Europäisches Patentamt
Beschwerdekammern

European Patent Office
Boards of Appeal

Office européen des brevets
Chambres de recours

Veröffentlichung im Amtsblatt Publication in the Official Journal Publication au Journal Officiel	Ja/Nein Yes/No Oui/Non

Aktenzeichen / Case Number / N° du recours : T 147/88 - 3.3.1

Anmeldenummer / Filing No / N° de la demande : 81 304 687.7

Veröffentlichungs-Nr. / Publication No / N° de la publication : 0 050 013

Bezeichnung der Erfindung: Olefin polymerization process
Title of invention:
Titre de l'invention :

Klassifikation / Classification / Classement : C08F 10/00

ENTSCHEIDUNG / DECISION

vom / of / du 22 August 1989

Anmelder / Applicant / Demandeur :

Patentinhaber / Proprietor of the patent /
Titulaire du brevet : MITSUI PETROCHEMICAL INDUSTRIES, LTD.

Einsprechender / Opponent / Opposant : BP Chemicals Limited

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Articles 54, 56

Schlagwort / Keyword / Mot clé : "Novelty (yes)"
"Inventive step (denied) - No contribution to inventiveness by merely formulating a technica problem"

Leitsatz / Headnote / Sommaire

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number : T 147/88 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal
of 22 August 1989

Appellant : (Opponent)
MITSUI PETROCHEMICAL INDUSTRIES, LTD.
2-5, Kasumigaseki 3-chome Chiyoda-ku
Tokyo 100
JP

Representative :
Myerscough, Philip Boyd, et al
J.A. Kemp & Co.
14 South Square Gray's Inn
London WC1R 5EU
GB

Respondent : (Proprietor of the patent)
BP Chemicals Limited
Belgrave House
76 Buckingham Palace Road
London SW1W 0SU
GB

Representative :
Lederer, Franz, Dr.
Van der Werth, Lederer & Riederer
Patentanwälte
Lucile-Grahn-Strasse 22
D-8000 München 80

Decision under appeal :
Decision of the Opposition Division of the European Patent Office of 16 December 1987, posted on 11 February 1988, revoking European patent No. 81 304 687.7 pursuant to Article 102(1) EPC

Composition of the Board :

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

Summary of Facts and Submissions

I. The mention of the grant of the European patent No. 50 013 in respect of European patent application No. 81 304 687.7, filed on 8 October 1981 and claiming a priority of 9 October 1980 from an earlier application in Japan, was published on 16 January 1985 on the basis of six claims.

Claim 1 reads as follows:

"A process for polymerizing an olefin in the gaseous phase in a multiplicity of steps in at least two independent polymerization zones (3, 18) connected to each other by a transfer passage (10, 10'), which process comprises feeding an olefin and a catalyst into a first polymerization zone (3), polymerizing the olefin in the gaseous phase, intermittently or continuously withdrawing a gaseous stream containing the resulting polymer from the first zone (3) and feeding it into said transfer passage (10, 10'), introducing the withdrawn polymer-containing gaseous stream into a second polymerization zone (18) through the transfer passage (10, 10'), feeding the or another olefin into the second zone (18) with or without feeding an additional supply of the catalyst thereinto, and polymerizing the olefin in the gaseous phase in the second zone (18), characterized in that an inert gas zone (11) is provided in the transfer passage (10, 10'), and at least a part of the gas components of the gaseous stream containing the polymer is replaced by an inert gas."

II. On 16 October 1985, the Respondent (Opponent) filed a notice of opposition requesting the revocation of the whole patent on the grounds that the subject-matter of the patent in suit was not novel and did not involve an inventive

step. These objections were based upon, inter alia, FR-A-1 386 838 (document (4)).

Together with his counterstatement of 21 July 1986, the Appellant (Patentee) filed a new main claim representing a combination of original Claim 1 with all the features of Claim 2; the latter reads as follows:

"A process according to Claim 1 wherein a collecting zone (17) for the polymer is provided downstream of the inert gas zone (11) and upstream of the second polymerization zone (18), and the polymer is collected therein from the inert gas zone (11), and after shutting off the communication (15) between the inert gas zone (11) and the collecting zone (17), the polymer is introduced into the second polymerization zone (18)."

