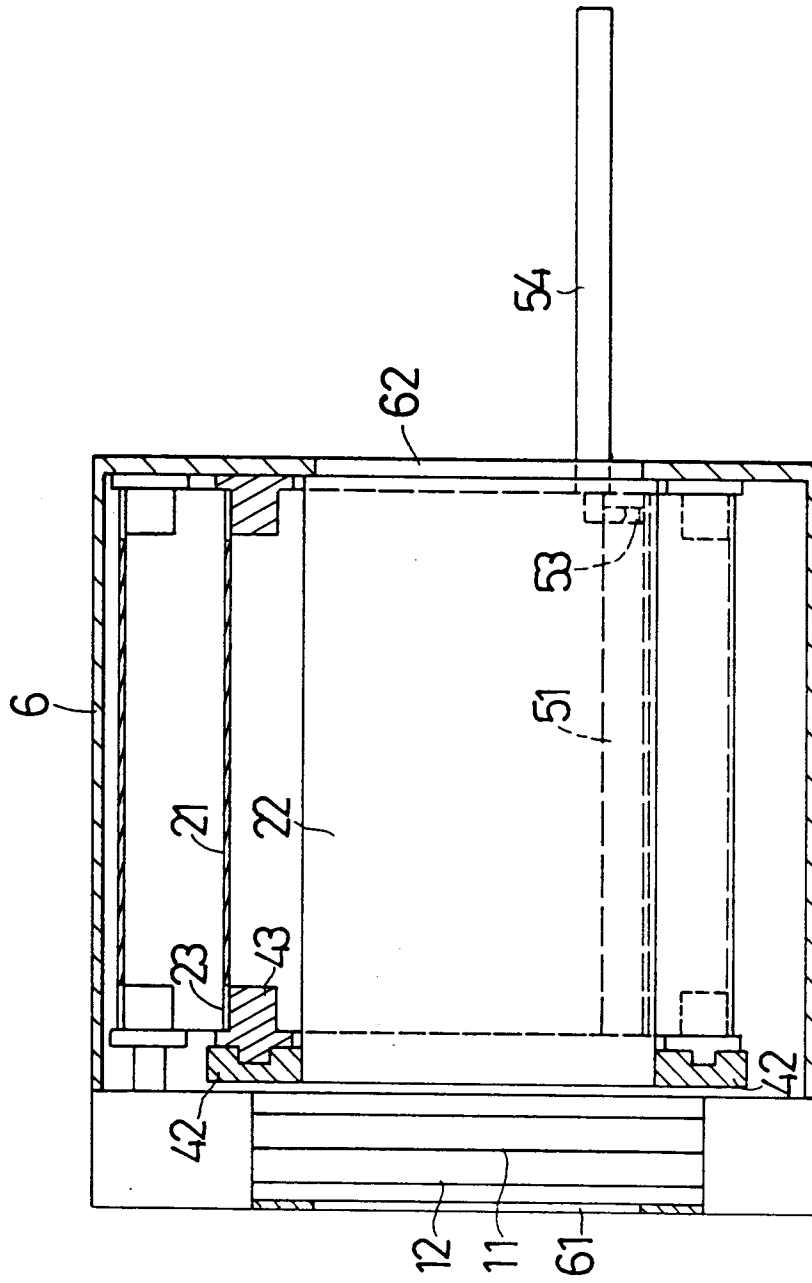


FIG. 4



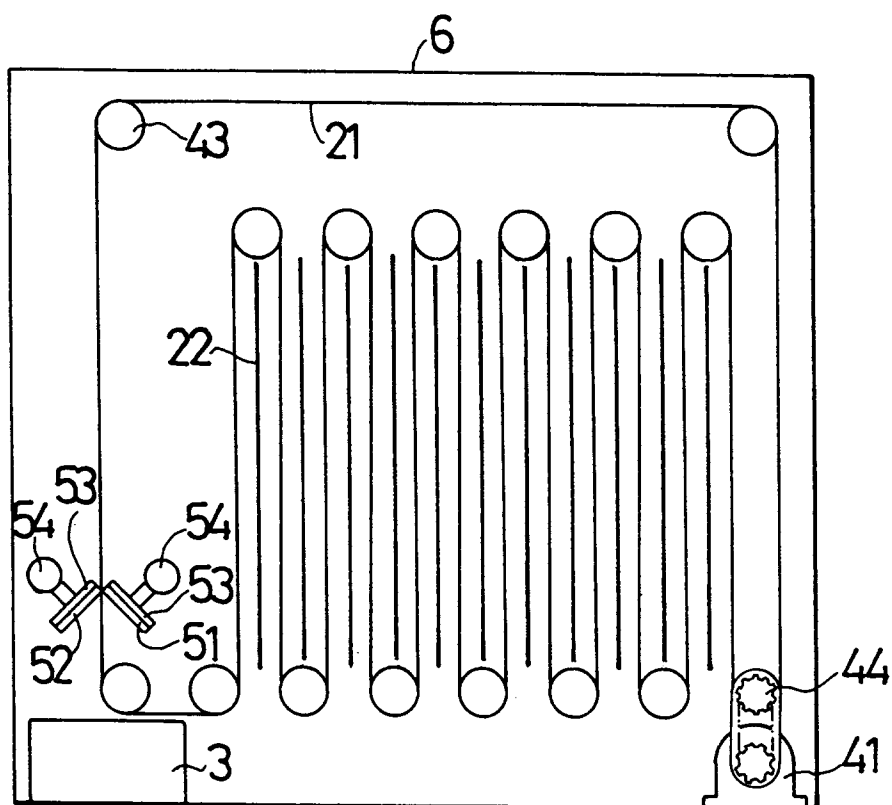


FIG. 5

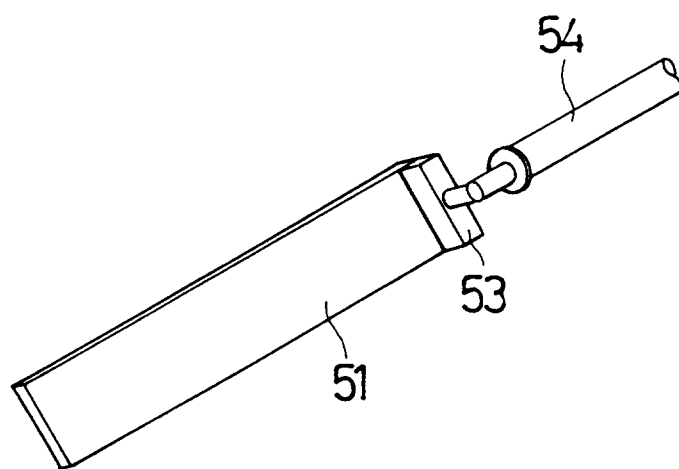


FIG. 6

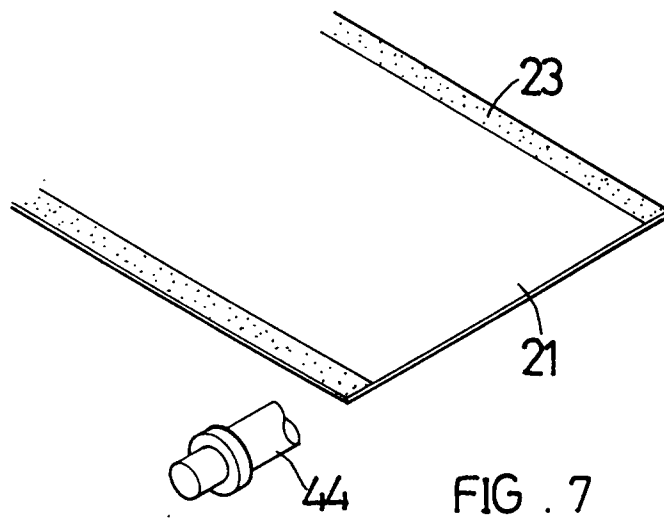


FIG . 7

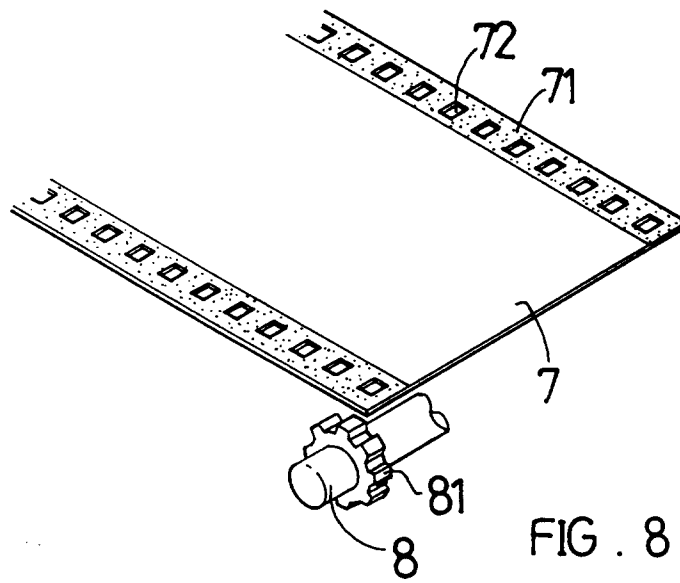


FIG . 8

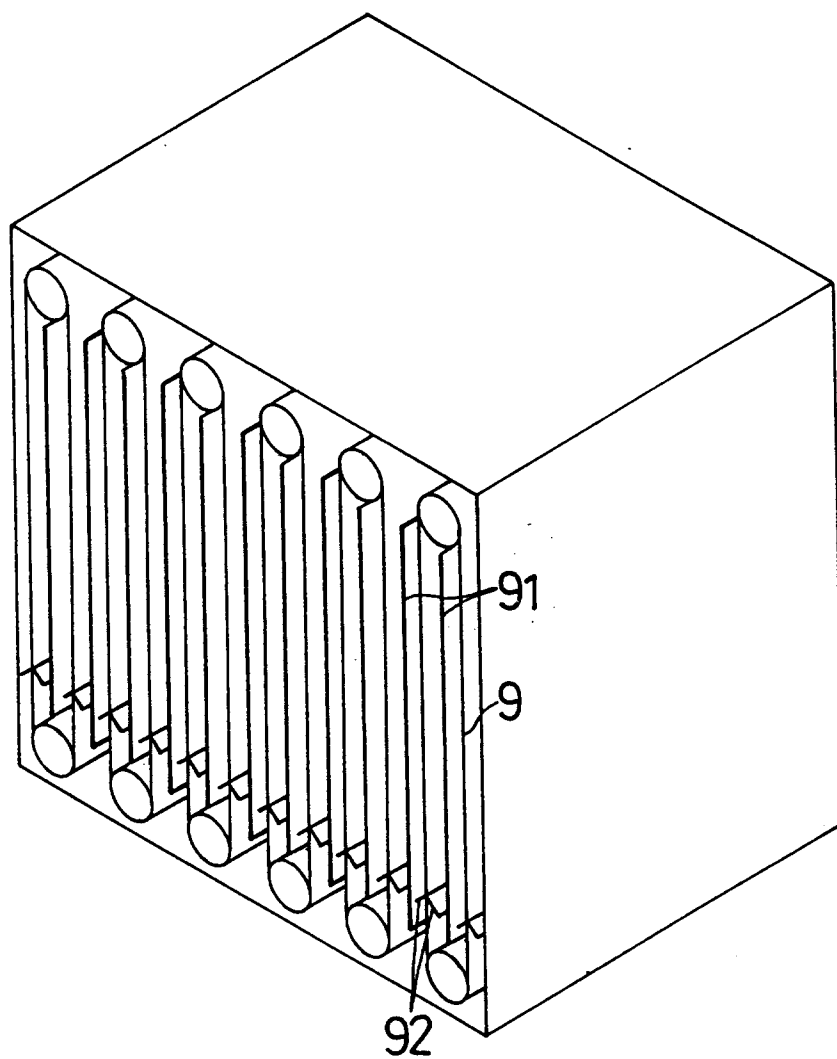


FIG. 9



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## EUROPEAN SEARCH REPORT

Application Number  
EP 96 30 5784

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)
X	DE-A-31 08 587 (HITACHI PLANT ENG & CONSTR CO) 14 January 1982 * page 12, paragraph 8 - page 13, paragraph 1 * * page 20, paragraph 2 - page 22, paragraph 1; claims 1,9,11; figures 1,2,6,7 * * page 19, paragraph 1 * ---	1,4,9	B03C3/74 B03C3/10
A	DE-A-34 18 112 (BBC BROWN BOVERI & CIE) 21 November 1985 * claims 1-3; figure 1 * ---	1-3	
A	WO-A-91 09679 (LOUISIANA PACIFIC CORP) 11 July 1991 * page 4, line 16 - page 6, paragraph 1 * * page 7, line 5 - line 9; figures 1-3 * ---	1,3-5,8	
A	US-A-4 065 275 (KIKUCHI YOSIO ET AL) 27 December 1977 * claim 1; figure 3 * ---	1,5	
A	EP-A-0 703 006 (CHANG CHIN CHU) 27 March 1996 ---		
A	US-A-5 437 713 (CHANG CHIN CHU) 1 August 1995 -----		
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		5 December 1996	Decanniere, L
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document			

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