COMMISSIONER'S DECISION

INSUFFICIENT DISCLOSURE: Claims Too Wide.

The specification taught a process using catalysts which rupture during polymerization, achieved by supporting the catalyst upon a porous carrier. The use of porous catalyst supports was prior knowledge. The claims were refused since only silyl chromate catalysts were mentioned in the disclosure. It was held that it would be obvious to skilled chemists that this procedure could use other catalysts and porous carriers to produce the required result.

FINAL ACTION: Reversed.

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This decision deals with a request for review by the Commissioner of Patents of the Examiner's Final Action dated March 27, 1972 on application 028,123. The application was filed on August 21, 1968, claiming a priority of August 21, 1967. The applicant is the Union Carbide Corporation, the inventor Adam R. Miller, and the title of the invention "A Continuous Process for the Production of High Molecular Weight Polymers of Olefins by Employing a Particulate Catalyst." The applicant filed a written response to the rejection, and specified that no oral hearing was requested.

In his rejection the examiner refused two claims, 20 and 25, as being indefinite and too broad for the disclosure. Claims 21-24 and 26-30 would also fall, since they are dependent on either claim 20 or claim 25. Claims 1-19 and 31 to 40, however, were not refused.

The invention relates to an improved method for polymerizing olefins, and to apparatus used for that process. Heretofore the polymerization had been carried out in the vapour phase using fluidized catalysts, such as hexavalent chromium oxide catalysts, but one problem has been corrosion produced by the catalysts. Another difficulty relates to contamination of the product with the catalyst used.

By using a silyl chromate catalyst, the applicant has overcome some of these problems. The catalyst residue, for example, is non corrosive. He uses the catalyst in a special reactor, one feature of which is the presence of a gas distribution plate. This plate permits the applicant to keep the reaction area fluidized by recycling gas through the distribution plate into the reaction zone. By injecting the catalyst above the distribution plate, the polymers desired are formed only above the plate, and will not clog it. These features form an essential part of the improved process covered by process claims 1-4, 10-13, 18, 19 and apparatus claims 31-40.

The applicant has also disclosed a second improvement. If he supports the silyl chromate catalyst (and according to the applicant other catalysts) upon certain porous carriers, the polymer will form not only on the surface of the catalyst but also within the pores, eventually rupturing the carrier. This rupture exposes fresh catalyst surfaces which promote further polymerization. As a result catalyst efficiency is increased. Furthermore the size of the catalyst is kept small by the rupturing process, so that the reaction zone remains fluidized, and does not clog up with large masses of solid polymer. Another result of such subdivision is a low residual catalyst content in the polymer formed, partly because of greater dilution of the catalyst with polymer product.

Illustrative of the claims to which no objection has been made, and which presumably are allowable, are 1 (the process) and 31 (the apparatus).

1. A continuous process for the production of solid particulate polymers of olefinically unsaturated compounds which comprises simultaneously:

(a) contacting, in a vertical reactor having gas distribution plate means within and towards the base of said reactor, a polymerization zone above said gas distribution plate means and a gas velocity reducing zone above said polymerization zone,

a gaseous stream containing a polymerizable olefin with a powdery silyl chromate polymerization catalyst for said olefin in said polymerization zone,

said polymerization zone containing a fluidized bed or formed and forming polymer particles,

at a mass gas flow rate sufficient to maintain complete fluidization of said bed and at a temperature below the sintering temperature of the polymer particles,

(b) withdrawing a small portion of the fluidized bed as discrete particles in suspension with a portion of the gaseous stream from the reactor at a point above said gas distributor plate means and towards the bottom of said polymerization zone,

(c) withdrawing the unreacted portion of said gaseous stream from said reactor at a point above said polymerization zone,

(d) cooling said unreacted gaseous stream to remove heat of reaction therefrom,

(e) recycling the cooled unreacted gaseous stream through said gas distribution plate means to the polymerization zone at a velocity sufficient to maintain fluidization of said bed,

(f) feeding make-up gas containing said olefin to the recycled gaseous stream at a rate of feed of make-up olefin as is equal to the rate of polymerization of said olefin in said polymerization zone, and

(g) feeding make-up catalyst to the polymerization zone at a rate of feed of make-up catalyst as is equal to the rate of catalyst consumption.

