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(71) Applicant(s)
Société Anonyme des Ateliers Houget Duesberg Bosson

(Incorporated in Belgium)

Houget Duesberg Bosson, Rue du Tissage 37, B-4800, Ensival, Belgium

(72) Inventor(s)
Julien Houart

(74) Agent and/or Address for Service
Mewburn Ellis
York House, 23 Kingsway, LONDON, WC2B 6HP, United Kingdom

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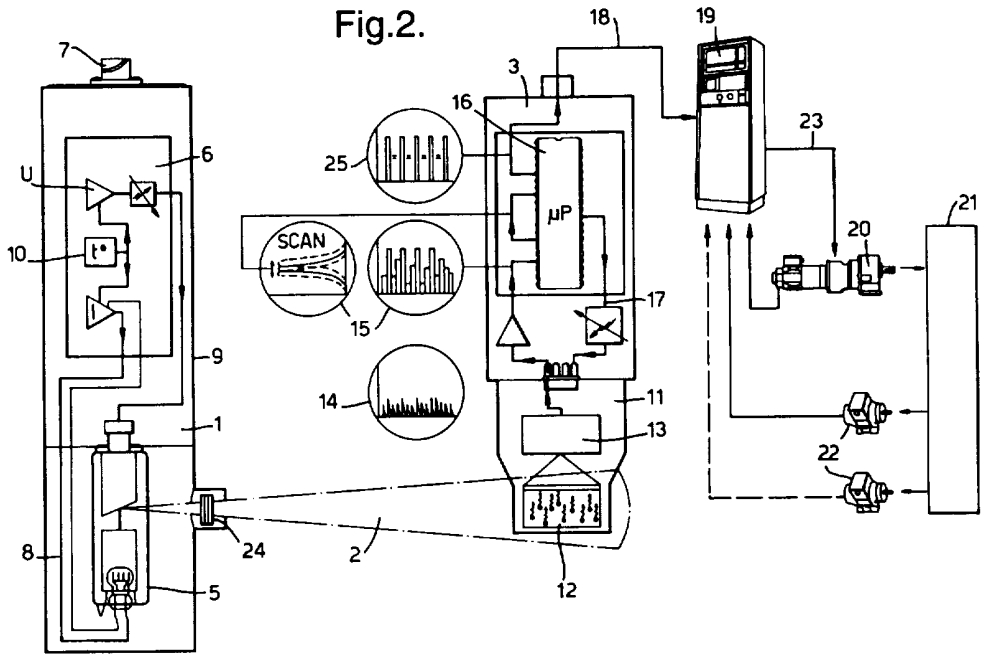
(56) Documents Cited
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(54) Control of the throughput rate of a carding machine

(57) In a process and apparatus for controlling the feed rate of a carding machine or similar machine, X-rays 2 are passed through a web (4, not shown) of fibres entering the machine. The rays not intercepted by the fibres are measured and the fibre supply drums of the carding machine are regulated as a function of the rays measured. The X-ray generator 1 is provided with a system for automatic regulation of the voltages applied to the X-ray tube 5 so as to produce stable radiation 2. The collector is a scintillation tube 3 which is preferably provided with control which takes into account the state of ageing of the crystal 12.

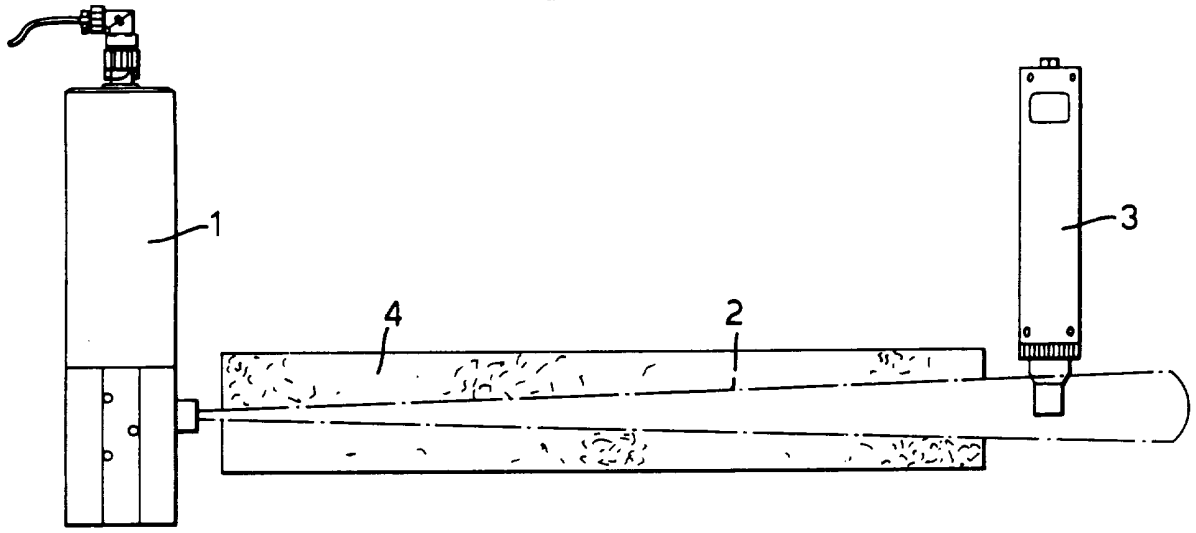
Fig.2.



