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PELLETIER M J ET AL: "FLUORESCENCE SORTING INSTRUMENT FOR THE REMOVAL OF AFLATOXIN FROM LARGE NUMBERS OF PEANUTS" REVIEW OF SCIENTIFIC INSTRUMENTS, AIP, MELVILLE, NY, US, vol. 62, no. 8, 1 August 1991 (1991-08-01), pages 1926-1931, XP000260772 ISSN: 0034-6748

DESCRIPTION

[0001] The invention concerns a method for detecting and possibly removing inferior products and/or strange constituents from a product flow, whereby at least one light beam is directed to these products which move according to a certain direction through a detection zone, such that this light beam is at least partly scattered and/or reflected by said products, whereby the scattered light at least partly enters a detector, and whereby constituents or products which scatter the light can be distinguished from suitable products in a way which differs from that of the latter.

[0002] According to the present state of the art as disclosed in US 4,723,659, said products are moved over a reference element in said detection zone. A light beam moves crosswise to the direction according to which said products move through the detection zone, such that the light beam is scattered and/or directly reflected by these products. The optical characteristics of the reference element are chosen such that it scatters said light beam in a way similar to that of a good product. When te light beam impinges on this reference element a signal is generated that is similar to that for a suitable product. No distinction is made by the apparatus between a suitable product and the reference element and the presence of suitable products is not detected.The aim here is to detect only strange constituents or inferior products by means of a sorting device and to possibly remove them.

[0003] With such a method, edge effects are produced with inferior products, strange constituents as well as suitable products in the signal which is generated when said light beam moves over one or several products, since said light beam moves from the reference element to the products and vice versa. These edge effects may result in an incorrect identification by the sorting device.

[0004] American patent US 4,634,881 describes a device whereby use is made of a light-emitting reference element. Light coming from the light beam that is scattered by the products as well as light of the reference element hereby enters one and the same detector. The signal which is thus generated by the detector when there is no product in the path of said light beam is substantially identical to that of a suitable product.

[0005] The use of such a light-emitting reference element does not produce any satisfactory results either, since edge effects are not sufficiently compensated.

[0006] The invention aims to provide a method which makes it possible to identify products in a very accurate manner, whereby edge effects no longer have any influence whatsoever.

[0007] To this aim, a stream of light is generated in the detection zone between a reference element and said scan means, whereby the intensity of this stream of light is observed in a direction which substantially corresponds to the direction of said light beam and, when this intensity exceeds a preset value, in particular when it is lower than this preset value, a product which is hit by the light beam will be qualified as a suitable product or as an inferior or a strange product as set forth in claim 1.

[0008] According to an embodiment of the method according to the invention, said products are illuminated by means of a light source, forming a stream of light with a frequency spectrum which is at least partly different from the spectrum of said light beam. When said products move through the detection zone, they will at least partly disturb said stream of light. This disturbance is detected, and when such a disturbance occurs with a product in a position near or on the path of the above-mentioned light beam, this product will be identified as a strange constituent, an inferior product or a suitable product by means of said light beam.

[0009] Practically, said products are illuminated by said stream of light on the side which is mainly opposite to the side where said light beam impinges upon the products, and said stream of light is detected on the last-mentioned side of the product in such a direction that, when a product is situated in a position near or on the path of said light beam, the disturbance of the stream of light by this product can be observed in the direction of said light beam, whereby subsequently, when such a disturbance occurs, the product will be identified as a strange constituent, an inferior product or a suitable product.

[0010] In an advantageous manner, said product will be identified by means of said light beam when it impinges entirely upon the product and, consequently, the light scattered by this product can be detected substantially without any influences of edge effects.

[0011] In the method according to the invention, when said light beam moves over a product, the signal, generated by said detector as a result of light of the light beam entering it as scattered by the product, will only be used to identify the product when the disturbance of the stream of light coming from said light source has reached a predetermined detection level, whereby said

signal is no longer used to identify the product when said level is exceeded again as said disturbance decreases.

[0012] According to another embodiment of the method according to the invention, said light beam impinges upon said reference element and forms said stream of light, whereby this stream of light is guided at least partly to a detector via the reference element which detects the intensity of the stream of light and converts it in an intensity signal, whereby the product is qualified when this intensity signal exceeds a preset value.

[0013] The invention also concerns a sorting device to apply the method according to the invention, in particular for separating inferior products and/or strange constituents from products which move in a certain direction through a detection zone, with a detection device which is provided with at least two detectors and with means to generate at least one light beam directed to said products, moving crosswise to the direction of movement thereof, such that the light of this light beam is scattered and/or reflected by said products, whereby the light which is scattered by said products at least partly enters a first detector. According to the invention, this sorting device is provided with a light source which generates light which can be distinguished from that of said light beam, in particular light which has a frequency spectrum which is at least partly different from that of the light of said light beam and which is directed such that it becomes possible to illuminate said products, and whereby a second detector is provided which measures a disturbance of the stream of light coming from said light source by at least one of the products.

[0014] In an advantageous manner, the detector which measures the disturbance of said stream of light is mounted such that this disturbance is measured according to the direction of said light beam.

[0015] According to a preferred embodiment of the sorting device according to the invention, said light source is longitudinal and it extends at least partly in said detection zone, such that said light beam moves over the light source.

[0016] According to an alternative embodiment of the sorting device according to the invention, it comprises means for generating a stream of light in the detection zone between a reference element and scan means, whereby at least one second detector is provided which makes it possible to detect the intensity of said stream of light in a direction which corresponds substantially to the direction of said light beam and to generate a corresponding intensity signal, whereby this sorting device comprises means to compare the intensity signal to a preset value, whereby means are further provided to qualify a product hit by the light beam, when said intensity signal exceeds the preset value, as a suitable product or as an inferior or strange product as a function of the detection signal of said first detector. The reference instrument of this variant of the sorting device preferably comprises a light-conducting instrument which is connected to and works in conjunction with said second detector.

