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(71) Applicant: **COMMONWEALTH SCIENTIFIC AND
INDUSTRIAL RESEARCH ORGANISATION**
Campbell, ACT 2601 (AU)

(72) Inventors:
• **Robinson, Gary Alfred**
Anglesea 3230, Victoria (AU)

• **Atkinson, Kenneth Ross**
Highton 3216, Victoria (AU)
• **Harrowfield, Barry Valentine**
Belmont 3216, Victoria (AU)

(74) Representative: **Senior, Alan Murray**
J.A. KEMP & CO.,
14 South Square,
Gray's Inn
London WC1R 5LX (GB)

(54) Removal of contaminant waste in textile carding

(57) Apparatus for removing contaminants such as a vegetable matter from a travelling fibre web (5), including:

a roller (18) adapted to support and convey the travelling fibre web (5);
means (33) on the roller to enhance exposure of

contaminants from the web;
means (30) to cyclically strike and dislodge contaminants from the web, while a gaseous flow is disposed about the contaminants; and
duct means (34) for receiving said flow and conducting it away from the web (5) with the dislodged contaminants entrained therein.

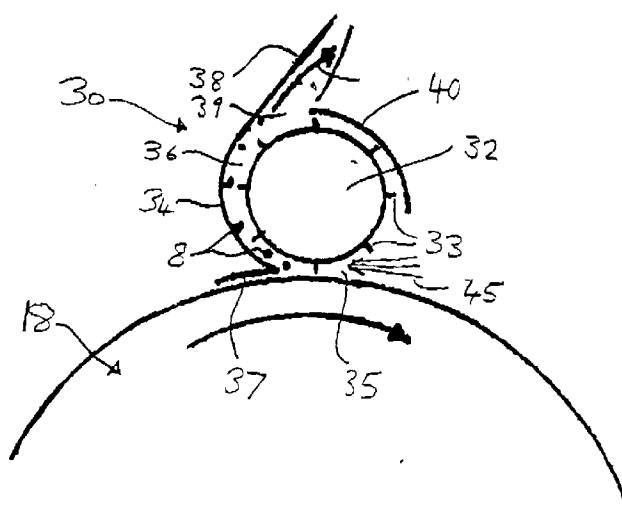


FIG 2

EP 0 770 715 A1

Description

This invention relates to the removal of contaminant waste in textile carding and is particularly useful in high speed wool carding involving web speeds of 120 m/min or greater.

It has been established that worsted card productivity may be substantially increased without detriment to sliver quality or card yield by substantially increasing the card speed above the conventional level. This was proposed in a paper by Gravalin *et al*, "Doubling or even tripling worsted card productivity", Proceedings of the Textile Institute Annual World Conference, Sydney, 1988, and a commercial worsted carding machine has recently been offered in which web speeds of the order of 120 m/min are achieved.

Carding machines are commonly referred to as "cards", and this convention will be adopted herein.

Vegetable matter (VM) is a contaminant in wool that demands efficient removal. This is best achieved as early in the process as practical so that the contaminant particles are removed as whole pieces before they are broken up by the later processes. The conventional approach has been the morel units of the carding machine, and two of these are traditionally fitted between the breast and the swift in the industrial card. The main cylinder of the morel unit, known as the morel roller, is clothed with a wire of a special profile which tends to leave the particles of vegetable matter sitting proud of the wool above the wire. A rotating hollow burr beater roller has blades which strike the particles and sweep them into an associated tray attachment along which a further train of blades scrapes the particles along and to one end of the tray, and thence into a waste disposal system.

Initial attempts to simply speed up the burr beaters to match increased morel speed proved not to be feasible because of inherent resonance related limitations on the speed of the burr beaters. This difficulty was overcome by fitting each morel with a pair of burr beater rollers and associated tray attachments, as disclosed in international patent publication WO91/09164. French patent publication 2232626 also discloses a vegetable matter removal unit for a textile card in which an enlarged morel roller accommodates a pair of burr beaters separated by a reverse worker/stripper carding unit which functions to invert the web on the morel wire to bring the shives and burrs that lie on the inside of the web at the first burr beater to the outside of the web for dislodgment by the second burr beater. A still earlier disclosure of a double burr beater arrangement is to be found in German patent 150650.