31. A fluid bed reactor system in which olefin monomers may be catalytically polymerized continuously in a fluid bed under gas medium fluidized conditions, and comprising,

a vertical reactor having a cylindrical lower section and an upper section having a cross section greater than that of said lower section, said lower section being adapted to house a polymerization zone in which the catalyzed polymerization reaction may be conducted under gas medium fluidized fluid bed conditions, and said upper section being adapted to function as a velocity reduction zone for the recovery of particles entrained in fluidizing medium entering said upper section from said lower section, fluidizing medium permeable distribution plate means within and towards the base of said lower section, said distribution plate means being adapted to diffuse fluidizing medium up through fluidized bed in said lower section and to support said bed thereon where said bed is quiescent,

fluidizing medium supply line means in gas communication with, and adapted to supply fluidizing medium to, the lower section of said reactor and below said distribution plate means,

catalyst injection means in catalyst supply communication with, and adapted to supply particulate olefin polymerization catalyst to, the polymerization zone in said lower section,

polymer product recovery means in polymer product recovery communication with, and adapted to recover polymer product from, the base of said polymerization zone and above said distribution plate means,

fluidizing medium recycle line means in gas communication with said reactor and adapted to recover fluidizing medium from the upper section of said reactor and to recycle the thus recovered fluidizing medium to the lower section of said reactor at a point below said distribution plate means, and

heat exchange means within said recycle line means adapted to remove heat of reaction from the recycled fluidizing medium.

The claims filed originally were all process claims, similar to the claim 1 quoted above, and restricted to the use of silyl chromate catalyst. After making a preliminary amendment in 1969, the applicant made a second amendment on June 16, 1970, some two years after the original filing date and three years afte the effective filing date under the International Convention. At that time he added apparatus claims similar to the claim 31 quoted above, and further process claims similar to claims 20-30 now under rejection. Those new process claims enlarged the scope of the protection sought by claiming the process whenever a catalyst is used which subdivides under polymerization conditi. The applicant subsequently restricted this slightly to exclude certain catalysts claimed in another copending application assigned to Union Carbide, viz Canadian Application 038,434, now patent 876,181, G.L. Karapinka, July 20, 1971. Claim 20, which is representative of the rejected claims, reads as follows:

A continuous process for the production of solid particulate polymers of olefinically unsaturated compounds which comprises simultaneously:

(a) contacting, in a vertical reactor having gas distribution plate means within and towards the base of said reactor, a polymerization zone above said gas distribution plate means and a gas velocity reducing zone above said polymerization zone,

a gaseous stream containing a polymerizable olefin with a particulate polymerization catalyst for said olefin in said polymerization zone,

said catalyst comprising a solid porous support adapted to subdivide under the polymerization conditions, and being other than a supported bis(cyclopentadienyl) chromium (II) catalyst, and

said polymerization zone containing a fluidized bed of formed and forming polymer particles,

at a mass gas flow rate sufficient to maintain complete fluidization of said bed and at a temperature below the sintering temperature of the polymer particles,

(b) withdrawing a small portion of the fluidized bed as discrete particles in suspension with a portion of the gaseous stream from the reactor at a point above said gas distribution plate means and towards the bottom of said polymerization zone,

(c) withdrawing the unreacted portion of said gaseous stream from said reactor at a point above said polymerization zone,

(d) cooling said unreacted gaseous stream to remove heat of reaction therefrom,

(e) recycling the cooled unreacted gaseous stream through said gas distribution plate means to the polymerization zone at a velocity sufficient to maintain fluidization of said bed,

(f) feeding make-up gas containing said olefin to the recycled gaseous stream at a rate of feed of make-up olefin as is equal to the rate of polymerization of said olefin in said polymerization zone, and

(g) feeding make-up catalyst to the polymerization zone at a rate of feed of make-up catalyst as is equal to the rate of catalyst consumption.

The examiner rejected claims 20-30 on the ground that they cover an invention which was not disclosed in nor supported by the disclosure. He stated that they were "too broad and indefinite." This, of course, would be contrary to Section 36 of the Patent Act and Section 25 of the Patent Rules. It was his contention that the only process properly supported by the disclosure is one where silyl chromate is utilized. He phrased his objection in the following terms:

> One of the essential features of the process as disclosed is the use of a silyl chromate catalyst. Support for this contention is found on page 3, lines 25 to 28 where it is stated: "It has now been found that solid particulate olefin polymers of low, non corrosive catalyst residue content can be obtained by continuously contacting a gaseous stream containing a polymerizable olefin with a powdery silyl chromate catalyst". Also on page 4, lines 27 to 29 it is stated "This invention relates to the continuous production of high molecular weight particulate polymers of olefins by feeding a powdery silyl chromate catalyst..." again on page 5, lines 23 and 24 it is stated

"The catalysts used in the practice of this invention are silyl chromate catalysts..." On page 6, lines 4 to 6 it is stated "The silyl chromate catalysts used in the practice of this invention are in the form of powdery free flowing solid particles and are preferably capable of subdivision". Furthermore all the Examples describe polymerization processes using silyl chromate catalysts. There is no suggestion anywhere in the disclosure that any catalyst other than the silyl chromate catalyst could be used in the claimed process. Applicant's claims must therefore be limited to silyl chromate catalyst.