[0017] Other particularities and advantages of the invention will become clear from the following description of some particular embodiments of the method and of the sorting device according to the invention; this description is given as an example only and does not restrict the scope of the claimed protection in any way; the reference figures used hereafter relate to the accompanying drawings.

Figure 1 is a schematic view in perspective of a sorting device according to the state of the art.

Figure 2 schematically represents a detection device according to the state of the art.

Figure 3 is a schematic view of a reference element with a product, represented according to the direction of movement of the product, with an accompanying graph which represents the signal coming from light of said light beam, generated by a detector, as the light beam moves over the product.

Figure 4 is a schematic view of a reference element, represented according to the direction of movement of a product to be detected.

Figure 5 is a schematic view of two products situated next to one another and a reference element, represented according to the direction of movement of these products with an accompanying graph which represents the signal coming from light of said light beam, generated by a detector, as this light beam moves over the products.

Figure 6 schematically represents a detection device according to the invention.

Figure 7 is a schematic view of a product with a light source according to the invention, represented according to the direction of movement of the product, with an accompanying graph which represents the signal coming from light of said light sources, generated by a detector.

Figure 8 is a schematic view of two products situated next to one another and a light source according to the invention, represented according to the direction of movement of these products with an accompanying graph which represents the signal

coming from light of said light beam, generated by a detector.

Figure 9 is a schematic top view of a part of the light source according to the invention with a product to be identified.

[0018] In the different drawings, the same reference figures refer to identical or analogous elements.

[0019] Figure 1 shows a traditional sorting device which is provided with a conveyor belt 1, a compressed air device 2 and a detection device 3 working in conjunction with a reference element 4. The detection device 3 is schematically represented in figure 2. By means of the conveyor belt 1, products 5 consisting of loose parts such as peas, raisins, shrimps, nuts, fries or granular products are moved over said reference element 4 through a detection zone 6. The far end of the conveyor belt 1 extends up to the reference element 4, such that products 5 which are moved by the conveyor belt 1 according to arrow 1' in the direction of the detection zone 6 and the reference element 4, when leaving the conveyor belt 1, have a sufficiently large speed to successively move through the detection zone 6 over the reference element 4 and under the compressed air device 2.

[0020] A light source 26 of said detection device 3 generates a light beam 9, in particular a laser beam, directed to the reference element 4 and moving at a relatively high frequency over the latter through the detection zone 6. To this end, the light beam 9 enters a rotating, regular, octagonal prism 25 provided with mirror surfaces 24 and it is reflected to the reference element 4, as is schematically represented in figure 2. Such a prism 25 is also called a polygon mirror and it is part of what are called the scan means. In this way, the light beam 9 moves according to arrow 10 over the reference element 4. This light beam 9 thus enters the products 5 moving through said detection zone 6 and it will be scattered and/or reflected by the products 5.

[0021] In the present description, by scattered light is understood the light which is reflected in a diffuse manner at the surface of a product 5 on the one hand, and the light which is emitted by the product 5 on the other hand as said light beam 9 at least partly penetrates the latter and is scattered therein, thus illuminating at least a part of the product 5. As a consequence, the scattered light is normally not polarized, as opposed to the light of the light beam 9.

[0022] By means of the thus scattered light, every product 5 is identified as a strange constituent, an inferior product or a suitable product 5 according to techniques known as such. Light that is scattered by the product 5 is hereby discerned by a detector 23 and, on the basis of the signal generated by the detector 23, the above-mentioned identification takes place.

[0023] Said detector 23 discerns the scattered light which enters a mirror 27 according to the path of the light beam 9 via the mirror surface 24. The latter mirror 27 reflects the scattered light to a polarisation filter 28 and the detector 23. By means of the polarisation filter 28, light that is not scattered but that is for example directly reflected by a product 5 is prevented from entering the detector 23. Further, the mirror 27 is provided with a central opening 27' through which the light beam 9, coming from light source 26, enters the mirror surface 24.

[0024] When a product 5 has been identified as a strange constituent or an inferior product, said compressed air device 2 will be activated. In particular, a valve 7 of this device 2, situated in a position corresponding to said strange constituent or inferior product, will be opened. Thus, a powerful, directed flow of air 8 is created which removes the strange constituent or inferior product from the flow of products 5, as is schematically represented in figure 1.

[0025] In such a sorting device is used a reference element 4 in the shape of a longitudinal tube according to the present state of the art, preferably having substantially similar diffusion qualities as a suitable product 5 for the used light beam 9. This makes sure that, when there is no product 5 under said light beam, there will nevertheless be a diffusion of the light beam which approaches the diffusion of a suitable product 5, such that said compressed air device 2 is not needlessly activated.

[0026] Figure 3 shows a light beam 9 which moves over said reference element 4 according to arrow 10. When this light beam 9 moves over the product 5 represented in this figure, a signal 11 will be generated by said detector 23 which is provided on the detection device 3 and discerns the light which is scattered by this product 5.

[0027] Thus, the level 12 of this signal 11 has a value that is in relation to the amount of scattered light which is discerned by said detector 23 and which comes from the reference element 4. When the light beam 9 moves according to arrow 10 and reaches a product 5, it will first be only partly interrupted by the product 5. This has for a result that a part of the light beam 9 is scattered by the product 5 on the one hand, and that the other part of the light beam 9 enters the reference element 4 and is scattered there on the other hand. The light which is scattered at this reference element 4 is largely screened from said detector 23 by the product 5. This is also the case when the light closely passes the product 5. Indeed, the detector 23 discerns the

scattered light in a direction which substantially coincides with the direction of said light beam 9 on the side of the products 5 opposite to said reference element 4. This results in an edge effect, in particular what is called a shadow effect.

