(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 598 294 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
23.11.2005 Bulletin 2005/47

(51) Int Cl.[7]: **B65H 3/52**, B65H 3/06

(21) Application number: **05008405.2**

(22) Date of filing: **18.04.2005**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR LV MK YU

(30) Priority: **18.05.2004 JP 2004147807**

(71) Applicant: **KABUSHIKI KAISHA TOSHIBA**
Tokyo 105-8001 (JP)

(72) Inventor: **Nishimura, Takanobu**
Tokyo 105-8001 (JP)

(74) Representative: **Kramer - Barske - Schmidtchen**
European Patent Attorneys
Patenta
Radeckestrasse 43
81245 München (DE)

(54) Sheet processing apparatus

(57) A sheet processing apparatus takes out postal matters that are inserted by a take-out roller, and separates them in sheets by a feed roller (21) and a reversing roller (22), and feeds into the apparatus. A cleaning roller (27) having rubber sponges having foamed vesicles in mean diameter 50 to 500 μm is provided to the feed roller (21) in contact with it. Paper-dusts on the surfaces of the feed roller (21) and the reversing roller (22) are removed by driving this cleaning roller (27) to rotate at a velocity equal to or higher than a rotating speed of the feed roller (21).

EP 1 598 294 A2

Description

FIELD OF THE INVENTION

[0001] This invention relates to a sheet processing apparatus that is provided with a cleaning roller to remove paper-dust adhered to members to contact sheets in a sheet processing apparatus such as, for example, a postal matter processing apparatus, a banknote processing apparatus and the like.

DESCRIPTION OF THE BACKGROUND

[0002] In recent years, a sheet processing apparatus such as a postal matter processing apparatus, a banknote processing apparatus, etc. is provided with devices to take out sheets one by one from a bundled state in a take-out portion as disclosed in the Japanese Patent Application Publication No. 2003-81461. Such take-out devices are broadly divided into a friction type using a rubber roller and a suction type using a suction drum. In a friction type take-out device using a rubber roller, more than two sheets may be taken out and are supplied into a sheet processing apparatus after separated into a single sheet.

[0003] In such the sheet take-out device, the frictional force of the rubber roller surface largely affects the sheet processing capacity and it is therefore important to keep a frictional coefficient of the rubber roller surface always stable.

[0004] However, in a postal matter processing apparatus or a banknote processing apparatus for processing sheets at a high-speed, fabrics on sheet surfaces come apart violently and paper-dust is generated in large amounts. Paper-dust generated tends to adhere to paper feeding rubber rollers of high frictional coefficient. When paper-dust is adhered to the rubber roller surface, its frictional coefficient drops sharply. As a result, such a trouble is generated as it becomes difficult to take out sheets one by one as explained above.

SUMMARY OF THE INVENTION

[0005] An object of this invention is to provide a sheet processing apparatus that is capable of efficiently cleaning paper-dust adhered to such sheet conveying means as a take-out roller, a feed roller, a conveying roller, a conveying belt, etc.

[0006] According to the embodiment of this invention, there is provided a sheet processing apparatus comprising conveying means for conveying sheets in contact with them; processing means for performing a specified process of the sheets conveyed by the conveying means; and a cleaning roller of which surface is formed of a porous material to remove paper-dust from the surface of the conveying means by rotating in contact with the conveying means.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. 1 is a top view of the rough construction of a postal matter processing apparatus showing a face culler canceller (a post-office stamp)that is a part of the postal matter processing apparatus in an embodiment of this invention;

[0008] FIG. 2 is a rough construction diagram showing the vicinity of a take-out portion of the face culler canceller (the post-office stamp) shown in FIG. 1;

[0009] FIG. 3 is a top view showing the state where one sheet of postal matter fed between a feed roller and a reversing roller;

[0010] FIG. 4 is a top view showing the state where two sheets of postal matter are fed between the feed roller and the reversing roller;

[0011] FIG. 5 is a conceptual diagram of the experiments conducted for the paper-dust collecting capacity of a sheet of paper and a roller shaped member;

[0012] FIG. 6 is a graph showing the results of the experiments conducted for the materials or roller and paper-dust gatherring capacity;

[0013] FIG. 7 is a graph showing the relationship between diameter of vesicle of sponge and weight of paper-dust gatherring amount;

[0014] FIG. 8 is a conceptual diagram showing a usage pattern of a feed roller, a reversing roller and a cleaning roller; and

[0015] FIG. 9 is a graph showing the results of the experiments conducted for the relative rotational speed of the feed roller and the reversing roller (a peripheral speed difference of rollers) and a gathering rate of paper-dust.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0016] The embodiment of this invention applied to a postal-matter processing apparatus will be explained below referring to the attached drawings as an example of a sheet processing apparatus to realize this invention.