Applicant's claims as originally filed were limited to a polymerization process having the step of contacting a gaseous stream containing a polymerizable olefin with a powdery silyl chromate polymerization catalyst. However by an amendment letter dated June 16, 1970 applicant inserted additional claims 20 to 40. New process claims 20 and 25 do not refer to silyl chromate catalyst but instead define the catalyst as "a particulate polymerization catalyst". In the Office Action of December 30, 1970, the examiner objected to that expression and stated that the only catalysts mentioned in the disclosure are silyl chromate catalysts. In the amendment letter of March 29, 1971, applicant responded to the objection by submitting that there is adequate support in the specification for the use of such broad claim terminology. He noted that the silyl chromate catalyst materials which are to be used constitute a broad family of catalyst materials. He also noted that various types of supports are also listed in the disclosure. In the Office Action of April 23, 1971, the examiner repeated the objection. In this report the examiner agreed that the silyl chromate catalyst materials which are disclosed constitute a broad family of catalyst materials and that the disclosure states that the silyl chromate catalyst may be combined with any of a variety of supports. However the examiner pointed out that the disclosure is limited to that silyl chromate family as an essential element of applicant's catalyst.

By his amendment letter of October 15, 1971, applicant amended claims 20 and 25 by inserting the statement "said catalyst comprising a solid porous support adapted to subdivide under the polymerization conditions". Applicant argued in support of that amendment that the essence of the catalyst which is to be used in the polymerization process of the present invention is not dictated so much by the choice of chromium compound alone, but rather by the use of the solid porous support which is adapted to subdivide under the polymerization conditions. Applicant further submitted that "there is no teaching of this concept regarding the subdividing of the catalyst in the prior art, and therefore the applicant should be entitled to broad protection in this regard since he is apparently the first to claim such a concept". The examiner contends however that the amendment to claims 20 and 25 and the supporting argument do not overcome the objections made in the two previous Office Actions and reiterated hereinabove. The new statement inserted in claims 20 and 25 is functional and merely describes a desirable characteristic of the catalyst support. There is no indication in the disclosure or the claims as to how the ability of the catalyst support

to subdivide is to be achieved. Reference to the disclosure on page 6, lines 4 to 6 which is quoted hereinbefore indicates that the subdividable catalysts are merely a preferred group of the silyl chromate catalysts used in the practice of the invention.

Amended claims 20 and 25 are also objectionable in that the statement "said catalyst comprising a solid porous support adapted to subdivide under the polymerization conditions" introduces a further element of indefiniteness. This statement which purports to define the catalyst, in fact, does not define the active ingredient of the catalyst at all. The statement describes the catalyst support but fails to define the complete catalytic composition. The claims therefore do not comply with Section 36(2) of the Patent Act.

Among the reasons for allowance advanced by the applicant are the following:

1. The rejected claims are directed to the same concept as the apparatus claims, and would grant the applicant no greater monopoly than do the apparatus claims. Since the apparatus claims are acceptable, claims 20-30 should also be accepted.

2. The fact that the procedure for operating the reactor of claims 31-40 is disclosed in the specification only with specific reference to the use of silyl chromate catalysts therein should not prevent the applicant from obtaining broader process protection relative to the choice of catalyst. The silyl chromate catalysts, per se, and their use as olefin polymerization catalysts, is not novel. What is novel is the applicant's reactor and his process for using subdividable catalysts therein, of which the supported silyl chromate catalysts represent one family. It is submitted that the essence of the catalyst which is to be used in the polymerization process of the present invention is not dictated so much by the choice of chromium compound alone, but rather by the use of the solid porous support which is adapted to subdivide under the polymerization conditions, and this concept is disclosed in the applicant's specification, page 6, lines 12-33. This ability for the supported catalyst to subdivide is a unique necessity in the applicant's fluid bed process, as contrasted to the utility of a catalyst system which may be used in a solution or slurry system. In the latter type of polymerization systems it is usually not necessary for the catalysts to have this ability to subdivide, whereas, in the applicant's fluid bed process, it is essential that the catalyst have this property because of the very nature of the process. As the catalyst particles become larger and larger during the polymerization reaction in the fluid bed process because of the accumulation of polymer thereon they tend to sink lower and lower in the gas stream. In order to maintain the fluidity of the fluid bed it is necessary for the particles to subdivide so that they can remain small enough to be maintained in suspension. It is submitted that there is no teaching of this concept regarding the subdividing of the catalyst in the prior art, and therefore the applicant should be entitled to broad protection in this regard since he is apparently the first to claim such a concept.