[0028] Moreover, on the side 29 of a product 5, relatively more light of the light beam 9 will be reflected and thus less light scattered as, especially with a spherical product 5, the angle of incidence β of the light beam 9 is relatively large, as shown in figure 4.

[0029] Thus, when the light beam 9 reaches the product 5, an edge effect is created which is expressed in said signal 11. When the light beam 9 transgresses the perimeter 13 of the product 5, said signal 11 will evolve from said level 12 to a level 14 which is different from the level 15 of the signal 11 for a suitable product 5.

[0030] When such an edge effect occurs, suitable products 5 may possibly be identified as strange constituents or inferior products. In certain cases and for certain products, a strange constituent or inferior product may be identified as a suitable product 5. Consequently, such an edge effect has an influence on the quality of the sorted products 5 and it should be avoided.

[0031] When the light beam 9 entirely enters the product 5, the above-mentioned shadow effect will not occur. The signal 11 generated by the detector 23 reaches a level 15 for a suitable product 5. The height of this level 15 determines whether a product 5 is either or not identified as a strange constituent, an inferior product or a suitable product.

[0032] A second type of edge effect occurs when two products 5 are situated at a short distance from one another, or substantially against one another while moving through said detection zone 6. Such a situation is represented in figure 5.

[0033] When said light beam 9 moves according to arrow 10 over these products 5 and over said reference element 4, a first edge effect will occur, as described above, when the perimeter 13 of a first product 5 is transgressed. Said second type of edge effect occurs when the light beam 9 is situated between both products 5 lying next to one another.

[0034] Thus, the light beam 9 will substantially not be scattered or not be scattered at all by these products 5, and it will enter the reference element 4 between the latter. This reference element 4 scatters the light coming from the light beam 9, but this scattered light cannot be discerned, or only to a very small extent, by said detector 23 as the products 5 are situated between the latter and the light scattered by the reference element 4. Thus, the signal 11 of this detector 23, due to the shadow effect, will evolve to a level 14 which is usually different from the level 15 of the signal 11 for a suitable product 5 or from the level 12 of this signal 11 for the reference element 4. This may lead to a wrong identification of the products 5, whereby for example an inferior product is identified as being suitable.

[0035] At the bottom of figure 5, the course of the signal 11 from said detector 23 is represented as the light beam 9 moves according to arrow 10 over the products 5 and the reference element 4.

[0036] The invention aims to prevent said edge effects from having any influence on the identification of the products 5.

[0037] To this end, according to the invention, said products are illuminated by a light source 16 forming a stream of light with a frequency spectrum which is at least partly different from that of the light of said light beam 9. Thus, light coming from the light source 16 or light coming from said light beam 9 can be distinguished and detected separately.

[0038] Said stream of light is mainly formed in the detection zone 6, such that products 5 moving through the latter at least partly disturb this stream of light. When such a disturbance is caused by a product 5 situated in the vicinity of said light beam 9 or which is at least partly entered by the latter, the product 5 will be identified by means of said detection device 3. This makes it possible to only identify a product 5 when said beam 9 entirely enters the latter or, in other words, when said edge effects do not occur.

[0039] Figures 6, 7 and 8 schematically represent the above-mentioned light source 16. This light source 16 is longitudinal and extends over substantially the entire length of the detection zone 6, and it thus replaces the above-mentioned reference element 4 in the embodiment according to figure 1. Consequently, the stream of light generated by the light source 16 partly enters the side 17 of a product 5 directed towards the latter moving crosswise over it. This side 17 is situated opposite to the side 18 of the product 5 which is hit by the light beam 9.

[0040] The detection device of the sorting device according to the invention differs from the detection device of figure 2 in that it comprises among others a light source 16 and an additional detector 30.

[0041] The light scattered by a product 5 and coming from the light source 16 is directed via a mirror surface 24 and a mirror 27

to the above-mentioned polarisation filter 28. The latter partly reflects the light from the light source 16 to the detector 30. Thus, this detector 30 will notice a disturbance in the stream of light when a product 5 is situated in a position near or on the path of the light beam 9. As a result of the rotation of the prism 25 with the mirror surfaces 24, the direction in which said detector 30 observes the stream of light will vary in the same manner as that of the light beam 9.

[0042] Thus, a signal 19 is obtained in this detector 30, as represented in the graph at the bottom of figure 7, when the light beam 9 moves over a product 5 which is situated in said stream of light. In this graph, the size of the signal 19 is represented as a function of time.

[0043] This signal 19 will have a constant level 20 when the stream of light is not disturbed by a product 5 in the direction according to which it is being detected. When the perimeter 13 of the product 5 is transgressed, the observed stream of light will be disturbed and the signal 19 will decrease to a level 21 whereby the light source 16 is substantially entirely screened from the detector 30 by the product 5. When the perimeter 13 is transgressed again by the light beam 9 according to arrow 10, a level 20 will be reached again for the signal 19 whereby the stream of light will not be disturbed.

[0044] With the method according to the invention, a detection level 22 is set which has been selected such that, when the signal 19 decreases, as the level 22 is transgressed, the light beam 9 will enter the product 5 concerned over its entire cross section, or at least partly. Thus, when this detection level 22 of the signal 19 is transgressed again, the part of the light beam 9 entering the product 5 will decrease.