[0017] FIG. 1 is a top view showing the rough construction of a face culler canceller 1 of a sheet processing apparatus involved in the embodiment of this invention, which cancels postal indicias such as stamps pasted on postal matters P, sorts and stacks them.

[0018] Face culler canceller 1 is composed of an insert port 2, a take-out portion 4, an inspection portion 5, a rejection stacker 6, detectors 7a and 7b, a reversing portion 8, a sealing portion 9, and a sorting stacker 10. Postal matters P (sheets) that are subjects for processing are inserted into insert portion 2 in the arranged state in the upright position. In take-out portion 4, plural postal matters P inserted in the stated of the upright position through insert portion 2 are taken out on a conveying route 3 in order from postal matters at the end in the stack position one by one. Inspection portion 5 inspects postal matters P taken out on conveying route 3 for postal matters containing foreign matters and irregular-size

postal matters. Postal matters that are judged to contain foreign matters/in irregular-size by inspection portion 5 are stacked in reject stacker 6. Inspection portions 7a and 7b detect postal indicias pasted on the surfaces of postal matters P passed through inspection portion 5 and judged to be normal postal matters that can be processed. In reversing portion 8, postal matters P are turned over upside down selectively based on the detection result in inspection portions 7a and 7b. In sealing portion 9, postal indicias pasted on postal matters P passed through reversing portion 8 are stamped as necessary. Sorting stacker 10 is composed of sorting boxes 10a to 10f and postal matters P are sorted and stacked in sorting boxes 10a to 10f according to the detection results by detectors 7a and 7b. Detectors 7a and 7b, reversing portion 8 and sealing portion 9 partially comprise the processing means to make the face culler cancellation.

[0019] Face culler canceller 1 displays various operational guides to operator and an operation panel 11 to accept various operating inputs made by operator is provided near insert portion 2.

[0020] In insert portion 2, plural postal matters P are housed in the state of upright position with the long side in contact with the base. Postal matters P inserted through insert portion 2 are inserted in the loose upside-down and front/back state. Insert portion 2 has a backup plate 2a to press all housed postal matters P toward take-out portion 4 along their stacking direction.

[0021] Take-out portion 4 takes out postal matters inserted into insert portion 2 from the most remote end at the opposite side of pickup plate 2a on conveying route 3 one by one. On conveying route 3 extending from take-out portion 4 to sorting stacker 10, there are a branch gate 12 for branching conveying route 3 to reject stacker 6, a branch gate 13 for sorting postal matters P passing through reversing portion 8 in two directions, and sorting gates 14a to 14e for branching conveying route 3 to six sorting boxes 10a to 10f of sorting stacker 10.

[0022] The details of the vicinity of take-out portion 4 of face culler canceller 1 will be explained referring to FIG. 2.

[0023] In FIG. 2, supplied postal matters P are pressed to a take-out roller 20 side by backup plate 2a (not shown in FIG. 2) and a postal matter P at the most remote side is supplied to a feed roller 21 side by take-out roller 20. A reversing roller (a separation roller) 22 that will be described later is provided facing to feed roller 21. Conveying roller pairs 23 and 24 are provided at the inner side from feed roller 21 in the apparatus to convey postal matters P to inspection portion 5.

[0024] A cleaning roller 27 that is described later is provided to rotate in contact with take-out roller 20, feed roller 21 and conveying rollers 23, 24.

