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Bezeichnung der Erfindung:
Title of invention:
Titre de l'invention : Method and apparatus for the manufacture of fusecord

Klassifikation / Classification / Classement : C 06 C 5/04

ENTSCHEIDUNG / DECISION

vom / of / du 1 September 1987.

Anmelder / Applicant / Demandeur : Imperial Chemical Industries PLC

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Article 56

Kennwort / Keyword / Mot clé :
"Inventive step - obvious alternative"

Leitsatz / Headnote / Sommaire

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Case Number : T 270 /84

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 1 September 1987

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Decision under appeal : **Decision of Examining Division** 026 **of the European Patent Office dated** 09.08.1984 **refusing European patent application No** 79 302 862.2 **pursuant to Article 97(1) EPC**

Composition of the Board :

Chairman : K. Jahn
Member : C. Gérardin
Member : W. Moser

Summary of Facts and Submissions

I. European patent application No. 79 302 862.2, filed on 12.12.79, claiming priority of the prior application on 24 January 1979 (GB 7 902 492) and published on 6 August 1980 with publication No. 13 810, was refused by the decision of the Examining Division 026 of the European Patent Office dated 9 August 1984.

II. The application contained 12 claims filed on 2 July 1982, of which Claim 1 directed to the method and independent Claim 6 directed to the apparatus were worded as follows:

Claim 1: A method for the production of explosive fusecord which comprises continuously advancing a carrier tape (10) in a horizontal linear path, partially convoluting said tape to form a longitudinal open trough portion extending over a feed zone of said path, continuously feeding a stream of powdered explosive material (34) into said trough portion to form the explosive core of the fusecord, further convoluting said tape in a zone subsequent to said feed zone to form a closed tube surrounding the said explosive material (34) and conveying the thus produced core of explosive material and subsequently applying reinforcing materials around the said closed tube, characterized in that the said stream of explosive material (34) is (a) fed at a rate controlled to provide only the exact amount required for the formation of the desired explosive core, (b) extends longitudinally over a portion of feed zone of greater length than the diameter of the core to be formed and (c) has uniform distribution of the powdered explosive material over the longitudinal extent of said portion of feed zone.

Claim 6: An apparatus for the manufacture of explosive fusecord comprising draw means (26) to advance a carrier tape (10) in horizontal linear path, a guide means (18) to convolute said carrier tape to form a longitudinal open trough portion at a feed zone, feed means (13, 14, 15) to deliver a stream of explosive material to said trough portion, further guide means (18) to further convolute said carrier tape (10) to form a closed tube around the explosive material fed into said trough portion and means (21, 23-25, 51-54, 36-39, 56) to apply reinforcing material around said closed tube, characterized in that said feed means (13, 14, 15) is (a) arranged to deliver said stream at a rate controlled to provide only the exact amount required for the formation of the fusecord core, and has an outlet whereby said stream is (b) elongated in cross-section to extend over a longitudinal portion of said feed zone of greater length than the diameter of the core of material to be formed by the apparatus and (c) is uniformly distributed along said longitudinal portion.

The references (a), (b) and (c) were added by the Examining Division for ease of reference.

III. The reason given for the decision to refuse was that the subject-matter of Claims 1 and 6 did not involve an inventive step with regard to the teaching of

(1) GB-A-295 266

(2) Chemical Engineers' Handbook by R.H. PERRY and C.H. CHILTON; 5th Edition, McGraw Hill, Section 7, pages 7-3 to 7-29

More specifically, it was stated that the method as well as the apparatus for forming fusecords were generally known from document (1) and that the only difference was in the way of feeding the explosive powder into the

trough-shaped section of the carrier. This feature, however, was disclosed in document (2) as conventional in the art of conveying and packaging in general, although it had not been applied to the production of fusecords.

The advantages put forward by the Applicant were admittedly present, but were those which would be expected to follow from the choice of this means of feeding, which was different to that previously used in fusecord manufacture, but which was in any event a well-known equivalent in other fields. The transfer into the field of fusecord production had not brought with it an advantage peculiar to the art of fusecord manufacture and as such it could not be seen as providing any unpredictable benefit sufficient to justify the acknowledgement of inventive merit.

Although the application was rejected for lack of inventive step it was specified in the decision that the features (a) and (b) in both independent claims were neither explicitly, nor implicitly, disclosed in the application as originally filed.