[0045] To thus prevent said edge effects from having a disadvantageous influence on the detection, it is made sure that a product 5 can only be identified when the level of the signal 19 is situated between said level 21 and the detection level 22.

[0046] Consequently, scattered light coming from the light beam 9 will be only used to identify a product 5 when the disturbance of the stream of light coming from said light source 16 has reached a predetermined detection level 22, and the signal 11 for light that is scattered by a product 5 will be no longer used to identify this product 5 when the detection level 22 is reached again as said disturbance decreases.

[0047] Figure 8 shows a graph which is analogous to the graph in figure 7. However, the graph in figure 8 represents a signal 19 which is observed when said light beam moves over two products 5 situated very close to one another.

[0048] In order to adjust the sensitivity to edge effects of the detection device according to the invention, the device is provided with a lens 35, as shown in figure 6, and an adjustable diaphragm 36. This diaphragm 36 is situated in the focal plane of the lens 35 where the light which is reflected by the polarisation filter 28 enters. In this focal plane is formed an image of a possible disturbance of the stream of light by a product 5. By adjusting the size of the diaphragm 36, the amount of light entering the detector 30 can be adjusted or, in other words, the gradient of the signal 19 in figures 8 and 9 can be determined when this signal 19 is situated between level 20 and level 21.

[0049] In a variant of the above-described embodiment of the invention, said products 5 are mainly illuminated by said light source 16 on the side of the products 5 where the light beam 9 enters. Thus, a disturbance in the stream of light is detected by observing the light of this stream of light which is scattered or reflected by a product 5. This detection is preferably done according to the direction of said light beam 9, i.e. when a product 5 is situated near or in the path of said light beam 9.

[0050] When a set detection value of the thus observed scattered light is transgressed, the product 5 will be identified as a strange constituent, an inferior product or a suitable product.

[0051] Figure 9 represents a part of said light source 16 over which a product 5 and the light beam 9 move. The circle 31 represents a measuring zone 32 round the beam 9 where scattered light of said light beam 9 can be discerned by the detector 23. This measuring zone 32 moves together with the light beam 9 according to arrow 10. The surface of a product 5 on which a detection is performed with the light beam 9 is schematically represented by means of a dashed line in the circle 33. Between the circle 33 and the perimeter 13 of the product 5 is situated an edge region 34 where no scattered light is measured according to the invention since the aforesaid edge effects may occur in this edge region 34. As this edge region 34 is relatively small, not taking the latter into consideration will have a negligible influence on the quality of the sorted products 5. The size of the edge region 34 is determined, as described above, by the gradient of the signal 19 and thus by the opening of the diaphragm 36.

[0052] In order to avoid any disturbances occurring during the detection of the light that is scattered by the products 5 or any interferences occurring between the detection of light coming from the light beam 9 and from said light source 16, the latter will

preferably have mainly different frequency spectra.

[0053] Thus, said light source 16 is preferably formed of a conventional fluorescent lamp, in particular a gas-discharge lamp, and said light beam 9 is preferably formed of a laser beam. This makes it possible to discern light coming from the light beam 9 from that of said stream of light.

[0054] When the light source 16 and the light beam 9 partly have the same frequency spectrum, the intensity of a part of the spectrum of the light beam 9 may for example be higher than the intensity of the corresponding part of the spectrum of the light source 16, such that light coming from the light beam 9 may nevertheless be discerned from that of said light source 16.

[0055] Compared to the present state of the art, the use of such a light source 16 offers an additional advantage in that it is independent of the products 5 to be identified or to be sorted, as opposed to said reference element 4 which, according to the present state of the art, must scatter the light in a similar way as a suitable product.

[0056] Naturally, the invention is not restricted to the above-described embodiment of the methods and the sorting device. Thus, for example, said stream of light may also be formed of a light beam which is concentric to the light beam 9, but which is divergent or has a larger diameter.

[0057] Also the compressed air device of the sorting device may for example be replaced by any separating device whatsoever, and said conveyor belt may be replaced by all sorts of transport devices.

[0058] In an alternative embodiment of the method and the sorting device according to the invention, said stream of light is formed of said light beam 9 between said prism 25, also called a polygon mirror, and the reference element 4.

[0059] The intensity of this stream of light is hereby discerned in a direction which substantially corresponds to the direction of said light beam 9. When this intensity exceeds a preset value 22, and in particular when it is lower than this preset value, the presence of a product will be detected. In that case, the product which is hit by the light beam 9 will be qualified as a suitable product or as an inferior or a strange product depending on the detection signal of said detector 23 which discerns the light which is directly reflected or scattered by the product.

[0060] Thus, the light beam 9 forming said stream of light enters the reference element 4. This reference element 4 is made of a material which is light-conductive and which is connected to a detector, such that the stream of light which enters the reference element 4 will be at least partly guided to this detector. The detector discerns the intensity of the stream of light and converts it in an electric intensity signal. When this signal transgresses said preset value 22, a product in which the light beam 9 substantially entirely enters will be qualified as a suitable product or as an inferior or a strange product.

[0061] Such a reference element comprises for example a glass fibre which extends substantially crosswise to the direction of movement of the products and whose surface makes it possible to guide the stream of light entering the reference element further through the glass fibre to said second detector which is connected to it. Thus, the surface of the glass fibre is provided for example with unevennesses via which light in the glass fibre can be coupled.

[0062] According to a variant of this embodiment of the invention, the intensity of the stream of light entering the reference element 4 is determined as a function of the position according to the cross section of the product flow. This makes it possible, for example, to provide for an additional control of a removal device, such as for example a compressed air device 2 for removing products from the product flow.