[0025] How to separate postal matters P will be explained referring to FIG. 3 and FIG. 4. In take-out portion 4, postal matters P are supplied to roller 21 side by take-out roller 20 that is positioned at one end of stacked postal matter bundle P. When only one postal matter P is supplied as shown in FIG. 3, reversing roller 22 is turned jointly with postal matter P1 and rotated (normal rotation) in the same direction as the feeding direction of postal matter P1. FIG. 4 is a diagram showing a case wherein two postal matters are taken out by take-out roller 20. In this case, reversing roller 22 rotates in the reverse direction and pushes back a second postal matter P2. After a sensor (not illustrated) detects that a first postal matter P1 passed completely, second postal matter P2 is sent to feed roller 21. When this postal matter P2 is one sheet, reversing roller 22 is rotated again in the normal direction. Thus, only one postal matter is always taken out. The normal/reverse rotation of reversing roller 22 is switched by a torque limiter 25. That is, torque limiter 25 is provided to the shaft portion of reversing roller 22. When postal matter P1 is only one sheet, a prescribed force is transmitted to reversing roller 22 from feed roller 21 through postal matter P1 and torque limiter 25 is idling and reversing roller 22 is rotated jointly in the normal direction. On the other hand, when two sheets of postal matter P are taken out, a conveying force of relatively small frictional coefficient between paper sheets only is transmitted to the second postal matter P2 and therefore, torque limiter 25 of reversing roller 22 acts to reverse rotate reversing roller 22. Further, when there is no postal matter and feed roller 21 contacts reversing roller directly, the frictional coefficient between rollers is high and torque limiter 25 idles and reverse roller 22 is rotated jointly with feed roller 21.

[0026] Next, selection of materials for cleaning paper-dust is explained. FIG. 5 is a conceptual diagram showing the experiment made for a paper-dust gatherring capacity of a sheet of paper 50 using a roller-shape member. After sliding a roller 51 rotating at a constant speed with a constant load applied on sheet of paper 50 moving at a constant speed, weights of paper-dust on the surface of roller 51 were measured. Paper-dust weights were measured on roller 51 using various rubber sponges, rubbers, nylon sponges, nylon brushes, leathers and nonwoven clothes, respectively. Materials in hardness within the ranges of HA20 to HA90 (JIS K 6253 Type A) were evaluated. As seen from FIG. 6 showing the results of experiments, paper-dust collection capacity is excellent in rubber sponge, nonwoven cotton cloth and nonwoven rayon cloth and it was revealed that soft materials have especially high paper-dust collecting capacity.

[0027] The relationship of vesicle diameter of sponge with gathered paper-dust weights was examined. As seen from FIG. 7 showing the examined results, it was revealed that gathered paper-dust weights were much in a range of diameter of vesicle 50 to 500 μm of sponge and extremely less at diameter of vesicle 10 μm and 1000 μm. When the paper-dust adhered state was observed through an optical microscope, it is confirmed that paper-dust is captured and adhered in sponge vesicles. Cellulose fibers that are principal component of

paper-dust are 10 to 50 μm in diameter and 0.5 to 4 mm in length. Therefore, this is considered because the catch-up rate of paper-dust becomes low when sponge vesicles are smaller than 50 μm, and the sponge surface becomes rough when sponge vesicles are larger than 500 μm.

[0028] As a result of the experiments described above, it was found that rubber sponge in hardness HA50 (JIS K 6253 Type A) and mean vesicle diameter 50 to 500 μm is adequate as a material for a cleaning roller.

[0029] Next, a using pattern of cleaning roller 27 will be described. FIG. 8 is a conceptual diagram showing the using pattern of feed roller 21, reversing roller 22 and cleaning roller 27 described above. In FIG. 8, feed roller 21 and reversing roller 22 are kept in contact with each other except a time when a postal matter P passes. Paper-dust falling from postal matter P is adhered to the surfaces of both rollers of feed roller 21 and reversing roller 22. FIG. 9 shows the results of experiment to examine to which roller of feed roller 21 and reversing roller 22 in contact with each other paper-dust adhered on their surfaces moved when a relative rotational speeds of both rollers (a difference in roller peripheral speeds) were optionally changed. It was cleared that when a relative speed difference becomes large, paper-dust was concentrated on the roller at a high-speed rotating side but weights of paper-dust adhered on both rollers tend to be divided equally.

[0030] That is, in the case of reversing roller 22 shown in FIG. 8, paper-dust is adhered much to reversing roller 22 side that is mainly sliding together with postal matter P immediately after postal matter P passed. However, when two rollers of both feed roller 21 and reversing roller 22 are joint turned at a high-speed after postal matter passed, paper-dust is divided on both rollers almost equally 2, 3 seconds later. Cleaning roller 27 is in contact with feed roller 21 and driven to turn at a higher speed than feed roller 21. Accordingly, paper-dust adhered to feed roller 1 is collected to cleaning roller 27 and paper-dust attached to reversing roller 22 is also collected to cleaning roller 27 through feed roller 21 and cleaned simultaneously.

[0031] In a case wherein a large volume of paper-dust is generated in a short time as in a postal matter processing apparatus, cleaning roller 27 is covered by paper-dust in several hours.