> It is submitted that the applicant has, in fact, discovered a new invention relative to fluid bed polymerization processes wherein a specific type of solid porous support is to be used irrespective of the other components of the catalyst system that may be used therewith. Once the concept of using a solid porous support which is adapted to subdivide is made known to those in the art, the substitution of other heavy metal compounds or other catalyst materials for the silyl chromate compounds would be obvious, and the applicant should have broad claims relative to his contribution to the art in this regard.

In support of those contentions the applicant relied upon Lovell Manufacturing v Beatty (1964) 41 CPR 18 and Rodi v Metalliflex (1961) S.C.R. 117.Concerning the objection of indefiniteness, the applicant argued:

> ... the statement "said catalyst comprising a solid porous support adapted to subdivide under the polymerization conditions" is not indefinite with respect to the claimed invention. The intent of the language used in this regard is to claim, as the essence of the recited invention, the use of a subdividable support as the support to be used for a catalyst in a fluid bed process and not the use of a specific active catalyst site as contended by the Examiner. If the applicant is entitled to claim the invention of claims 20 and 25 at all, he is entitled to claim it in terms of the language in question. It is the applicant's contention that, with respect to the inventive concept of claims 20 and 25, the choice of specific catalyst sites is irrelevant, and that the additional recitation of active catalyst sites would add nothing by way of making more definite the delineation of the presently claimed concept of claims 20 and 25. The essence of the catalyst of claims 20 and 25 is the type of support to be used, not the type of active catalyst site that may be present thereon. Thus, while the statement in question may be broad with respect to the catalyst definition, it is certainly not indefinite with respect to claiming the concept which the applicant wishes to claim, and which he believes he is entitled to claim.

The fallacy in the first argument of the applicant stems from the fact that each claim (apart from dependent claims) must be considered separately. In considering apparatus claims it must be determined whether the apparatus is disclosed fully. In considering process claims it must be determined whether the process is disclosed fully. If the applicant means to suggest the apparatus claims give him the same monopoly as his broad process claims, then the process claims become redundant in affording him the protection to which he is entitled, and their presence is contrary to Section 43 of the Patent Rules. In point of fact the apparatus claims afford the applicant protection in that apparatus no matter to what use it may subsequently be put, whether that use be for olefin polymerization or other catalytic processes. To that extent they provide him with a different monopoly than the process claims. Quite possibly completely different

in his apparatus. The point at issue is not one of "greater" and "lesser" monopolies, but of different monopolies. An apparatus claim is patentably novel because of its own structure or combination of parts, and not because of its application to particular compounds.

The next consideration is whether the process is disclosed in the same breadth as that covered by claims 20 and 25. In the disclosure we find the following statements (underlining added):

> (1) It has now been found that solid particulate olefin polymers of low, non-corrosive catalyst context can be obtained by continuously contacting a gaseous stream containing a polymerizable olefin with a powdery silyl chromate catalyst... (Summary of Invention, page 3).
>
> (2) This invention relates to the continuous production of high molecular weight particulate polymers of olefins by feeding a powdery silyl chromate catalyst...." (Description, p.4)
>
> (3) The catalysts used in the practice of this invention are silyl chromate catalysts....." (p.5)
>
> (4) "The silyl chromate catalysts used in the practice of this invention are...." (p. 6)
>
> (5) "Injecting the catalyst at a point above the distribution plate is an important feature of this invention. The silyl chromate catalysts used in the practice of this invention are highly active." (p.11)
>
> (6) "The silyl chromate catalyst system of this invention appears to yield a product having an average particle size of about 40 mesh.... The low residual content is attributed to the high productivity of the silyl chromate catalyst ....." (p.13)
>
> (7) Each and every of the 17 examples involves the use of a silyl chromate catalyst, and no other.
>
> (8) The only claims filed originally, and the only claims on file for two years, were limited to silyl chromate catalyst.