[0063] Indeed, the positions where the intensity signal exceeds said preset value 22 determine the exact position of a product and thus of the part to be activated, in other words the valve 7 to be activated, of the removal device in order to remove a product from the product flow when it appears that this product is an inferior or a strange product.

[0064] In order to determine the intensity of the flow of light as a function of the position according to the direction crosswise to the direction of movement of the product flow, said reference element comprises for example successive glass fibres which are each connected to a separate detector. The far ends of these glass fibres are then directed to the above-mentioned scan means, in particular to said polygon mirror 25, such that said light beam 9 enters the far ends while moving over the product flow.

[0065] The reference element may further also be formed of a row of detectors situated next to one another, or it may for example consist of a linear camera.

REFERENCES CITED IN THE DESCRIPTION

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Patentkrav

1. Fremgangsmåde til sortering af produkter (5) ved skelnen mellem og eventuelt separering af egnede produkter fra dårlige eller fremmedartede produkter, hvorved disse produkter (5) bevæger sig i en produktstrøm med en vis bredde gennem en detektionszone (6), hvorved mindst en lysstråle (9) bevæges i denne detektionszone (6) over bredden af produktstrømmen ved hjælp af et scanneorgan (25) med henblik på at lade denne lysstråle (9) ramme produkterne (5) der skal sorteres, sådan at lysstrålen (9) mindst delvist spredes og/eller direkte reflekteres af disse produkter (5), hvor det spredte lys og/eller det direkte reflekterede lys mindst delvist trænger ind i mindst en første detektor (23) der genererer et detektionssignal (11), hvorved produkter (5) der spreder eller reflekterer lyset på en måde der er forskellig fra det af egnede produkter skelnes fra sidstnævnte ved hjælp af detektionssignalet (11), hvorved en lysstrøm genereres i detektionszonen (6) mellem et referenceelement (4) og scanneorganet (25), **kendetegnet ved at** intensiteten af denne lysstrøm observeres i en retning der i det væsentlige svarer til retningen af lysstrålen (9) ved hjælp af en anden detektor og, kun når denne intensitet overskrider en forudindstillet værdi, og især er mindre end denne forudindstillede værdi, et produkt der rammes af lysstrålen (9) vil blive kvalificeret som et egnet produkt eller som et dårligt eller fremmedartet produkt som funktion af detektionssignalet (11) af den mindst ene første detektor (23), hvor detektionssignalet ikke længere anvendes til at identificere produktet når den forudindstillede værdi overskrides igen.

2. Fremgangsmåde ifølge krav 1, hvor lysstrålen (9) trænger ind i referenceelementet (4) og danner lysstrømmen, hvorved denne lysstrøm mindst delvist ledes til den anden detektor via referenceelementet (4) der skelner intensiteten af lysstrømmen og omdanner den i et intensitetssignal, hvorved produktet (5) kvalificeres når dette intensitetssignal overskrider en forudindstillet værdi.

3. Fremgangsmåde ifølge krav 1 eller 2, hvor lysstrålen trænger ind i referenceelementet (4) og danner lysstrømmen, og intensiteten af lysstrømmen

bestemmes som en funktion af positionen i henhold til bredden af produktstrømmen eller af detektionszonen (6).

4. Fremgangsmåde ifølge et hvilket som helst af de foregående krav, hvorved disse produkter (5) belyses ved hjælp af en lyskilde (16) der er forskellig fra lysstrålens (9) lyskilde og som genererer lysstrømmen med et frekvensspektrum der er mindst delvist forskellig fra den fra lyset fra lysstrålen (9), hvorved disse produkter (5) mindst delvist forstyrrer denne lysstrøm og denne forstyrrelse detekteres, og hvorved, når sådan en forstyrrelse sker på grund af et produkt (5) der befinder sig i en position tæt ved eller på banen af lysstrålen (9), dette produkt (5) vil blive identificeret som et egnet produkt eller som et fremmedartet eller et dårligt produkt ved hjælp af lysstrålen (9).

5. Fremgangsmåde ifølge krav 4, hvorved disse produkter (5) belyses af lysstrømmen på siden (17) der er overvejende modstående til siden (18) hvor lysstrålen (9) trænger ind i produkterne (5), og hvorved intensiteten af lysstrømmen detekteres på den sidstnævnte side (18) af produktet (5) i sådan en retning at, når et produkt (5) er i en position tæt ved eller på banen af lysstrålen (9), kan forstyrrelsen af lysstrømmen ved dette produkt (5) skelnes i retningen af lysstrålen (9), hvorved efterfølgende, når sådan en forstyrrelse sker, vil produktet (5) blive kvalificeret som et egnet produkt eller et fremmedartet eller et dårligt produkt.

6. Fremgangsmåde ifølge krav 4 eller 5, hvorved disse produkter (5) overvejende belyses på den samme side (17,18) af lyskilden (16) som siden (17,18) på hvilken lyset der kommer fra lyskilden (16), når det trænger ind i et produkt (5) og reflekteres og/eller forstyrres af det, detekteres, hvorved efterfølgende, når dette produkt (5) befinder sig tæt ved eller i banen af lysstrålen (9), vil produktet (5) blive kvalificeret som et egnet produkt eller som et fremmedartet eller et dårligt produkt.

7. Fremgangsmåde ifølge et hvilket som helst af kravene 1 til 3, **kendetegnet ved at** lyset der kommer fra lyskilden (16) detekteres i en retning der mindst delvist falder sammen med retningen af lysstrålen (9).