Cellulose fibers are captured mechanically in sponge vesicles of cleaning roller 27 and therefore, paper-dust will not drop from cleaning roller 27 when two rollers are rotating jointly. Feed roller 21 and reversing roller 22 are cleaned with the driving of the apparatus and a paper-dust layer is formed on the surface of cleaning roller 27. This paper-dust layer becomes a nonwoven cotton (cellulose fiber) cloth roller in a manner. Because of this, as can be presumed from a graph shown in FIG. 6, a nonwoven cotton cloth is high in paper-dust gatherring performance and even when a paper-dust layer is formed on the surface of cleaning roller 27, its paper-dust gatherring performance does not drop. Further, the increased diameter of cleaning roller 27 by paper-dust is absorbed by the elastic deformation of sponge.

[0032] The diameter of cleaning roller 27 is increased gradually by a paper-dust layer. In order to limit the amount of this increase in the diameter, a scraping plate 28 is provided at a position separated by a fixed space from cleaning roller 27 as shown in FIG. 8. As a result of this scraping plate attached, paper-dust adhered to cleaning roller 27 is scraped off by scraping plate 28 when cleaning roller 27 is rotated. Further, the paper-dust layer can be peeled off easily with a tooth brush or other cleaning jigs, and a frictional coefficients of feed roller 21 and reversing roller 22 can be maintained for an extended period without dropping the take-out efficiency when cleaning roller 27 is cleaned in a periodic maintenance work.

[0033] Further, in the above embodiment, feed roller 21 and reversing roller 22 are explained. Cleaning roller 27 may be provided so as to rotate in contact with take-out roller 20, conveying roller 23 and further, conveying belt 24 as shown in FIG. 2. It is clear when providing conveying roller 23 and conveying belt 24, it is effective to install a cleaning roller to both of two conveying rollers and the conveying belt which are rotating in contact with each other.

[0034] In the above embodiment, the apparatus is explained by taking an example of the take-out roller as a friction roller. It is also possible to make the take-out roller as a suction take-out device using a suction drum for a take-out unit. In this case, a cleaning roller is provided only to such a conveying means as conveying roller, conveying belts, etc. When a cleaning roller is provided in contact with a conveying roller/a conveying belt, etc., a cleaning roller should be driven to rotate with a relative velocity difference between peripheral velocities of conveying roller and conveying belt as described above.

[0035] Further, in the embodiment described above, the apparatus is explained by taking postal matters as an example but it can be also applicable to such processing apparatus as a banknote processing apparatus, a copier, a printer, etc.

[0036] This invention is not restricted to the embodiment described above but, needless to say, it can be modified variously without departing from the scope thereof.

[0037] According to this invention, it is possible to provide a sheet processing apparatus that is capable of efficiently cleaning paper-dust attached to conveying means such as a take-out roller, a feed roller or a conveying roller, a conveying belt, etc.

It is explicitly stated that all features disclosed in the description and/or the claims are intended to be disclosed separately and independently from each other for the purpose of original disclosure as well as for the purpose of restricting the claimed invention independent of the composition of the features in the embodiments

and/or the claims. It is explicitly stated that all value ranges or indications of groups of entities disclose every possible intermediate value or intermediate entity for the purpose of original disclosure as well as for the purpose of restricting the claimed invention, in particular as limits of value ranges.

Claims

1. A sheet processing apparatus comprising:

conveying means (20, 21, 22, 23) for conveying sheets (P) in contact with them;
processing means for performing a specified process of the sheets conveyed by the conveying means; and
a cleaning roller (27) of which surface is formed of a porous material to remove paper-dust from the surface of the conveying means by rotating in contact with the conveying means.

2. The sheet processing apparatus claimed in Claim 1, wherein the conveying means includes a take-out roller (20) to take out sheets (P) by contacting a sheet at the most far end of plural sheets supplied, and the cleaning roller (27) removes paper-dust from the take-out roller by contacting it.

3. The sheet processing apparatus claimed in Claim 1 or 2, wherein the conveying means includes a feed roller (21) to feed sheets taken out by the take-out roller into the apparatus, and the cleaning roller (27) removes paper-dust from the surface of the feed roller by rotating in contact with the feed roller.

4. The sheet processing apparatus claimed in Claim 3, wherein the conveying means includes a separation roller (22) that is press contacted to the feed roller (21) and is given with a rotational torque in the direction reverse to the sheet feeding direction to separate the sheets (P) sent out by the feed roller one by one, and the cleaning roller (27) removes paper-dust adhered on the surface of the separation roller through the feed roller.