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

Fig.1.



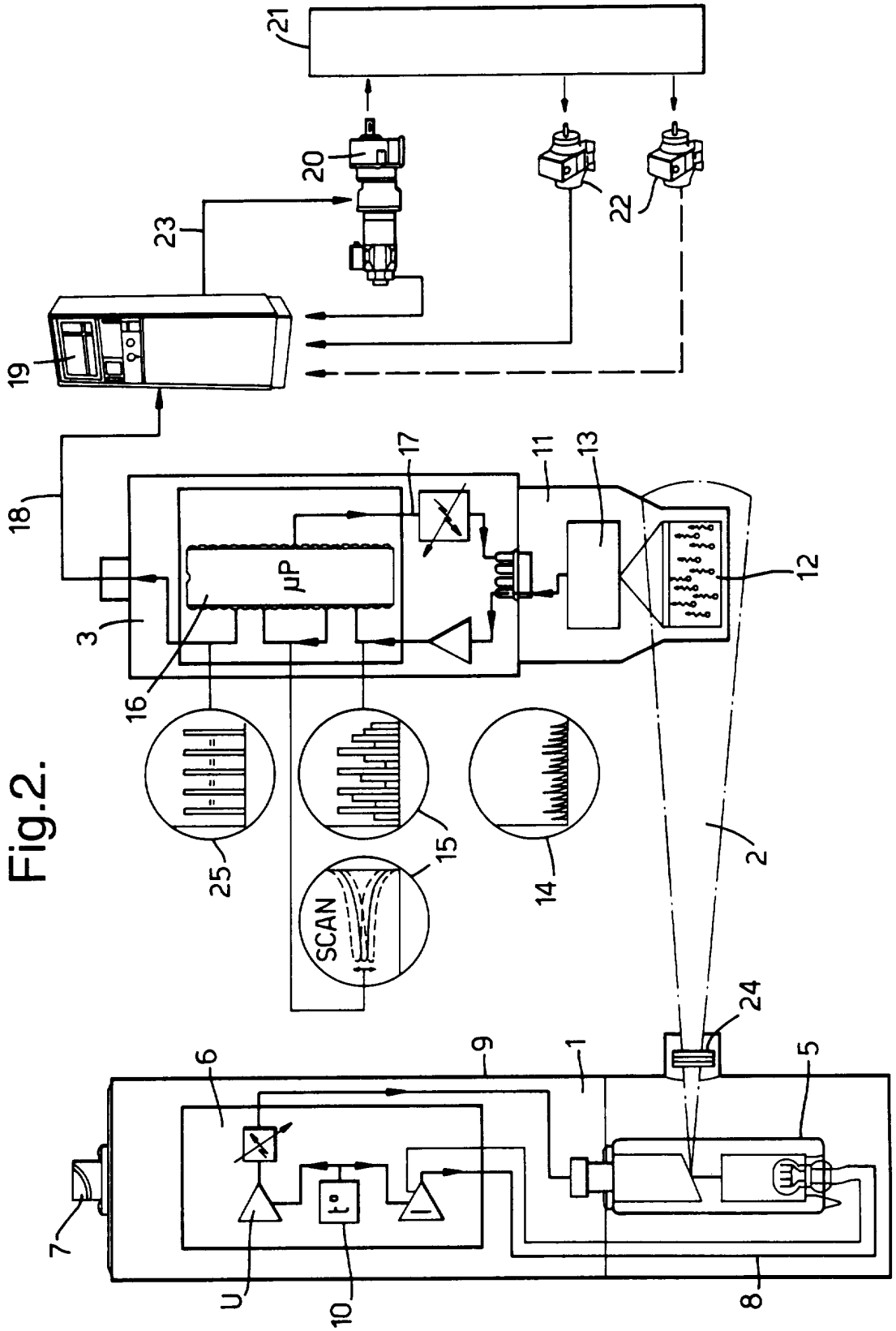


Fig.2.

Control of the throughput rate of a carding machine

The present invention relates to the field of carding machines and more particularly to a process and an apparatus for measuring and controlling the rate of progress of the web fed into a carding machine or similar machine and therefore for controlling the uniformity of the rovings produced by the carding machine.

Uniformity of the rovings delivered by a carding machine has always been a considerable problem for the spinner, because the quality of the finished product is directly dependent upon it.

In a machine in good working order, the uniformity of the input mass of fibres directly affects the uniformity of the output rovings. It is therefore preferable in a control process to measure the rate at which material is input, rather than to measure the output rate, since the reaction time is shorter.

Belgian patent 822.128 describes an apparatus for measuring the density of the web fed into the carding machine, without contact with the fibres, by means of a throughput sensor consisting of a radioactive source. The disadvantage of this system is the use of a radioactive element, for which the regulations for installation and factory use are very restrictive.

Safety measures are becoming more and more stringent and, with the advent of an increasingly ecological political situation, the radioactive technique has no future.

Other techniques exist, such as cyclic weighing, which has the disadvantage of introducing cyclic variations, and the continuous weighing, which creates accuracy problems resulting from the low weights being weighed.

The aim of the present invention is to retain the advantages of the contactless control method, while eliminating the severe restrictions of radioactivity.

In accordance with the invention, X-rays are passed through the web of fibres, the rays not intercepted by the fibres are measured and the input rate of the fibres into the carding machine is controlled as a function of the measured rays.

For this purpose an X-ray generator is used, the power of which is adapted to the low densities of the textile materials of which the mass has to be measured before entry into the carding machine.