IV. On 5 October 1984 the Appellants lodged an appeal against the Decision. The appeal fee was duly paid; the Statement of Grounds received on 29 October 1984, was based on the following arguments:

i) the belt conveyor provides a feed having a degree of uniformity of loading and packing superior to that obtainable with any prior art fusecord powder feed;

ii) the accurate feed of explosive powder enables fusecord production rates of more than 60 metres/minute without detrimental effect on the

fusecord quality; such production rates could not be achieved by prior art methods;

iii) the velocity of detonation of the fusecords obtained by the present method and apparatus is more consistent than in the prior art fusecords;

iv) the belt conveyors described in document (2) would in any case not be applicable to processing operations simply because, giving an irregular output, they are not generally regarded as metering devices; this statement on page 7-6 would be effective to prejudice a fusecord manufacturer against the use of a conveyor belt (Guidelines, C-IV, 9.8 D);

v) the immediate commercial success of the present detonating cord is indicative of the presence of an inventive step in accordance with the Guidelines, C-IV, 9.9.

Furthermore, in order to overcome a possible objection under Article 123(2) EPC, the Appellant expressed his readiness to amend the main claims by including a revised definition of the means used in practice to obtain features (a), (b) and (c) of these claims.

V. In a communication on 4 November 1986 the Board stated that features (a) and (b) were indeed objectionable under Article 123(2) EPC, but that this objection could probably be overcome by proper amendment of Claims 1 and 6.

As far as the problem of inventive step was concerned, the Board could not regard as surprising the advantages put forward by the Appellant.

VI. Together with his reply of 19 December 1986 the Appellant filed a set of 15 new claims to be substituted for those on file, of which Claim 1 directed to the method and independent Claim 7 to the apparatus, read as follows:

Claim 1: A method for the production of explosive fusecord which comprises continuously advancing a carrier tape (10) in a horizontal linear path, partially convoluting said tape to form a longitudinal open trough-shaped portion extending over a feed zone of said path, continuously feeding a stream of powdered explosive material (34) into said trough-shaped portion to form the explosive core of the fusecord, further convoluting said tape in a zone subsequent to said feed zone to form a closed tube surrounding the said explosive material (34) and conveying the thus produced core of explosive material, and subsequently applying reinforcing material around the said closed tube, characterized in that the said stream is provided by forming a uniform layer of powdered explosive material (34), advancing said layer to said feed zone at a controlled rate and at an angle to said linear path, permitting said explosive material to fall, as a stream which is elongated in the direction of said path, from the leading edge of said layer into said advancing trough-shaped portion of tape whereby said stream is entirely surrounded by the said convolution of said tape, continuously monitoring the amount of explosive charge in the formed fusecord core and adjusting the relative speeds of advance of the layer of explosive material and the carrier tape in response to the measured charge rate to maintain the charge rate at a predetermined value.

Claim 7: An apparatus for the manufacture of explosive fusecord comprising draw means (26) to advance a carrier tape (10) in a horizontal linear path, guide means (18) to convolute said carrier tape to form a longitudinal open trough-shaped portion at a feed zone, feed means (13, 14, 15) to deliver a stream of explosive material to said trough portion, further guide means (18) to further convolute said carrier tape (10) to form a closed tube around a core formed from the explosive material fed into said trough portion and means (21, 23-25, 51-54, 36-39, 56) to apply reinforcing material around said closed tube, characterized in that said feed means comprises means (12, 14, 15) to form a uniform layer of powdered explosive material (34), means 14 to advance said layer to said feed zone at an angle to said linear path and permit said material to fall, as a stream which is elongated in the direction of said path, from the leading edge of said layer into said advancing open trough-shaped portion of tape; means (22) for continuously monitoring the amount of explosive charge in the formed fusecord core and means (13) responsive to said monitoring means for adjusting the relative speeds of advance of the layer of explosive material (34) and the carrier tape (10) to maintain the core charge rate at a predetermined value.

Besides, the Appellant insisted on the fact that the word "uniformity" had a different meaning in document (2) and in the present application. According to the latter the layer of powder on the belt is uniformly thick both in cross-section and lengthwise whereas in the prior art all that is necessary is constant cross-section rather than uniform cross-section.

VII. The Appellant requests that the impugned decision be set aside and that the patent be granted on the basis of the new claims filed.

Grounds for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is, therefore, admissible.

2. In spite of slight editorial discrepancies with regard to the original description, there is no formal objection to the current version of Claims 1 and 7 since both are adequately supported by the application as filed. In both claims the amendments concern the characterizing parts.

Both characterizing parts find support in the passage on page 3, lines 18 to 34 which mentions forming a substantially uniform layer of powdered explosive material, advancing said layer to the feed zone at a controlled rate and at an angle to the carrier tape path, permitting the explosive material to fall from the leading edge of the layer into the open trough-shaped tape portion, monitoring the amount of explosive material in the fusecord core and adjusting the relative speeds of advance of the explosive layer and the carrier tape in response to any variation from the weight nominally required for the desired explosive core.

The features of a stream elongated in the direction of the path and further entirely surrounded by the convolution of the tape are supported by page 2, lines 29 to 33, where it is specified that the stream is elongated and extends longitudinally over a portion of the feed zone, the tape being further convoluted to form a closed tube surrounding a core of explosive material.