While the adoption of double burr beater morels allowed high carding speeds to be achieved, there was a downside in that the diameter of the morel roller has to be significantly increased, for example from 500 to 900mm, to accommodate two sets of burr beaters and their associated trays. Enlargement of the morel roller

is also noted in French patent publication 2232626. As worsted cards require at least two morel units, this means an undesirable increase in the overall length of the carding machine, e.g. by 800mm or so. This increase can make fitting the higher speed machine into established carding departments very awkward since machine layout is usually such that several machines face each other with a narrow work alley between them. Further, even with the increase in morel diameter, the fitting of the two burr beaters and their associated trays to the morel roller makes for operational problems, e.g. limited access making maintenance and changes to settings difficult. Moreover, to minimise this effect, the increase in morel roller diameter is kept to a minimum, and this in turn means the burr beater rollers and their associated trays and scrapers are crowded together into a minimum arc of the morel roller.

In general, with conventional burr beaters units, the scraper blades have a tendency, even at conventional carding speeds, to become jammed due to the wrapping of their working parts by the contaminants being moved, resulting in reduced efficiencies of operation and not infrequently in breakage of the component parts.

It is therefore an object of the invention to provide an improved approach to the removal of contaminants in textile carding which resolves, or at least in part, alleviates one or more of the aforementioned disadvantages.

The invention accordingly provides, in one aspect, apparatus for removing contaminants such as a vegetable matter from a travelling fibre web. The apparatus includes a roller adapted to support and convey a travelling fibre web, and means on the roller to enhance exposure of contaminants from the web. Means is further included to cyclically strike and dislodge contaminants from the web, while a gaseous flow, preferably a locally generated air stream, is disposed about the contaminants. The apparatus also includes duct means for receiving the flow and conducting it away from the web with the dislodged contaminants entrained therein.

In another aspect, the invention provides a method of removing contaminants such as vegetable matter from a travelling fibre web, including:

supporting and conveying the web while enhancing exposure of contaminants from the web;
cyclically striking and dislodging contaminants from the web, into a gaseous flow, preferably a locally generated air stream, about the contaminants; and
conducting said flow away from the web with the dislodged contaminants entrained therein.

The roller adapted to support and convey the web is preferably a morel roller, having a covering of a fine special profile wire providing said means to enhance exposure of contaminants from the web.

The means to cyclically strike and dislodge the contaminants from the web is preferably a hollow, bladed

burr beater roller, which may itself be of conventional form.

Preferably, a pair of burr beater rollers are provided on a single morel roller. Advantageously, the duct means is arranged for receiving a single gaseous flow in which are entrained the dislodged contaminants from both beater rollers. In one such arrangement, separate gaseous flows generated about each beater roller combine to form a single outflow. In an alternative arrangement, a gaseous flow generated by one beater roller is passed to and about the other beater roller and thereafter forms a single outflow.

The entrained contaminants may be recovered from the flow by passing the flow through traversing perforated belt means, on which the contaminants are deposited for lateral conveyance.

The duct means advantageously includes a housing extending adjacent the burr beater roller, which housing defines a chamber arranged to receive the flow and the entrained contaminants, and an outlet port and/or duct to which the flow is drawn or driven. There may be provided means to draw the flow from the region adjacent the supporting and conveying roller.

The invention will now be further described by way of example only with reference to the accompanying drawings, in which:

Figure 1 is a diagram illustrating in side elevation the principal working components of a worsted card modified to incorporate an embodiment of the present invention;

Figure 2 is an enlargement of one of the burr beater units represented schematically in Figure 1;

Figures 3 and 4 show two alternative configurations of double burr beater units; and

Figures 5 to 7 illustrate three modifications of the double burr beater unit of Figure 4, showing various alternative provisions for collecting and disposing of the VM waste.