The advantages of using X-rays, over the radioactive technique, are enormous. In fact, besides the elimination of the restrictions linked to the use of radioactivity, the use of X-rays allows the intensity of the radiation to be

adapted and therefore the density of any width of fibre web passing into the carding machine to be measured. Moreover, particle (X-ray) emission can be interrupted at source as soon as the motion of the textile web being measured is stopped, this being impossible with a radioactive source.

However, the major advantage arises from the fact that using X-rays it is possible to control the emission frequency of the X-ray generator over time, and thus produce X-rays of good linearity and stability. X-ray stability is preferably obtained in accordance with the invention by continuously monitoring the high voltage applied to the electrodes of an X-ray tube, and by varying the low voltage applied to the tube filament as a function of current variations in the high voltage. This monitoring may advantageously be performed by electronic regulation which compares the voltage and current values and adjusts the low voltage. Preferably, the automatic regulation will take into account temperature variations which may occur in the X-ray generator.

In addition to the stability of the X-rays emitted, the X-ray receiver should produce a signal which does not vary in time. In accordance with the invention preferably a scintillation tube is used. A scintillation tube has a crystal which converts X-rays into light rays. Such a crystal is subject to ageing phenomena. In accordance with a preferred embodiment of the invention, the scintillation

tube has an automatic regulation system in accordance with which the rate of ageing of the crystal is permanently analysed and compensated for by variation of the high voltage supplied to the receptor portion of the tube.

The invention will now be described in more detail by means of a non-limiting example with reference to the attached drawings, in which:

figure 1 is a diagram showing the regulation principle in accordance with the invention;

figure 2 diagrammatically shows an apparatus in accordance with the invention.

With reference to figure 1, an X-ray generator 1 is shown which passes its radiation 2 through a textile material 4 transversely to the direction of motion of this textile material.

The radiation, which is diminished to a greater or lesser extent by the textile material, is collected by a receiver 3.