5. The sheet processing apparatus as claimed in any of Claims 1 to 4, wherein the conveying means includes a conveying roller (23) and the cleaning roller (27) removes paper-dust from the surface of the conveying roller by rotating while contacting the conveying roller.

6. The sheet processing apparatus claimed in Claim 1, wherein the conveying means includes a conveying belt and the cleaning roller removes paper-dust from the surface of the conveying belt by rotating while contacting the conveying belt.

7. The sheet processing apparatus as claimed in any of Claims 1 to 6, wherein the porous material is a rubber sponge.

8. The sheet processing apparatus claimed in Claim 7, wherein a mean diameter of vesicles of the foamed rubber sponge is 50 to 500 μm.

9. The sheet processing apparatus claimed in Claim 7, wherein the rubber sponge is formed in a continuously foamed material.

10. The sheet processing apparatus claimed in Claim 1, wherein the cleaning roller (27) is rotated jointly with the contacting conveying means (20, 21, 22, 23) at a velocity equal to or higher than a conveying velocity of the conveying means.

11. The sheet processing apparatus claimed in Claim 1 further comprising:

a scraping plate (28) provided by separating for a specified distance from the cleaning roller (27) for limiting volume of paper-dust attached to the cleaning roller to a specified volume.

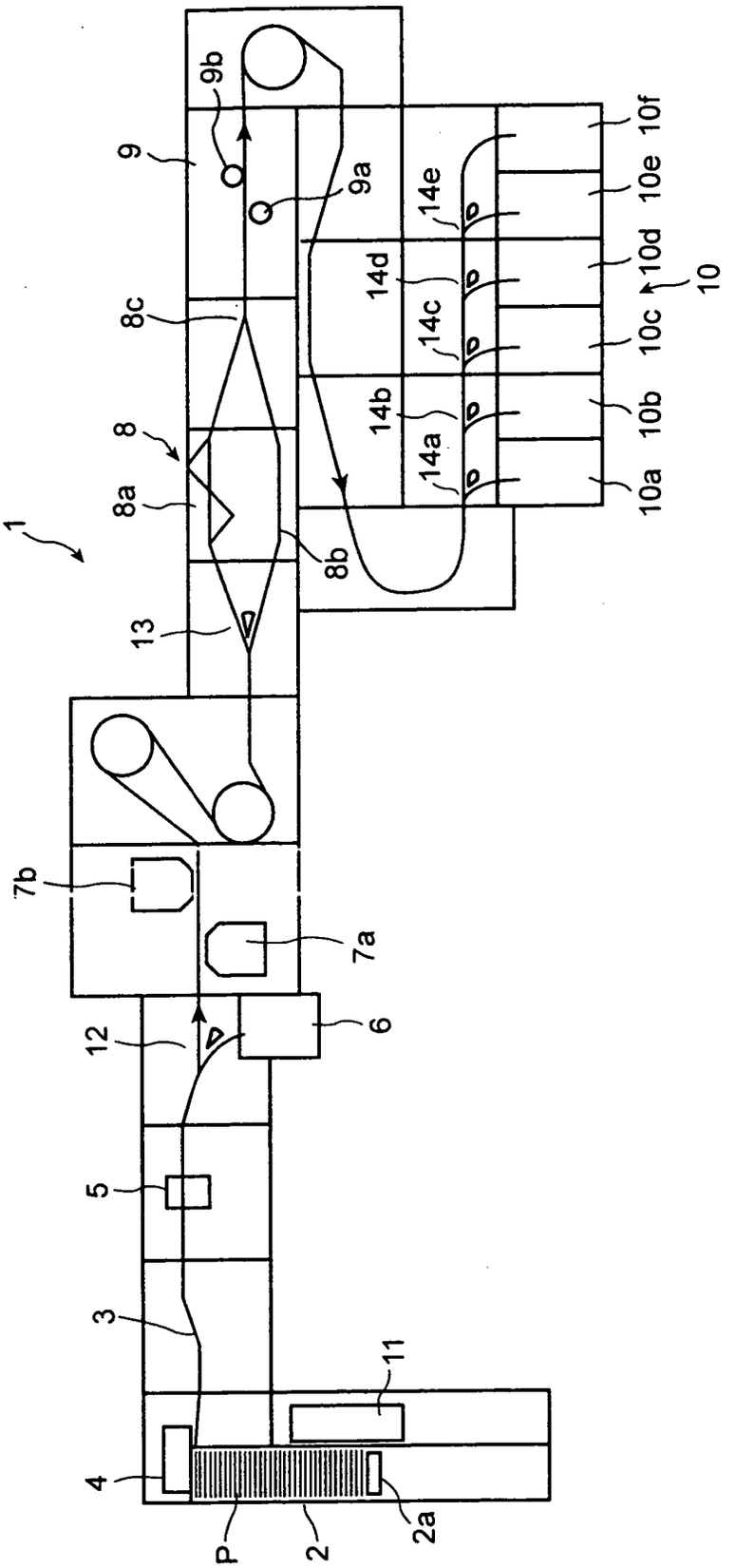
1
2
2a
3
4
5
6
7a
7b
8
8a
8b
8c
9
9a
9b
10
10a
10b
10c
10d
10e
10f
11
12
13
14a
14b
14c
14d
14e
P