The illustrated card 10 is of conventional general configuration to the extent that it includes a series of main carding cylinders including, in sequence, a licker 14, a breast 16, a pair of morels 18, 20 and a swift 22. The licker, breast and swift have the usual worker/stripper carding units 24 and transfer from the swift is to a pair of doffer rollers 26a, 26b with associated doffer blades (not shown). Each morel is associated with a pair of burr beater units 30 for removing contaminants including vegetable matter in accordance with an embodiment of the invention. The rotation of the burr beater rollers and the morels are indicated by the arrows in the diagrams. The fibre web 5 is fed along the sequence of cylinders at a higher than conventional carding speed, e.g. of the order of 120 m/min. Each worker/stripper unit 24 cooperates with the associated main cylinder in the well known manner, to open up the web and detach a mat of fibre tufts at the worker/cylinder nip and to return

the tufts to the main cylinder at the stripper/cylinder nip. The web is double doffed at rollers 26a, 26b to form web segments 5a, 5b which are subsequently converged at a cone into sliver.

With reference to Figure 2, each burr beater unit 30 includes a hollow roller 32 with angularly spaced longitudinally extending, and radially projecting blades 33. Roller 32 is disposed within a generally cylindrical complementary housing 34 which is open at 35 adjacent the morel roller. Burr beater roller 32 rotates in the same direction as the morel roller and its blades pass at high speed adjacent to the wire on the morel roller, in a direction opposite the direction of travel of the web. As previously mentioned, the vegetable matter is sitting proud of the morel wire, and blades 33 strike and dislodge the outstanding contaminant particles 8 into an arcuate space 36 within housing 34. The burr beater blades 33 simultaneously act as a fan and generate a local air flow (represented by arrows 45) into space 36 drawn in from the open front side of housing 34. A rear flap 37 sits closely adjacent the wire on the morel roller to maximise deflection of the air stream and entrained particles into chamber space 34. From here, the particles are directed tangentially through an exit opening 39 into a convergent conduit system 38 and conducted away to a collection point, which may be an entry port of an extended waste disposal duct system. The front side of housing 34 may include an adjustable segment 40 which is moveable to adjust the sides of exit opening 39. Note that the exit channel 38 may leave the housing 34 at any angle that makes for convenient positioning of the collector point.

It is of course not suggested by the inventors that conventional burr beater units did not entail the generation of an air flow by the blades of the burr beater rollers. However, the present inventors have appreciated that such air flow could be utilised, with appropriate modification of the units, to entrain and conduct the contaminant particles away from the dislodgment site, thereby obviating the need for a separate collection tray attachment and scraper blade conveyor. It is also within the scope of the invention that the lengths of the roller blades can be increased so as to increase the air flow generated by the burr beater roller.

Where two burr beaters are used on the one morel, as has been adopted in highspeed carding of wool, the configuration illustrated in Figures 1 and 2 may be simply duplicated. Alternatively, a more elegant approach may be obtained by combining the air flow and particles into a single outflow stream, leading to a further reduction in overall space requirement and only a single collection point to serve both burr beaters. Two possible such ganged configurations by which this might be achieved are illustrated in Figures 3 and 4, in which like components are depicted by like primed reference numerals. In the arrangement shown in Figure 3, separate gaseous flows generated about each beater roller combine to form a single outflow in collection duct 38'. In the

case of Figure 4, the distance between the two burr beater rollers has been reduced to a minimum and the air flow and entrained contaminant particles removed by the second burr beater, relative to the direction of travel of the fibre web, pass into the nip between the other burr beater roller and the morel roller, from which a combined air stream with entrained contaminant particles passes about the other beater roller and thereafter forms a single outflow in collection duct 38".

By virtue of the configurations shown in Figures 3 and 4, with optimum VM recovery provision, the diameter of the morel roller can be minimised, and can be held, for example, in the traditional range of 350-550mm.

Figures 5 to 7 depict options for collection and disposing of the entrained waste in the general configuration of Figure 4.

In the first option (Figure 5), the two ganged burr beaters cooperate with a single, conventional scraper and tray system. The tray 48 with a shallow V-shaped floor 50 extending parallel to roller 32 to receive contaminants entrained in the air stream. A scraper conveyor has scraper blades 52 which traverse the length of the tray to push the collected contaminants to one end for disposal. This combination would require approximately 620mm of arc on the morel roller, if, as is conventional practice, the second burr beater is mounted at top dead centre. Such an arrangement will require a morel roller of at least 800mm diameter. While this is an improvement over the prior double burr beater and tray system, a relatively large morel roller is still required. A further improvement can be made if the second burr beater can operate "uphill" i.e. forward of top dead centre. This is probably feasible with ganged burr beaters where the VM from the first burr beater will be "captured" by the airstream of the second burr beater to convey the waste stream against gravity. This will reduce the arc required on the input side by about 200mm, and so now 400 to 420mm of arc is needed in this sector. Such an arrangement can be sited on the conventional 500mm morel thus widening the scope of application of the more efficient double burr beater concept. In either of these above arrangements, the VM waste stream would be captured in the tray and removed to the side of the machine by the usual system of scrapers.