Clearly the tenor and main thrust of the disclosure and the original claims was directed to silyl chromate catalysts. It would be easy to assume that silyl chromates would be the only catalysts useful.

The only other reference to the catalyst appears in the abstract, which refers to "a particulate catalyst such as a powdery silyl chromate." Since Section 27(A) (2) of the rules specifically prohibits the use of the abstract to interpret the scope of the invention claimed, there is no need to consider the significance of the wording used in it. Suffice it to point out that in Scragg v Leesona, 1964 Ex. C.R. 649 at 711 the President of the Exchequer Court indicated that the expression "such as" must not be construed as meaning simply "for example", but is restrictive (in this case restricted to silyl chromate catalysts). The phrase was also considered by the Supreme Court of Canada in Noranda Mines v. Minerals Separation, 1950 SCR 36.

The applicant contends that he is entitled to claim obvious modification of the specifically disclosed embodiments of his invention, and cites both Rodi v. Metalliflex (supra) and Lovell v. Beattey (supra) in support of that contention. Those decisions do hold that obvious equivalents of an element claimed in a combination would, under the circumstances that arose, be protected by the claims. In the Rodi decision the subject matter involved means for holding together parts of a watch band, and with such relatively simple subject matter it could well be obvious that other fastening means could be utilized. In the Lovell decision the court applied the doctrine of mechanical equivalency to an invention involving washing machine ringers. One must, however, use caution in applying this principle to assess whether it fits another set of circumstances.

The decision of the Supreme Court in Sandoz v Gilcross Ltd., formerly Jules R. Gilbert, S.C. Oct. 18, 1972, has given added guidance on this point. As is indicated on page 10 of that decision:

> "A specification is addressed to persons skilled in the art and, therefore, is to be construed by the standard of what such a person would understand on reading it."

It further held that where a specification fully describes not only the invention but also its operation or use, it would not invalidate a patent on mere technicalities, nor did it consider that Section 36(1) required it to do so.

We must decide then what a skilled chemist would take from the disclosure given on page 6 of the application. It was previously known to polymerize olefins using the fluidized catalyst technique. It was also known to use porous catalyst supports (See, for example U.S. Patent 3,023,203, Feb. 27, 1962 referred to on page 2 of the applicants' disclosure). The applicant has taught that it would be useful to carry out his process utilizing the procedural steps specified in the claims, using catalysts which will rupture during the polymerization process, and that this rupturing could be achieved by supporting the catalyst upon a porous carrier. He illustrated it using silyl chromate catalysts. In our view, considering the state of the art, it would be obvious to skilled chemists that it would be equally desirable with other catalysts to use his procedure and porous carriers to produce the same result. The applicant has not specified what such other catalysts might be, at least in this application, but many would be suitable. In fact, several have subsequently been so used on porous supports which rupture during use. Having developed this new technique, we do not think the applicant should be restricted in the protection afforded him to its application to the specific catalyst he has disclosed. As was held in Riddell v Patrick Harrison, (1956-1960) Ex. C.R. 213 at 253, an inventor need not restrict his claims to what has been "specifically described in the specification and illustrated in the accompanying drawings," but, within the breadth of his invention, may claim it as broadly as it would normally be construed by persons skilled in the art. For such reasons, we do not consider that Section 36 prohibits the grant of claims 20-30.

The examiner's argument that the claims are indefinite is related to his contention that claims 20 and 25 fail to specify what catalysts are to be employed. We have concluded, however, that the essence of the invention covered by the rejected claims is not the catalyst itself, but the particular procedure employed including the use of a porous carrier which results in a rupturing of the catalytic material. Under those circumstances there is no requirement upon him to specify the particular catalyst to be used, and the indefiniteness to which the examiner refers is not a consideration.

The Board, then, is of the opinion that the rejection made under Section 36 should be withdrawn.

G.A. Asher,
Chairman,
Patent Appeal Board.

I concur with the findings of the Patent Appeal Board. The rejection made under Section 36 is to be withdrawn, and the application returned to the Examiner for resumption of the prosecution.

Decision accordingly

A.M. Laidlaw,
Commissioner of Patents.

Dated and signed
in Hull, Quebec this
18th day of February, 1974.

Agent for Applicant
Smart & Biggar,
Ottawa, Ontario.