Figure 2 shows an X-ray generator 1. Application of a high voltage 9 to the electrodes of an X-ray tube 5 and application of a low voltage 8 to the filament of the tube, causes the emission of X-radiation. The X-ray emission, both with regard to the quality, the energy of the photons

contained in the radiation, and with regard to quantity (number of photons emitted) is a direct function of the high voltage and the current applied to the electrodes of the X-ray tube. The generator 1 is supplied with low voltage 7 (24 volts direct current); the supply system 6 of the X-ray tube uses this low voltage and produces on the one hand a high voltage, in this example approximately 30,000 volts, with a given current to supply the electrodes of the tube, and on the other hand a variable low voltage 8 of several volts direct current to supply the filament of the tube. Stability of the X-rays produced is obtained by continuously adjusting the voltage 8 as a function of the current in the high voltage supply 9. This is effected by automatic regulation which compares the instantaneous values in electronic circuitry and modifies them if necessary. The current applied to the X-ray tube will be modified by varying the voltage 8 applied to the filament. Moreover, a temperature controller 10 readjusts the comparator values in accordance with the internal temperature of generator 1. Using electronic components of very high quality, the assembly has very high precision.

The radiation 2, absorbed to a greater or lesser extent by the textile material 4, is collected by a scintillation tube 3.

It is advantageous to work with a reception frequency at the scintillation tube which remains virtually constant,

when the ray is passing through air alone, whatever the distance between the generator and the receiver. To this end, it is preferable to place on the collimator 24 a filter which has increasing power for decreasing distance to reduce emission.

The receptor element of the scintillation tube 3 is an assembly 11 consisting of a crystal 12 which reacts to the photons contained in the radiation 2.

The photons received will be converted in the scintillator into light photons called scintillations. The scintillations observed pass through a photomultiplier 13 which converts the photons into electrical pulses 14, the amplitude of which is proportional to the light intensity of the scintillations, that is to the number of light photons received by the photo-cathode of the photomultiplier at each scintillation, and therefore proportional to the energy. The number of pulses received is equal to the number of photons absorbed by the crystal.

The electrical pulses 14 are filtered by a discriminator so as only to count the pulses emanating from the X-ray source and having a relevant frequency range (high energy).

The tube 3 is supplied with low voltage current but generates high voltage 17 in portion 11.

Depending on the physical and actual state of the measurement crystal 12, the high voltage is automatically regulated by a microprocessor 16, in this example between 700 and 1300 volts direct current.

This automatic regulation is obtained by permanent scanning 15 which permits adjustment of the zone containing the pulses corresponding to the X-photons. Automatic modification of the high supply voltage 17 of the photomultiplier permits location of the pulse amplitude within the reading window of the discriminator.

A microprocessor 16 analyses the pulses 15, counts them and puts them into form 25 for distribution in time and to allow interference-free transit in an electrical conductor 18.

The signal in conductor 18 is received by a computer 19 and processed by software including inter alia a mathematical algorithm permitting deduction of the quantity of textile material worked.

Computer 19 then continuously delivers a control signal 23 to a drive reduction-gear operating the supply drums of the carding machine 21.

Tachometric dynamos or coders 22 are provided on this carding machine 21 for general synchronisation of the

carding machine and for synchronisation of the next machine.

Clearly the invention is not limited by the data of the example described above, but includes any system using X-rays in which the stability of the X-rays emitted is regulated by variation of the voltage applied to the filament of the X-ray tube. Preferably reception of the X-rays is effected by a scintillation tube having a regulating system in accordance with which the signal received is processed by automatic regulation which compensates for ageing of the crystal by variation of the high voltage supplied to the receptor portion of the tube.

CLAIMS

1) A process for controlling the feed-rate of a web of fibres into a carding machine or similar machine comprising the steps of:

i) generating X-rays by means of a generator;

ii) passing said X-rays through a web of fibres;

iii) measuring said X-rays passing said web of fibres; and

iv) controlling feeding of said web in dependence on the measured value obtained in step (iii)

2) A process according to claim 1 including the step of regulating the emission frequency of said X-rays so as to produce stable radiation.

3) A process according to claim 1 or claim 2 wherein the generator comprises an X-ray tube having electrodes and a filament, and the X-rays are generated by the steps of:

i) applying a high voltage to said electrodes; and

ii) applying a low voltage to said filament.