In an alternative system (Figure 6), the tray and scraper is replaced by a narrow perforated traversing belt 60 in duct 38" cooperating with suitable control of the airflow so as to direct the VM/air stream onto the belt, thereby controlling the depositing of the VM onto a relatively narrower carrier that at the same time allows the air to separate from the VM by passing through the perforations in the belt. The belt, on traversing to one side of the carding machine, then deposits the VM due to the presence of a solid plate behind the perforated belt, causing the VM to drop away from the belt. The surface of the belt is suitably designed to optimise capture and release of the VM. The chamber 64 in which the belt 60 is situated for fitting and driving purposes

may be a suitably designed plenum narrow at one end so as to aid removal of the laden air. The worst situation with regard to occupying maximum room on the morel, approximately 420mm of arc, is shown in Figure 6, and is capable of adaptation to a conventional 500mm morel.

Finally, a third option would be to make full use of the air flow generated by the burr beaters and use it as the sole source of transport. Such an arrangement is shown in Figure 7 and would require optimisation of the WM/air conveyancing duct 38a, to ensure the satisfactory removal of VM, entrapped wool fibre, and the air, across the full width of the machine. This option would require an arc of only 420mm and could therefore also be fitted to a morel of 500mm diameter.

The reduction in morel size required by the systems described above will allow double burr beater systems to be fitted to both new and existing carding machines and will, by their presence, substantially improve the VM removal efficiency of the carding machine and the cleanliness and quality of the final wool sliver.

It will of course be understood that the card 10 includes the usual drive and linkage mechanisms for rotating the cylinders and rollers, and operating the other units, at the desired relative speeds and cycles. This provision of a drive and linkage mechanism to burr beater units 30 is in accordance with conventional textile machinery practice and is not accordingly further discussed in detail.

It will be understood that the invention disclosed and defined herein extends to all alternative combinations of two or more of the individual features mentioned or evident from the text or drawings. For example, there may be more than two burr beater rollers, say in groups of one and two. Such groups might be arranged on the upstream and downstream sides of top dead centre, or vice versa. All of these different combinations constitute various alternative aspects of the invention.

It will also be understood that the term "comprises" or its grammatical variants as used herein is equivalent to the term "includes" and is not to be taken as excluding the presence of other elements or features.

Claims

1. Apparatus for removing contaminants such as a vegetable matter from a travelling fibre web, including:

a roller adapted to support and convey the travelling fibre web;
means on the roller to enhance exposure of contaminants from the web;
means to cyclically strike and dislodge contaminants from the web, while a gaseous flow is disposed about the contaminants; and
duct means for receiving said flow and conduct-

ing it away from the web with the dislodged contaminants entrained therein.

2. Apparatus according to claim 1 wherein said gaseous flow is a locally generated air stream. 5
3. Apparatus according to claim 1 or 2 wherein said roller adapted to support and convey the web is a morel roller, having a covering of a fine special profile wire providing said means to enhance exposure of contaminants from the web. 10
4. Apparatus according to claim 1, 2 or 3 wherein said means to cyclically strike and dislodge the contaminants from the web is a hollow, bladed burr beater roller. 15
5. Apparatus according to claims 3 and 4 wherein a pair of said burr beater rollers are provided on a single morel roller. 20
6. Apparatus according to claim 5 wherein said duct means is arranged for receiving a single gaseous flow in which are entrained the dislodged contaminants from both beater rollers. 25
7. Apparatus according to claim 6 wherein separate said gaseous flows generated about each beater roller combine to form a single outflow. 30
8. Apparatus according to claim 6 wherein a gaseous flow generated by one beater roller is passed to and about the other beater roller and thereafter forms a single outflow. 35
9. Apparatus according to any preceding claim further including traversing perforated belt means disposed so that said flow passes through the belt means, whereby, the contaminants are deposited on the belt means for lateral conveyance. 40
10. Apparatus according to any preceding claim wherein the duct means includes a housing extending adjacent the burr beater roller(s), which housing defines a chamber arranged to receive the flow and the entrained contaminants, and an outlet port and/or duct to which the flow is drawn or driven. 45
11. Apparatus according to claim 10, further including means to draw the flow from the region adjacent the supporting and conveying roller. 50
12. A method of removing contaminants such as vegetable matter from a travelling fibre web, including: 55