FIG. 1

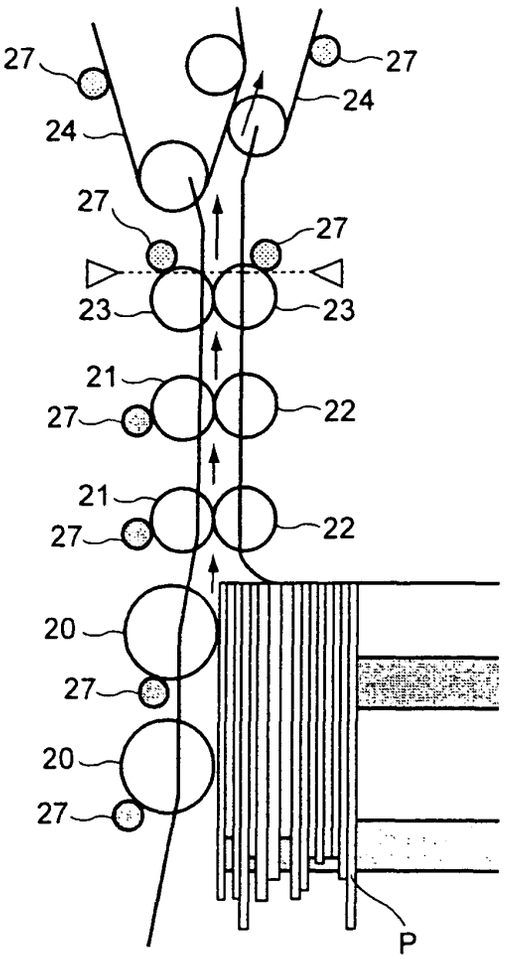

FIG. 2

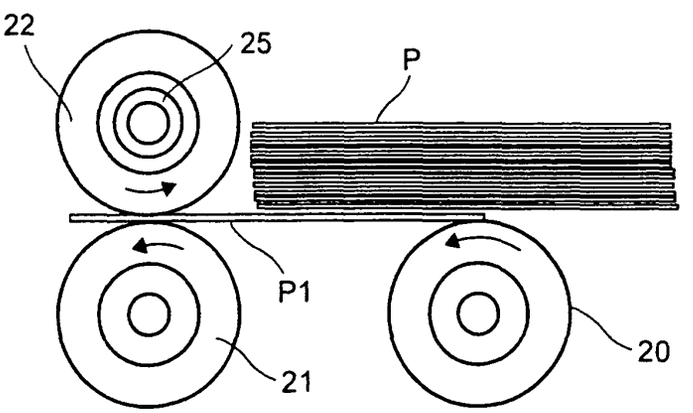

FIG. 3

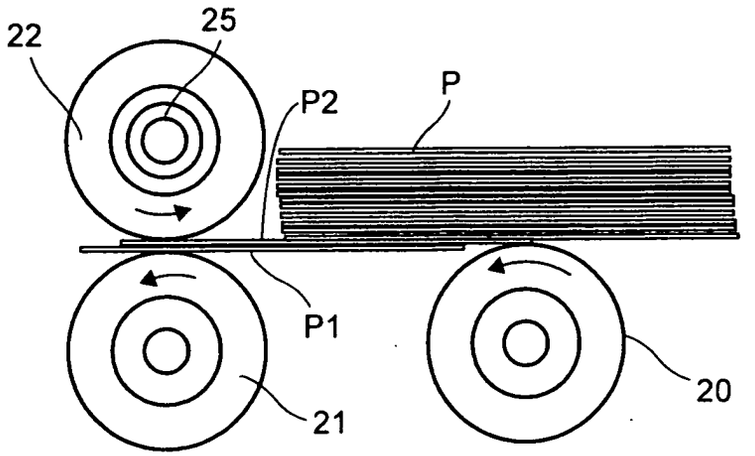

FIG. 4

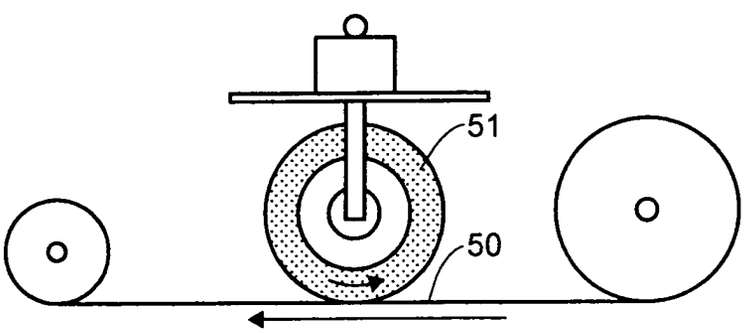

FIG. 5

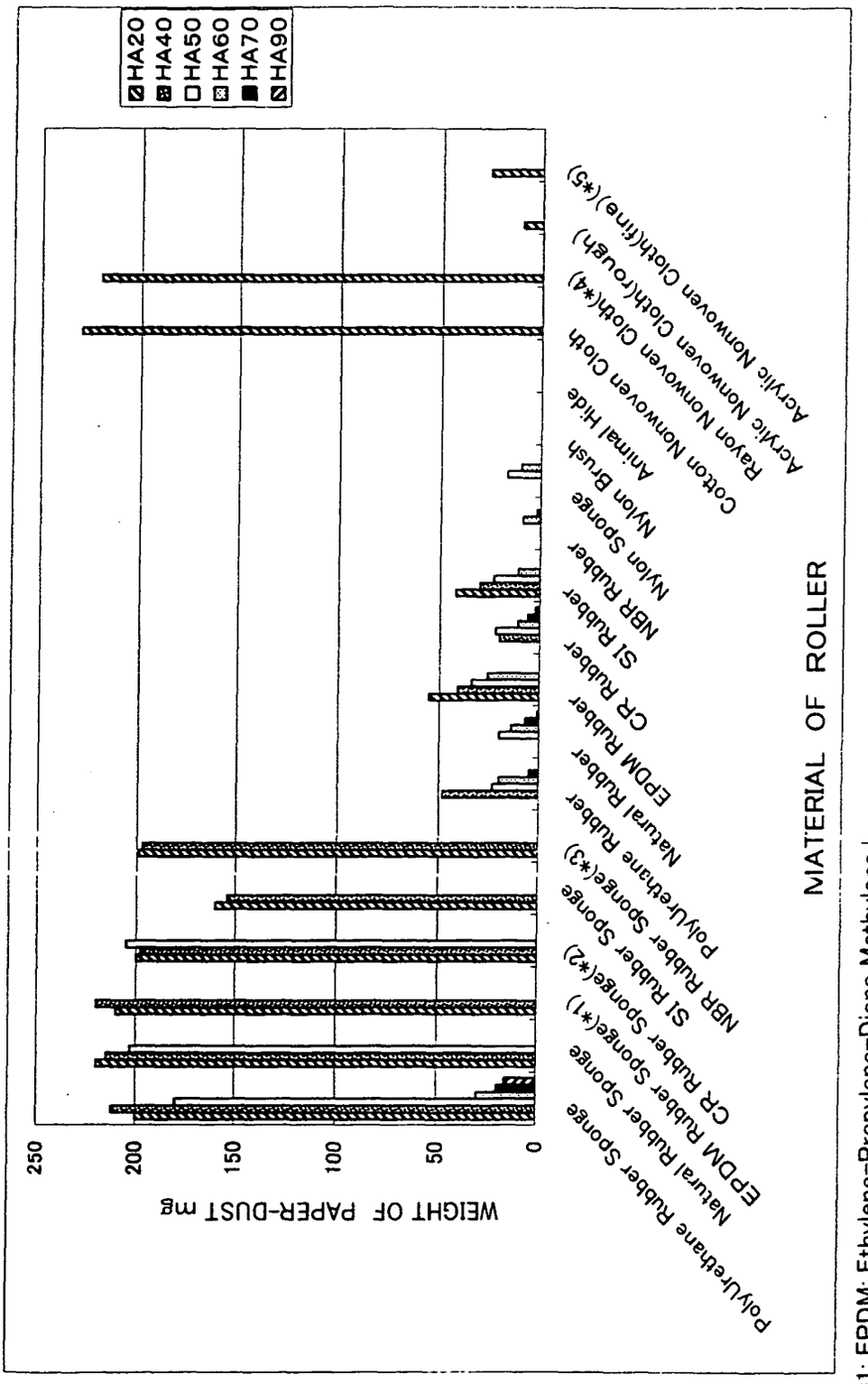

FIG. 6

*1: EPDM: Ethylene-Propylene-Diene Methylene