4) A process according to claim 3 wherein the process further comprises the steps of:

i) monitoring the high voltage applied to the electrodes and;

ii) varying the low voltage applied to the filament as a function of variation in the high voltage.

5) A process according to claim 4 wherein said monitoring of the high voltage is done by automatic regulation which takes into account temperature variations which may occur in the generator.

6) A process according to any one of the preceding claims further comprising the steps of:

i) collecting the X-rays passing through the web in a scintillation tube, said scintillation tube comprising a crystal;

ii) monitoring the state of ageing of said crystal;

iii) varying the voltage in the scintillation tube in order to compensate for the ageing of the crystal.

7) An apparatus for controlling the feed-rate of a carding machine or similar machine comprising:

i) an X-ray generator which passes radiation through a web of fibres;

ii) a detector for measuring the radiation not intercepted by said fibres; and

iii) a controller for controlling the feeding of said fibres into the carding machine in dependence on the output of said detector.

8) An apparatus according to claim 7 wherein said X-ray generator has an X-ray tube comprising

a) electrodes supplied by a high voltage;

b) a filament supplied by a low voltage; and

there is provided a regulation circuit which varies the low voltage as a function of variations in the high voltage so as to produce stable radiation passed towards said detector.

9) An apparatus as claimed in claim 8 wherein said regulation circuit takes into account variations in the temperature inside the X-ray generator.

10) An apparatus according to claim 8 or claim 9 wherein the detector is a scintillation tube which has a crystal, and an automatic regulator is provided for varying the high voltage produced in said scintillation tube as a function of the state of the ageing of the crystal.

11) A process for controlling the feed-rate of a web of fibres into a carding machine or similar machine substantially as herein described.

12) An apparatus for controlling the feed-rate of a carding machine or similar machine substantially as herein described with reference to the accompanying illustrative drawings.

Amendments to the claims have been filed as follows

1. A process for controlling the feed-rate of a web of fibres into a carding machine or similar machine comprising the steps of:

i) generating X-rays by means of a X-ray tube having electrodes and a filament, and the X-rays are generated by the steps of:

a) applying a high voltage to said electrodes, and

b) applying a low voltage to said filament;

ii) passing said X-rays through a web of fibres;

iii) collecting the X-rays passing through said web of fibres in a scintillation tube, said scintillation tube comprising a crystal;

iv) controlling feeding of said web in dependence on the measured value obtained in step (iii);

v) regulating the emission frequency of said X-rays so as to produce stable radiation by:

a) monitoring the high voltage applied to the electrodes and;

b) varying the low voltage applied to the filament as a function of variation in the high voltage;

vi) monitoring the state of ageing of said crystal by varying the voltage feeding said crystal in order to compensate for the ageing of the crystal and thus

obtaining a stable reception signal.

2. A process according to claim 1 wherein said monitoring of the high voltage is done by automatic regulation which takes into account temperature variations which may occur in the X-ray tube.

3. An apparatus for controlling the feed-rate of a carding machine or similar machine comprising:

i) an X-ray generator having an X-ray tube comprising:

a) electrodes supplied by a high voltage;

b) a filament supplied by a low voltage; and

c) a regulation circuit which varies the low voltage as a function of variations in the high voltage so as to produce stable radiation.

ii) a scintillation tube having a crystal for measuring the radiation which passed said web of fibres and wherein an automatic regulator is provided for varying the high voltage produced in said scintillation tube as a function of the state of the ageing of the crystal;

iii) a controller for controlling the feeding of said fibres into the carding machine in dependence of the measured value in the scintillation tube.

4. An apparatus as claimed in claim 3 wherein said regulation circuit takes into account variations in the temperature inside the X-ray generator.

5. A process for controlling the feed-rate of a web of fibres into a carding machine or similar machine substantially as herein described.

6. An apparatus for controlling the feed-rate of a carding machine or similar machine substantially as herein described with reference to the accompanying illustrative drawings.

The Patent Office

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Application No: GB 9600054.2 **Examiner:** Graham Werrett
Claims searched: 1-12 **Date of search:** 10 April 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): D1D ; D1N ; G1A.

Int Cl (Ed.6): D01G ; D01H ; G01N.

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2148496 A (STEELASTIC) see X-ray tube 16 and page 11, line 4 on and line 17 on.	1, 7

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.