8. Fremgangsmåde ifølge et hvilket som helst af de foregående krav, hvorved produktet kvalificeres ved hjælp af lysstrålen (9) når i det væsentlige hele tværsnittet af strålen (9) trænger ind i dette produkt (5) og, som en konsekvens, detekteringen af lyset der spredes eller reflekteres af dette produkt (5) udføres i det væsentlige uden nogen indflydelse fra kanteffekter.

9. Fremgangsmåde ifølge et hvilket som helst af de foregående krav, hvor lysstrålen (9) bevæger sig på tværs af retningen i henhold til hvilken disse produkter (5) bevæger sig gennem detektionszonen (6).

10. Fremgangsmåde ifølge et hvilket som helst af de foregående krav, **kendetegnet ved at,** når lysstrålen (9) bevæger sig over et produkt (5), signalet (11,19) genereret af den første detektor (23) når lyset der kommer fra lysstrålen (9) der er spredt eller reflekteret ved produktet (5) trænger ind i det, vil kun blive anvendt til at bestemme produktet (5) når intensiteten af lysstrømmen der kommer fra lyskilden (16) har nået et forudbestemt detektionsniveau (22), og signalet (11,19) vil ikke længere blive anvendt til at identificere produktet (5) når dette niveau (22) overskrides igen når forstyrrelsen falder.

11. Sorteringsindretning til anvendelse af fremgangsmåden ifølge et hvilket som helst af de foregående krav, især til at skelne og separere dårlige produkter og/eller fremmedartede produkter fra de egnede produkter (5) der bevæger sig ifølge en bestemt retning gennem detektionszonen (6), med en detektionsindretning (3) der er forsynet med mindst en første detektor (23) og med scanneorgan (25) til at generere mindst en lysstråle (9) rettet mod disse produkter (5) og bevægende sig på tværs af produkternes bevægelsesretning, sådan af lyset af denne lysstråle (9) spredes og/eller reflekteres af disse produkter (5), og lyset spredt af disse produkter (5) mindst delvist trænger ind i detektoren (23), **kendetegnet ved at** den omfatter organ til generering af en lysstrøm i detektionszonen (6) mellem et referenceelement (4) og scanneorganet (25), hvorved mindst en anden detektor er tilvejebragt der muliggør detektion af intensiteten af lysstrømmen i henhold til en retning der i det væsentlige svarer til retningen af lysstrålen (9) og at generere et tilsvarende intensitetssignal, hvorved sorteringsindretningen omfatter organ til at sammenligne intensitetssignalet med en forudindstillet værdi, hvilket organ er yderligere tilvejebragt til at kvalificere et

produkt (5) i hvilket lysstrålen trænger ind, når intensitetssignalet overstiger den forudindstillede værdi, som et egnet produkt eller som et dårligt eller fremmedartet produkt som funktion af detektionssignalet af den første detektor (23).

12. Sorteringsindretning ifølge krav 11, hvorved referenceelementet (4) omfatter et lys-ledende instrument der er forbundet til og arbejder i forbindelse med den anden detektor.

13. Sorteringsindretning ifølge krav 11 eller 12, hvorved referenceelementet (4) omfatter mindst en glasfiber der strækker sig i det væsentlige på tværs af produkternes (5) bevægelsesretning og hvis overflade gør det muligt at lede lysstrømmen som trænger ind i referenceelementet videre gennem glasfiberen til den anden detektor der er forbundet til den.

14. Sorteringsindretning ifølge et hvilket som helst af kravene 11 til 13, hvorved referenceelementet (4) omfatter efter hinanden følgende glasfibre der hver er forbundet til den anden detektor eller til separate detektorer, hvorved de fjerneste ender af disse glasfibre er rettet mod scanneorganet (25), sådan at lysstrålen trænger ind i disse fjerneste ender mens den bevæger sig over produktstrømmen.

15. Sorteringsindretning ifølge et hvilket som helst af kravene 11 til 14, hvorved referenceelementet (4) er sammensat af på hinanden følgende anden detektorer som nævnt ovenfor, tilvejebragt ved siden af hinanden.

16. Sorteringsindretning ifølge et hvilket som helst af kravene 11 til 15, hvorved referenceelementet (4) omfatter en lyskilde (16) der genererer lys der kan skelnes fra lysstrålen (9), især lys med et frekvensspektrum der er mindst delvist forskellig fra det fra lyset af denne lysstråle (9) og der gør det muligt at belyse disse produkter (5), hvorved den anden detektor (30) er følsom for mindst en del af frekvensspektret af lyskilden (16) og den første detektor (23) er følsom for et frekvensspektrum der er forskelligt fra det for hvilken den anden detektor er følsom.

17. Sorteringsindretning ifølge et hvilket som helst af kravene 11 til 16, **kendetegnet ved at** den anden detektor (30) er monteret sådan at intensiteten af lysstrømmen måles i henhold til retningen af lysstrålen (9).