*2: CR: Chloroprene-Rubber
*3: NBR: Nitrile Butadiene Rubber
*4: polyacrylic fiber
*5: polyacrylic fiber

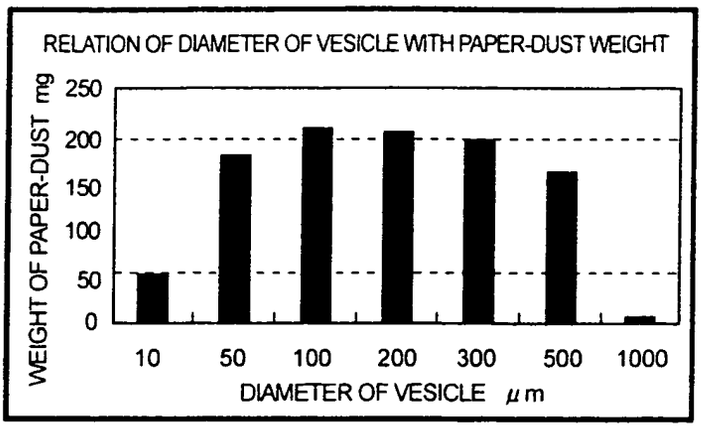
RELATION OF DIAMETER OF VESICLE WITH PAPER-DUST WEIGHT
WEIGHT OF PAPER-DUST mg
250
200
150
100
50
0
10
50
100
200
300
500
1000
DIAMETER OF VESICLE μm

FIG. 7