III. In its decision, delivered orally on 16 December 1987 and sent in writing on 11 February 1988, the Opposition Division revoked the patent on the ground that the requirement of inventive step was not met. In this decision it was stated that novelty could be acknowledged on the basis of a two-fold difference between the claimed process and the process described in document (4); first, the screw conveyors used to transport the reaction product of the first reactor to the subsequent reactor had been replaced by a transfer in gaseous phase; secondly, there was a collecting zone in the transfer passage between the two reactors. These two features, however, did not involve an inventive step, since the use of a more diluted fluid instead of the more solid prior art composition was obvious in order to avoid deposits in the transfer means, and no technical effect in relation to these features, especially to the collector, had been demonstrated.

IV. The Appellant thereafter lodged a notice of appeal on 6 April 1988 and paid the prescribed fee simultaneously. In the Statement of Grounds filed on 20 June 1988 as well as during oral proceedings held on 22 August 1989, the Appellant first raised the point of the relevance of document (4) for the definition of the problem underlying the patent in suit; in this respect, US-A-4 048 412, which was known from the search report and will be referred to as document (5) hereinafter, was regarded as more relevant, since it already provided for the transfer of polymer from one polymerization zone to the subsequent one by means of a gaseous stream. Nothing in this document, however, suggested apparatus features enabling to select polymerization conditions in the second reactor fully independently of the conditions in the first reactor.

Even if one regarded document (4) as relevant, the drawbacks resulting from the use of screw conveyors were so numerous - energy to provide, degradation and/or unwanted polymerization during transfer as well as slowness of the transfer along the helical path - that this teaching could not lead to the specific features of a fluid transfer, let alone foreshadow the advantages thereof. The fluid transfer alternative was rapid, minimised the contact of the polymer with the internal surface area of the transfer passage, overcoming thereby the problems of undesired reactions, only required an apparatus of very simple construction, virtually without moving parts, and allowed to select the operating conditions in the two reaction zones with complete freedom.

V. In his counterstatement filed on 1 February 1989 and during oral proceedings, the Respondent put forward essentially the following arguments:

The process according to document (4) should be considered as the closest prior art, since it already referred to two polymerization zones capable of operating independently and only differed from the subject-matter of the patent in suit by the absence of a specific collecting zone. The Appellant had failed to demonstrate a technical effect in connection with the collecting zone and had not even specified how this feature should be devised. Therefore, the duration of the transfer in the screw conveyor could not be regarded as fundamentally different from the residence time of the polymer in the collecting zone, which meant that the teaching of document (4) was even prejudicial as to novelty.

VI. The Appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of the five claims filed on 21 July 1986.

The Respondent requested that the appeal be dismissed.

At the end of the oral proceedings the decision was announced that the appeal was dismissed.

Reasons for the Decision

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

2. There are no formal objections on the basis of Article 123(2) EPC to the current version of the claims.

As mentioned above, the new main claim results from the combination of original Claims 1 and 2, the latter having been incorporated into the characterising part of the

former. As to Claims 2 to 5, they merely correspond to previous Claims 3 to 6 with their numbers and, where appropriate, appendancies adjusted.

3. During oral proceedings, the Respondent raised the issue of novelty with regard to the teaching of document (4) for the first time. More specifically, the Respondent regards the combination of features described therein as the implicit disclosure of a process comprising at least two polymerization zones together with a transfer passage and a collecting zone.

3.1 This document describes a process for the preparation of heteroblock copolymers which, according to the general teaching of Claim 1, point a, comprises introducing an unsaturated monomer or a mixture of unsaturated monomers into a polymerization zone wherein it is or they are contacted with a polymerization catalyst, transferring at least part of the resulting polymer block into subsequent polymerization zones, each of them being distinct from the one which is immediately up-stream, introducing therein a monomer different from the one introduced into the up-stream polymerization zone or a mixture of monomers, in which at least one is different from the monomer or at least from one of the monomers introduced into the up-stream polymerization zone, forming thereby block polymers by successive addition of blocks to the block produced in the up-stream polymerization zone. In points b and d, it is specified that polymerization is carried out in gas phase and that the reaction products are washed with an inert gas during their transfer from one polymerization zone to the subsequent one. According to a preferred embodiment, the transfer is achieved by means of at least one screw conveyor (Claim 5, point c); such conveyors are gas-tight, except at their central parts where a current of dry

nitrogen with a flow of 2 m^3/h provides washing of the monomer residues (page 3, column 1, paragraph 7 to column 2, paragraph 1; Example).

3.2 In the process according to the patent in suit (column 7, lines 18 to 33 and Figure), the transfer passage (10, 10') conveys the block polymer together with monomer residues to a container 11; there, the gases in this polymer-containing gas are at least partly replaced by an inert gas introduced from the line 13. Whereas the gases discharged from the container 11 are sent to a recovery unit through line 14, the polymer maintained in an inert gas atmosphere is transferred first to a small chamber or collecting zone 17, then under pressure into the second polymerization reactor 18.