supporting and conveying the web while enhancing exposure of contaminants from the web;

cyclically striking and dislodging contaminants from the web, into a gaseous flow about the contaminants; and
conducting said flow away from the web with the dislodged contaminants entrained therein.

13. A method according to claim 12 wherein said gaseous flow is a locally generated air stream.
14. A method according to claim 12 or 13 wherein the entrained contaminants are removed from the flow by passing the flow through traversing perforated belt means, on which the contaminants are deposited for lateral conveyance.

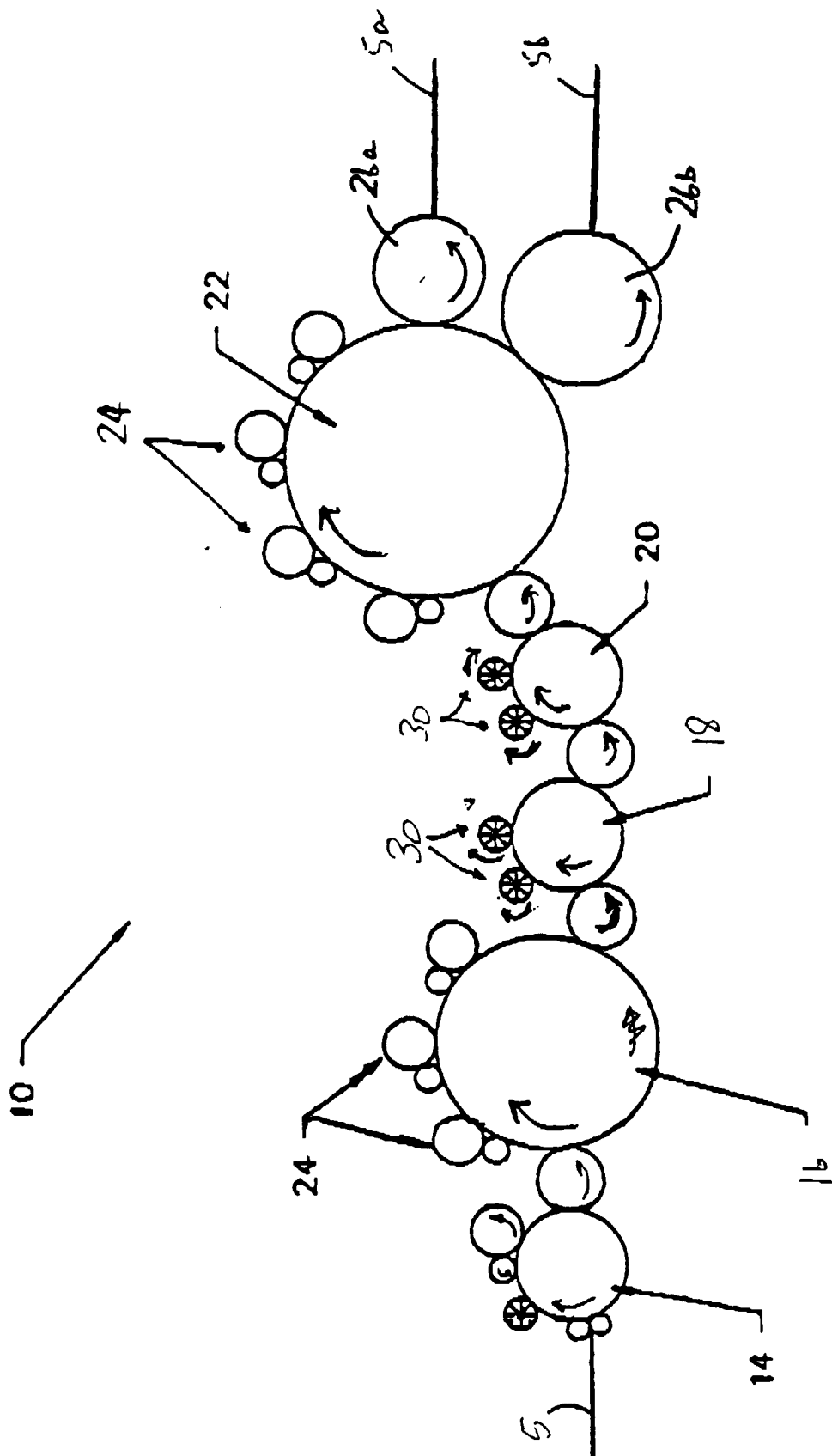


FIG 1

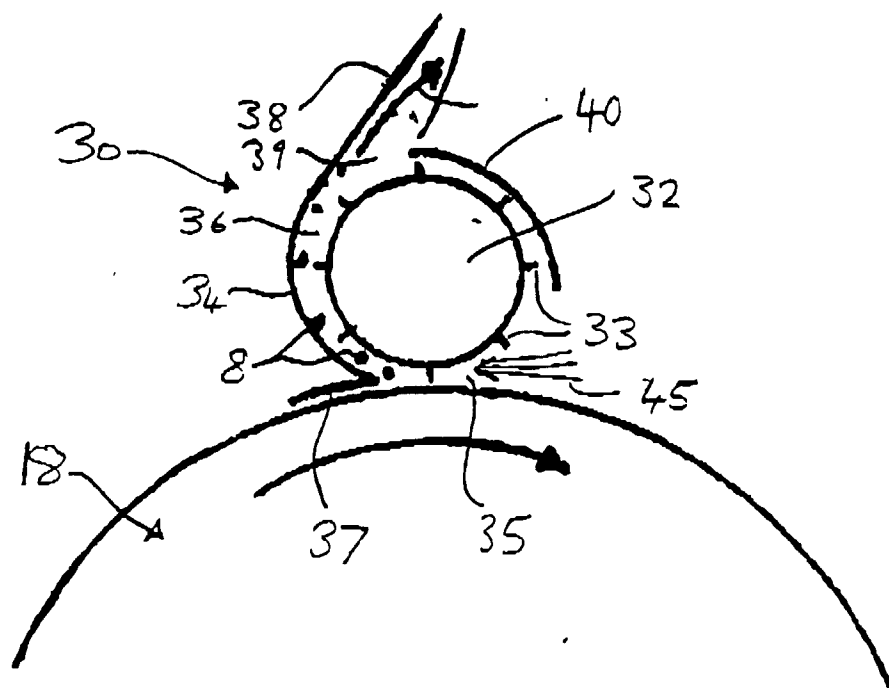


FIG 2

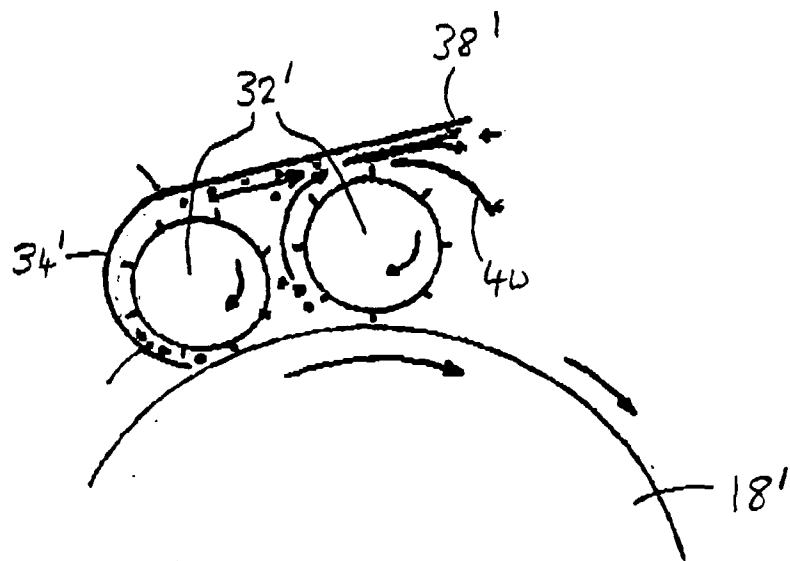


FIG 3

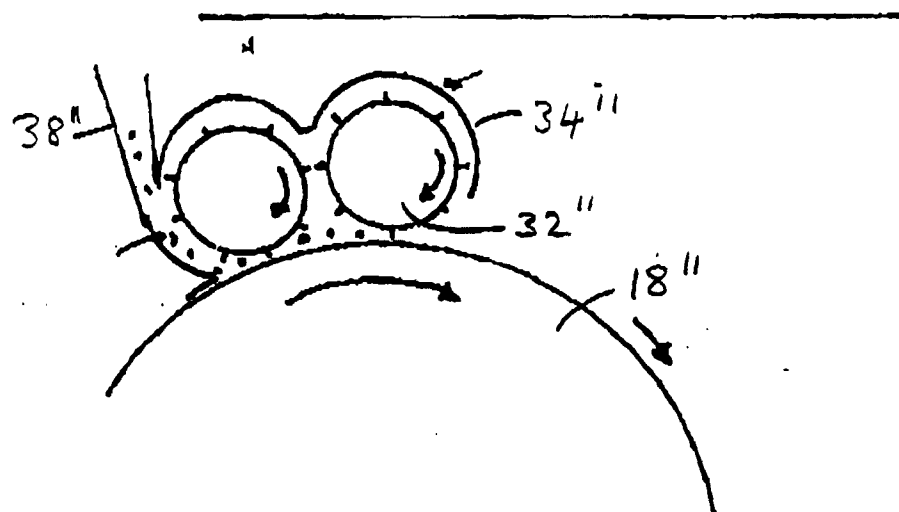
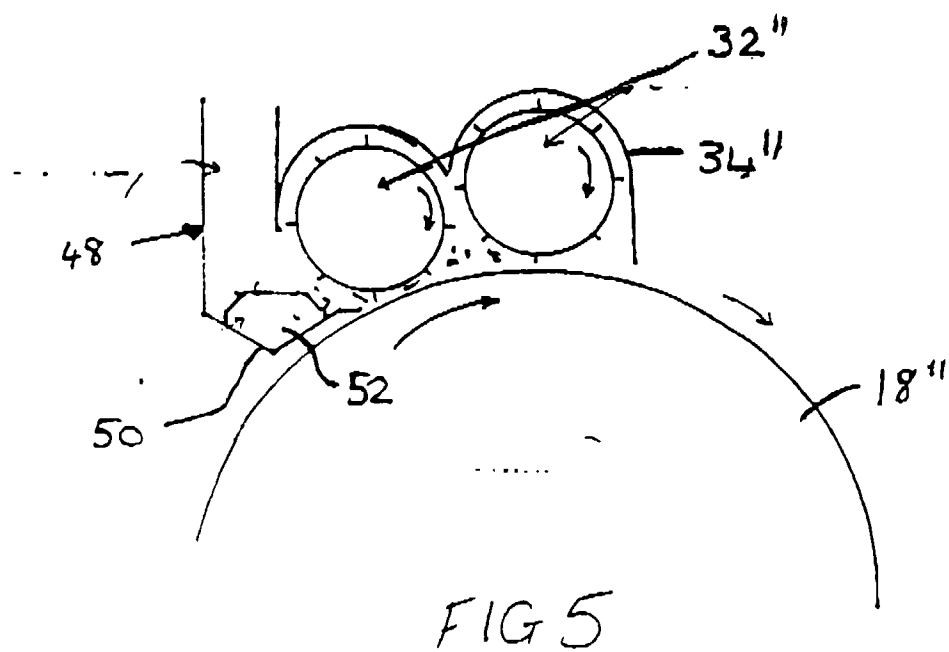
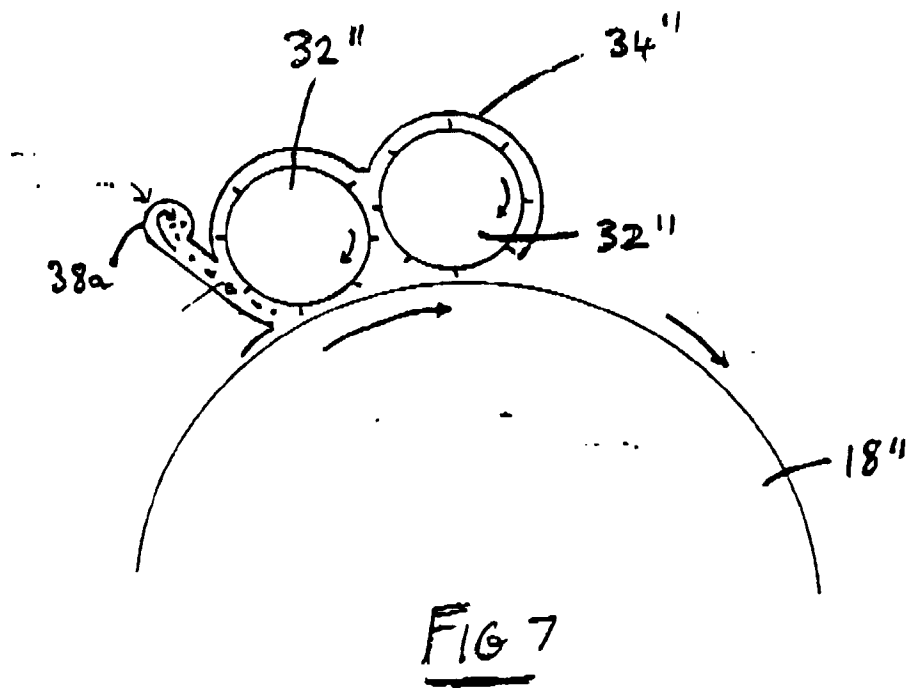
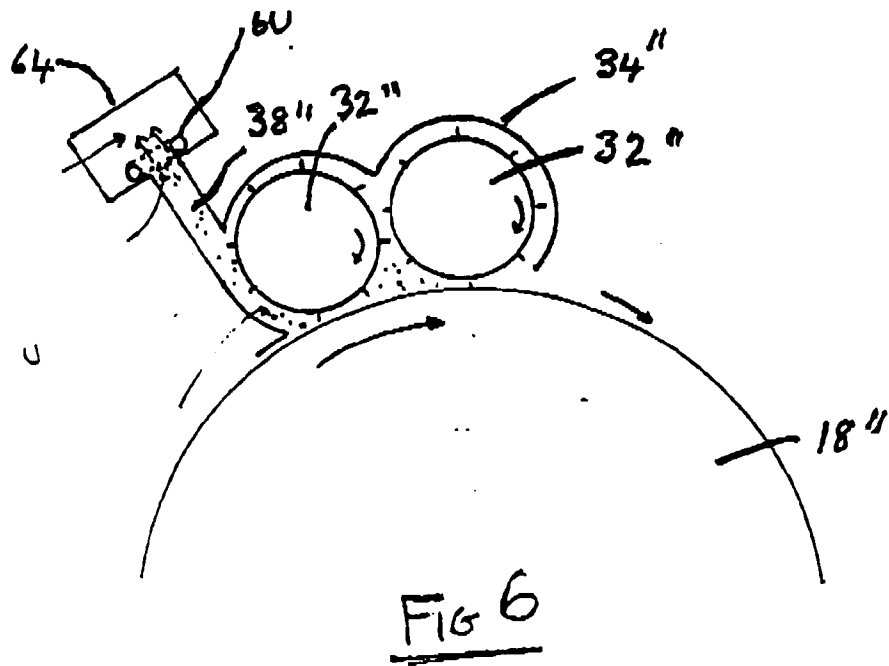


FIG 4







European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 96 30 7739

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)
Y	EP-A-0 517 636 (N.SCHLUMBERGER & CIE,S.A.) * column 2, line 13 - column 3, line 4; claims 1,2; figure 1 *	1-3,5	D01G15/98 D01G15/80
A	---	10	
Y	US-A-4 064 598 (TAKASHI KATO ET AL) * column 5, line 1 - column 7, line 43; claim 1; figures 1,2,4 *	1-3,5	
A	---	11	
A	DE-C-291 059 (JOCHIMS,J.) 30 January 1915 * the whole document *	1	
A	PATENT ABSTRACTS OF JAPAN vol. 15, no. 512 (C-0898), 26 December 1991 & JP-A-03 227413 (IWAMOTO SEISAKUSHO:KK), 8 October 1991, * abstract *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			D01G
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 11 February 1997	Examiner Munzer, E
CATEGORY OF CITED DOCUMENTS		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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