3. The present application relates to a method and an apparatus for the manufacture of dry spun explosive fusecord. The closest state of the art is represented by

document (1) which discloses the manufacture of safety fuses by feeding explosive powder from a container into a channel-shaped portion of a horizontally advancing carrier tape or wrapper, maintaining the powder in a loose or uniform condition, preventing all cramping and crumpling of the strip and removing superfluous powder automatically from the wrapper during the working (page 1, lines 81 to 99; page 3, lines 39 to 67; Figure 3). Although this process leads to a core of powder of absolute evenness and uniformity (page 1, lines 70 to 80), it is not adapted to the high speed production of fusecord because the powder feed involves gravitational flow through an aperture not substantially greater than the core of the fusecord, which limits the flow rate; and because the spillage of excess explosive powder, which increases with the speed of the moving tape, is unacceptable for safety reasons.

4. In the light of this closest prior art the problem underlying the present application has to be seen in providing improved process and apparatus permitting higher speed production of a fusecord without impairing its high degree of uniformity.

This problem is solved according to the present application by the technical features indicated in the characterizing part of Claims 1 and 7 which can be summarized as follows: forming and advancing a uniform layer of explosive powder at an angle to the carrier tape, permitting the powder to fall into the advancing trough-shaped portion of tape, continuously monitoring the amount of powder in the fusecord core, adjusting the relative speeds of advance of the layer of powder and of the carrier tape in response to the measured change rate, further convoluting the tape to form a tube surrounding the explosive powder and applying reinforcing material around the closed tube.

In view of the compared fusecord production rates between the prior art processes, involving feeding the explosive powder through an orifice, and the presently claimed method (see Grounds of Appeal, 29 October 1984, page 3, paragraph 1), the Board is satisfied that this technical problem has been plausibly solved.

5. The solution claimed by the Appellant is not to be found in any prior art document so that novelty is acknowledged. As the Examining Division has not raised the issue of novelty it is not necessary to consider the matter in detail.

6. It has thus to be examined whether the subject-matter of the present application as defined in the independent Claims 1 and 7 involves an inventive step with regard to the teaching of the cited documents.

7. Document (2) describes various flow-assisting devices which all ensure a uniform feed of powdery material even in large amounts (pages 7-26 and 27). The amount actually conveyed can be controlled either by batch weighing or by continuous weighing (page 7-28). The latter technique is used when both the total amount of material flowing and the changes in the flow have to be continuously controlled; this is carried out with continuous-weighing scales which use a section of a belt conveyor, over which the powdery material to be weighed passes. These scales require continuous monitoring to assure that the desired set weight is maintained and does not drift off because of changes in product bulk-density or flowability. This technique is particularly suitable to feed materials to continuous processes at uniform, measured rates (page 7-29).

This continuous weighing process represents exactly the improvement the skilled man, faced with the shortcoming of the process taught in document (1), is looking for. In other words the simple condition of higher feed rate together with a uniform distribution would be an incentive to substitute the container located above the carrier tape, as described in document (1), by the conveyor belt known from (2). This simple combination of teachings would leave as the single undisclosed feature the powder layer advancing at an angle to the carrier tape resulting in a falling stream elongated in the direction of the tape moving. Once the skilled man has come to the idea of using a conveyor belt as feeding device for the carrier tape in order to solve the main aspect of the problem, i.e. speeding up the production rate of fusecord, the selection of the most appropriate configuration does not require more than common general knowledge. Economic and practical considerations will suggest the right angle, because this is the configuration in which the conveyor belt extends the most over the carrier tape and thus results in the highest amount of powder being delivered.

The mere condition of a higher fusecord production rate, which is the essential problem underlying the present application, will thus lead the skilled man to a relative orientation for the conveyor belt and the carrier tape such that the powder feed stream extends longitudinally over the latter.

8. The advantages resulting from this obvious solution cannot be regarded as surprising.

8.1 Accuracy of loading and fusecord quality: it is specified in document (2) that the continuous-weighing scales are capable of weighing within 1% error, or even 0.1% under certain conditions (page 7-29). These figures are far better than the precision put forward by the Appellant, namely 2% as reflected in the variations of velocity of detonation.

8.2 Freedom from breaks: since the known fusecord cores exhibit absolute evenness and uniformity ((1), page 1, lines 70 to 80) and since uniformity generally confers freedom from breaks in the manufactured fusecords (Grounds of Appeal, page 6, point 4), the prior art fusecords should not be inferior in this respect to those obtained by the method presently claimed. In any case, a surprising difference has never been substantiated.

8.3 Production rates: in the method described in document (1) the amount of powder falling into the channel-shaped portion of the horizontally advancing carrier-tape is less limited by the aperture of the container than by the width of the tape (Figure 3). The substitution of the container by the conveyor belt as described in document (2) not only enables higher feeding rates, but increases the capacity of the moving tape per time unit, since the powder stream extends longitudinally, and thereby the fusecord production rate.