3.3 The screw conveyor in the prior art process and the transfer passage in the presently claimed process are thus both to be regarded as gas-tight areas fitted for conveying a polymer product from one reactor to the subsequent one, which are flushed by an inert gas in order to wash away any small amount of fluidization gas brought along from one reactor, to prevent it from entering the next reactor. In absence of a more accurate definition by means of specific apparatus features in Claim 1 of the patent in suit, the mere reference to a transfer passage cannot be regarded as a distinguishing feature over the prior art.

However, the collecting zone 17 differs both in its structure and its function from the screw conveyor disclosed in the prior art. In practice, the rate of flow within the screw conveyors (400 kg/h) is high with regard to the filling volume of the reactor (150 l), which means that the residence time of the polymer within the screw conveyors is relatively short; although the rate of passing the reaction product from one reactor to the subsequent one

may be adjusted in order to regulate the frequency of the blocks in the heteroblock copolymer chains (page 3, column 2, paragraph 4), this can at most be regarded as the control to a very limited extent of a short residence time within a moving zone, which cannot be equated with the residence time of a polymer in a static collecting zone specifically devised for this purpose.

3.4 In conclusion, novelty of the subject-matter of the patent in suit can, therefore, be acknowledged on the basis of the collecting zone.

4. As stated above, the prior art process requires the use of screw conveyors for the transfer of the block polymer from one reaction zone to the subsequent one. The energy necessary to provide for the mechanical transport of solid polymer gives rise to the generation of heat which can cause polymer degradation and/or unwanted polymerization initiated by residual monomer and catalyst. Further, there is a large surface area of contact between polymer and screw conveyor which comprises not only the tubular internal surface area of the screw extruder, but also the surface area of the screw itself, and may cause undesired accumulation of polymer deposits within the transfer passage or even the blockage thereof. Moreover, the working conditions of the screw conveyor are such that all the parameters, especially the pressure, within the second and subsequent zones cannot be selected as desired without any restriction being imposed by the polymerization conditions of the first zone.

In the light of this prior art the problem underlying the patent in suit may thus be seen in providing a simplified process for the transfer of the polymer material from one polymerization zone to the subsequent one, which not only reduces the above mentioned drawbacks to a large extent,

but additionally ensures the fully independent choice of polymerization conditions within the subsequent polymerization zone.

This problem is solved according to Claim 1 by transferring the reaction product of the first polymerization zone by means of a gaseous stream and by collecting the polymer in a small chamber situated upstream with respect to the second polymerization zone, the amount of polymer in this collector being controlled by two switch valves.

In view of the description of the patent in suit and the undisputed advantages put forward by the Appellant, the Board is satisfied that the above technical problem is plausibly solved.

5. It remains to be examined whether the requirement of inventive step is met by the claimed subject-matter.

5.1 The use of an inert gas stream in order to transfer polymer material from one polymerization zone to the subsequent one has already been suggested. It is even the essential feature of the process described in document (5).

This document discloses the dry polymerization of olefins in reaction vessels arranged in a series in which the solid polymer in course of formation, which is kept in the fluidized state, flows successively from the first reaction vessel through the last reaction vessel (Claim 1). Advantageously, the direct transfer from one reaction vessel to the subsequent one is achieved, while protecting the transferred polymer from the air, by moving the forming polymer by means of a stream of gas resulting from the difference in pressure between the two reaction vessels (column 5, line 20 to 30). This allows the composition of

the gaseous mixture to vary depending upon the reaction vessels; more specifically, it is possible to use different monomer compositions in the various polymerization zones as well as to supply different reactors with gaseous mixtures containing different proportions of hydrogen (column 4, lines 18 to 29) and with different cocatalysts (column 2, line 61 to column 3, line 4).

The advantages offered by this method all correspond to the improvements aimed at by the Appellant. Besides leading to polymer particles of uniform size, this process also enables the polymerization reaction vessels to function in a smooth manner without the formation of agglomerates which may cause lumping of the polymer. It also increases the operational flexibility of the installation, since it is possible to adjust the working conditions of each reaction vessel of the installation separately and to get the best out of each type of catalyst (column 5, line 60 to column 6, line 1).

5.2 The Appellant objected repeatedly that the possibility to adjust the operating conditions in each reaction vessel separately applied mainly to the ingredients added into the reaction vessels, namely monomer(s), hydrogen and cocatalyst, but could not be understood as the control of the actual polymerization conditions, especially the free choice of pressure in these reaction zones.