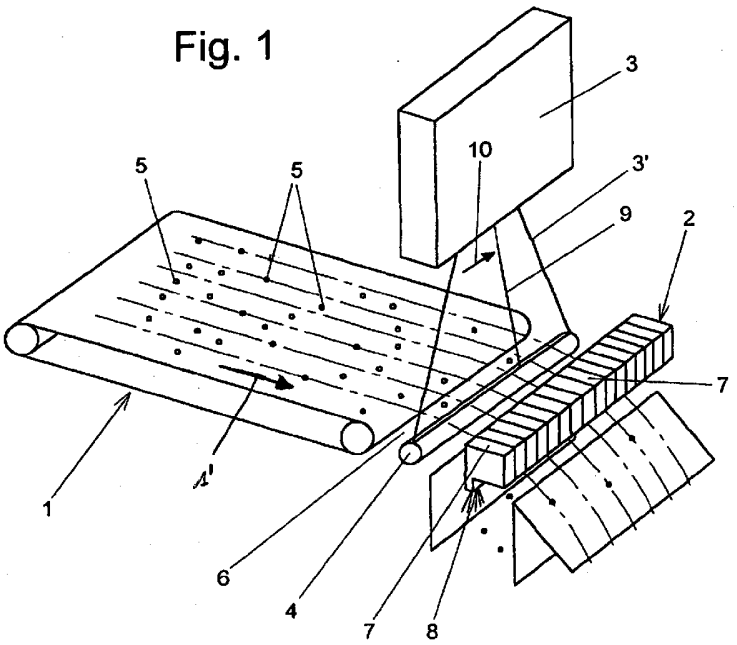
18. Sorteringsindretning ifølge krav 16 or 17, **kendetegnet ved at** lyskilden (16) er monteret sådan at disse produkter (5) bevæger sig i relation til denne lyskilde (16) med deres side (17) rettet mod lyskilden (16), hvilken side (17) er modstående til siden (18) hvor lysstrålen (9) trænger ind.

19. Sorteringsindretning ifølge et hvilket som helst af kravene 16 til 18, **kendetegnet ved at** lyskilden (16) er langsgående og strækker sig mindst delvist i forhold til detekteringszonen (6), sådan at lysstrålen (9) bevæger sig over lyskilden (16).

20. Sorteringsindretning ifølge et hvilket som helst af kravene 16 til 19, **kendetegnet ved at** en blænde (36) er tilvejebragt der gør det muligt at justere følsomheden til detektionsindretningens (3) kanteffekter.