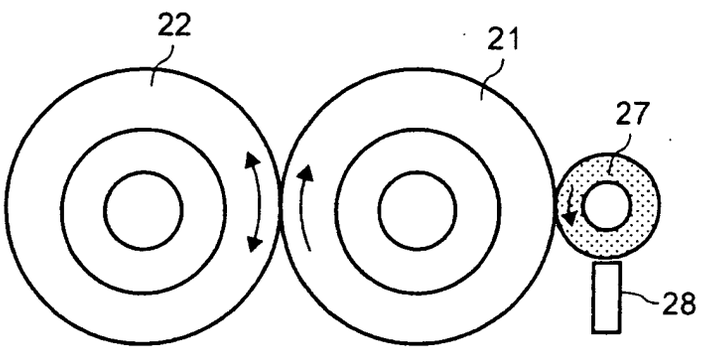
22
21
27
28

FIG. 8

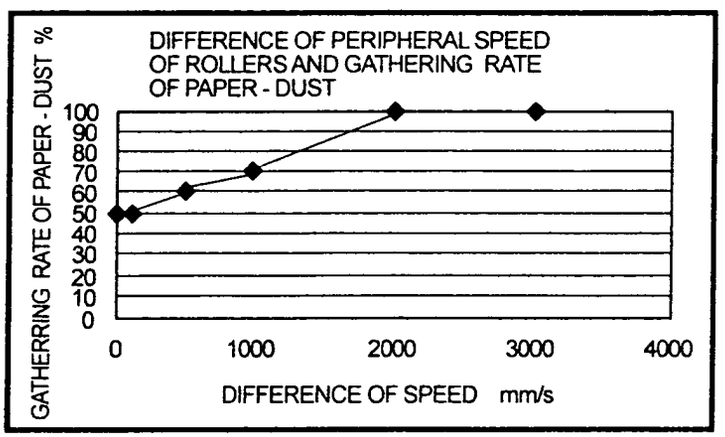
DIFFERENCE OF PERIPHERAL SPEED
OF ROLLERS AND GATHERING RATE
OF PAPER - DUST
GATHERRING RATE OF PAPER - DUST %
100
90
80
70
60
50
40
30
20
10
0
0
1000
2000
3000
4000
DIFFERENCE OF SPEED mm/s

FIG. 9