As stated above, the transfer of polymer from one reaction vessel to the subsequent one can only be achieved if the pressure maintained in a particular reaction vessel is lower than the pressure within the previous reaction vessel (Figure; column 6, lines 48 to 52 and column 7, lines 1 to 5); in the case of three reaction vessels arranged in series as illustrated in Example 1, the pressure in these vessels is respectively 23, 20 and 17 bars. In practice,

thus, there is a limitation in the choice of pressure within the second and subsequent reactors which is imposed by the pressure within the first reactor.

5.3 Therefore, the question of inventive step boils down to the question to know how the skilled man, who wants to be freed from the restrictive condition of decreasing pressures, should modify the transfer zone between two subsequent reactors.

For a chemical engineer it is self-evident that the pressure in the second reactor can only be equal to or higher than the pressure in the first one if the transfer between the two reactors is not direct, i.e. if there is a discontinuity in the duct through which the polymer is fed. This does not require more than a couple of valves to prevent the pressure equilibrium within the system to be reached and, consequently, a collecting vessel to store the polymer between the two reactors. In the Board's view, such a solution lies within the realm of the skilled man and, therefore, does not involve an inventive step.

As the Respondent underlined during oral proceedings, this solution is in fact implicitly suggested by the teaching of document (4). As a result of the current of dry nitrogen in the central part of the gas-tight screw conveyor to provide washing of the monomer residues as well as the continuous helical transfer of solid polymer particles through which the gas can only go back by diffusion, the pressure is not necessarily the same within the two reaction zones. In this prior art system, thus, the screw conveyor acts as a pressure stop like a valve and brings about an actual separation of the two polymerization zones, which is exactly the concept underlying the patent in suit.

5.4 Although the Appellant conceded the obviousness of the solution to a certain extent during oral proceedings, he objected that neither document (4), whose process is specifically tailored for the production of heteroblock copolymers, nor document (5), whose process is characterised by decreasing pressures in the successive reactors, could actually be the starting point for the definition of the problem underlying the patent in suit. In absence of any relevant reference, the subject-matter of the patent in suit should therefore be regarded as a problem invention.

The Board cannot accept this argument, since both documents deal with the multistage preparation of olefin copolymers in different polymerization zones and even specify to which extent these zones operate independently. In document (4) it is suggested to introduce a different monomer composition in each polymerization zone (page 2, column 1, paragraph 6) and to adapt the polymerization conditions, especially the concentration of each monomer and the temperature, according to the combination of monomers (page 4, column 1, paragraph 7 to column 2, paragraph 1, point 2); likewise, according to document (5), the composition of the gaseous mixture and amount of hydrogen introduced in each reaction vessel may vary (column 4, lines 18 to 24), the amount and type of cocatalyst may be different in the successive reactors (column 2, line 61 to column 3, line 4). For the skilled man, it is clear that the flexibility of such processes depends basically upon the number of parameters and features which can be freely selected for each step; increasing the flexibility of the whole process by making of the pressure a parameter independent in each polymerization zone is a mere optimisation effort which can normally be expected from the man skilled in the art.

As already noted in the decision T 109/82 of the Technical Board of Appeal published in OJ EPO, 1984, 473, point 5.1, the inventiveness of a subject-matter cannot result from merely framing a problem, but from the technical features of the solution to this problem. To pose the problem to be solved must be regarded as the consequence of the deficiencies identifiable in practice, which logically leads to a search for a solution to eliminate them. In the circumstances this problem could therefore readily have been posed by any skilled person when and if the need had arisen. It is thus in no way remote and cannot therefore make any contribution towards the inventive merits of its solution.

Thus, the arguments put forward by the Appellant to support an inventive contribution in merely formulating the technical problem cannot be accepted.

5.5 The same applies to the argument presented in the statement of grounds of appeal (page 3, paragraph 2) of the virtual complete absence of moving parts in the means provided for transfer in an apparatus constructed to carry out the process presently claimed.

As the Respondent pointed out, the description of the patent in suit (column 5, lines 38 to 44) explicitly envisages to continuously withdraw the polymer from the polymerization zone by means of a high-pressure rotary valve.

5.6 In conclusion, for the reasons given above, the subject-matter of Claim 1 does not involve an inventive step.

6. Claim 1 not being allowable, the same applies to Claims 2 to 5 which merely represent preferred embodiments of the subject-matter of Claim 1 and thus fall with the latter.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

M. Beer K. Jahn

03512

CG