DRAWINGS

Fig. 1



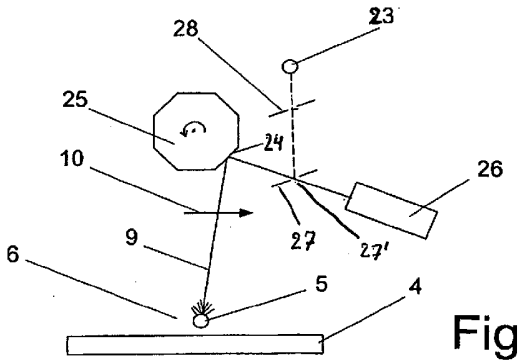


Fig. 2

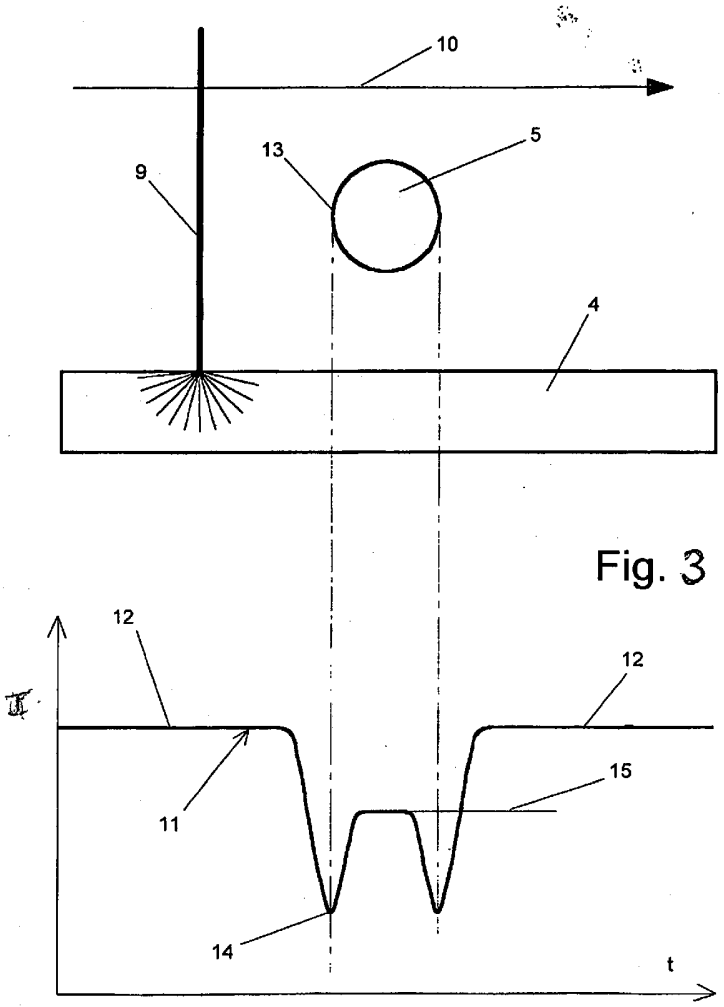


Fig. 3

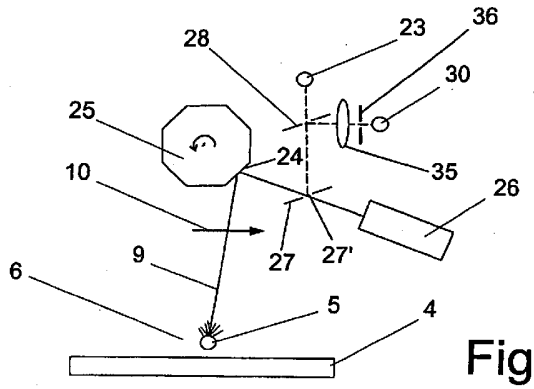


Fig. 6

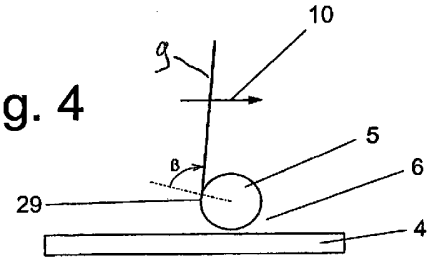


Fig. 4

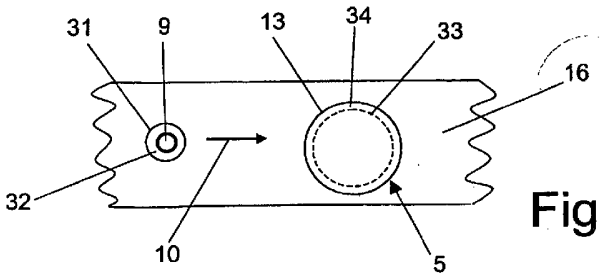


Fig. 9

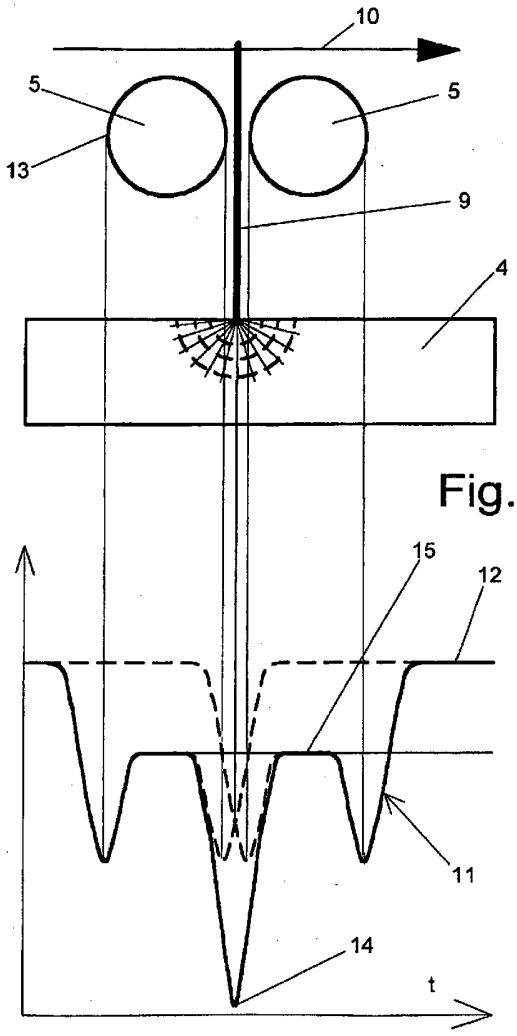


Fig. 5

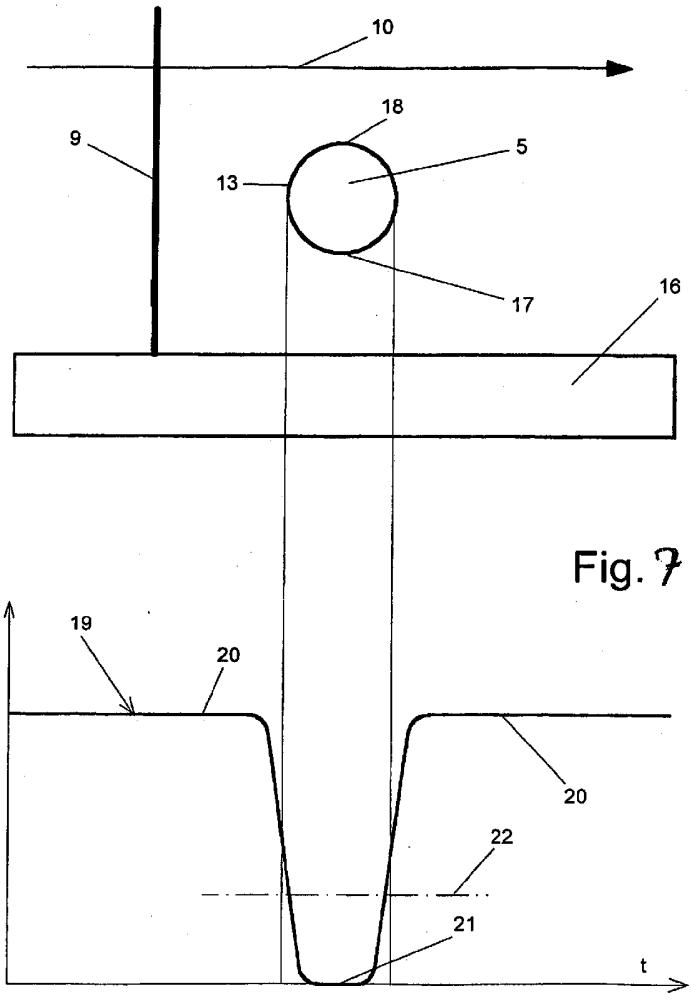


Fig. 7

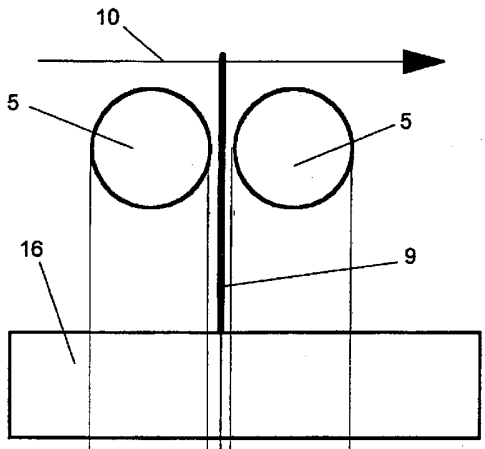


Fig. 8