The beneficial result put forward by the Appellant is not disputed, but was entirely predictable from the known advantages of the conveyor belts and, therefore, cannot contribute to demonstrate an inventive step.

9. The Appellant has argued that the prejudice suggested in document (2) against the use of conveyor belts in processing operations (page 7-7) as well as the commercial success of the claimed process and apparatus speak in favour of an inventive step. The Board takes the view that such so-called secondary indicia in support of an inventive step represent auxiliary considerations which can in certain cases facilitate a decision regarding inventive step. However, the presence of such secondary indicia does not mean that an inventive step must be recognized. An assessment of this patentability criterium requires a careful analysis of the prior art and consideration of all relevant facts having regard to the question whether the skilled person would have solved the existing technical problem by the means as suggested by the application at issue (see T 24/81, O.J. 1983, 133).

As far as the commercial success in England of the process presently claimed is concerned, no evidence has been provided demonstrating that this success actually reflects the great value of the invention, and is not merely based on factors such as market monopoly, advertisement policy or salesman skill.

When the Appellant tries to interpret the above-mentioned passage on page 7-7 of document (2) as a definite prejudice against the use of conveyor belts in processing operations, he overlooks that this restrictive statement includes the exception of the unusual conditions which are exemplified in the paragraph "Continuous weighing". On pages 7-29, right column, it is explicitly specified that the continuous weighing scales are used to feed materials to continuous processes at uniform, measured rates. The presently claimed process is nothing more than the use of this idea in a non-inventive way.

10. The following final arguments filed on 19 December 1986 still do not convince the Board that the requirements of Article 56 EPC have been met.

10.1 Uniform layer: the original description of the application does not specify that the layer of powder on the conveyor belt has to be uniformly thick both in cross-section and lengthwise, but only mentions in general terms a uniform layer of explosive powder advancing on a conveyor surface (page 2, line 20; page 3, lines 19-20; page 4, lines 3 and 10). Although document (2) only refers on page 7-29 to a uniform flow of powder which is a less restrictive condition than the uniform layer alleged in the process according to the application, it can hardly be disputed that the easiest and most obvious way to achieve a uniform flow is to start with a uniform layer. Thus, there is no doubt that the skilled man will interpret the uniform flow according to document (2) as a uniform layer.

10.2 Control method: the description of the application clearly specifies that continuously monitoring the amount of explosive charge in the formed fusecord core and adjusting the relative speeds of advance of the layer of explosive material and the carrier tape in response to the measured charge rate to maintain the charge rate at a predetermined value is achieved simply by maintaining a constant carrier tape speed and adjusting the speed of the explosive layer (new page 3, lines 30 to 37). This condition is self-evident since keeping track of a flow of material fed to a continuous process as described on pages 7-29 of document (2) is meaningless unless one takes steps to respond to detected deviations from the amount of material which it is desired to transport. Since the fusecord production

rate is determined by the speed of the carrier tape, the skilled man without inventive merit will compensate any variation of change rate by adjusting the speed of advance of the conveyor belt.

11. As far as Claim 7, drafted as an apparatus claim, is concerned, it is to be noted first of all that its characterizing part corresponds in essence to the characterizing part of Claim 1 so that the discussion may be limited to the technical features of the preamble.

These technical features are only identified by the number used in the description and are not specified any further. They comprise draw means (26) to advance the carrier tape, guide means (18) to convolute the carrier tape to form a longitudinal open trough portion, feed means (13, 14, 15) to deliver the powder to the trough portion, further guide means (18) to further convolute the carrier tape to form a closed tubular casing and means to apply reinforcing materials around this closed tube (21, 23-25, 51-54, 36-39, 56).

With the exception of the feed means, which comprises a conveying surface as described in document (2), all the other means have their counterpart in the apparatus as illustrated on Figures 3, 4, 5 and 9 of document (1). These Figures show the paper strip travelling horizontally into a winding unit being first caused to assume trough shape by the form of an initial guide; after the powder feed the edges of the paper trough are caused to close and to overlap due to the function of a nozzle, and jute threads are eventually spirally wound around the paper wrapper containing the powder core (page 3, lines 39 to 73 and 101 to 107; page 4, lines 68 to 71).

All these features are thus usual in the art; and their combination with a conveyor belt as feed means cannot be regarded as inventive for the reasons expressed above in relation to the method.

12. These arguments apply not only to Claim 1 and Claim 7, but equally to dependent method Claims 2 to 6 and apparatus Claims 8 to 15 which merely represent preferred embodiments of the method and apparatus according to Claims 1 and 7 and thus fall with it.

Order

For the above reasons, it is decided that:

The appeal is rejected.

The Registrar: The Chairman:

CG 21.8.87