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File No.: T 0547/88 - 3.2.2
Application No.: 80 301 891.0
Publication No.: 0 021 672
Classification: B29C 71/04, B32B 27/32, C23C 14/20, C25D 5/56
Title of invention: Oriented polypropylene film substrate and method of
manufacture

D E C I S I O N
~~of 19 November 1993~~

Applicant: MOBIL OIL Corporation
Proprietor of the patent: -
Opponents: HOECHST Aktiengesellschaft
MOPLEFAN S.p.A.

Headword:

EPC: Art. 56

Keyword: "inventive step" - (yes)

Headnote
Catchwords



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Boards of Appeal

Chambres de recours

Case Number: T 0547/88 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal 3.2.2
of 19 November 1993

Appellant: MOBIL OIL Corporation
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office dated 7 September 1993
revoking European patent No. 0 021 672 pursuant to
Article 102(1) EPC.

Composition of the Board:

Chairman: G.S.A. Szabo
Members: J. du Pouget de Nadaillac
L.C. Mancini

Summary of Facts and Submissions

I. The appeal lies from the decision dated 7 September 1988 of the Opposition Division of the EPO revoking the European Patent No. 0 021 672 (European patent application No. 80 301 891.0) on the ground that the subject-matters of the granted independent Claims 1 and 3 do not involve an inventive step in view of the following prior art documents (5) and (11) (or corresponding references (10) and (3), respectively):

(5) : US-A-3 620 825 (or (10): DE-A-1 769 028
(11): GB-A-1 145 199 (or (3): DE-B-1 694 694)

II. The granted independent Claims 1 and 3 read as follows:

Claim 1 : " A method of producing a metal coated oriented polypropylene film comprising the steps of coextruding a film substrate having a homopolymer polypropylene core layer and an ethylene propylene copolymer outer layer on at least one side of the core layer, neither the core layer or the outer layer containing a slip agent; biaxially orienting the film; subjecting the at least outer layer to corona discharge treatment; and applying a metal coating to the treated outer layer, characterised in that the ethylene propylene copolymer outer layer contains from 2 to 4% by weight of ethylene and 96 to 98% by weight of propylene."

Claim 3 : "A metal coated oriented polypropylene film comprising a coextruded homopolymer polypropylene core layer and an ethylene propylene copolymer outer layer on at least one side of the core layer, the core and outer layers containing no slip agent and being biaxially oriented, the at least one outer layer being corona

discharge treated and the treated surfaces having a metal coating deposited thereon, characterised in that the ethylene propylene copolymer outer layer contains from 2 to 4% by weight of ethylene and 96 to 98% by weight of propylene."

III. The Appellant (Patentee) lodged the appeal on 7 November 1988 and paid the appeal fee the same day. The Statement of Grounds of appeal was filed on 16 January 1989 by telefax and confirmed by letter on 18 January 1989. In this Statement, the Appellant contested the views of the Opposition Division.

The two Respondents (Opponents) answered on 9 and 10 August 1989, respectively.

IV. After the summons for the oral proceedings, the Appellant submitted on 4 February 1991 a sworn affidavit of Dr. Mount, who is responsible of research of the firm Mobil Co, which is the proprietor of the patent. Comparative tests and their results were disclosed in this affidavit. A particular metal adhesion test was used to measure the bond strength between the metal coating and the laminate support.

With a letter dated 5 March 1991, Respondent II gave briefly the results of his own comparative tests concerning the ethylene content.

Oral proceedings took place on 6 March 1991. In these proceedings, the Respondents questioned the particular metal adhesion test described in the affidavit submitted by the Appellant. At the end of the proceedings, the Board decided to continue the procedure by writing.

V. Subsequently the procedure continued as followed:

On the 30 April 1991, the Board issued a communication, in which the parties were asked to exchange views about further tests to be done, including information about available equipments to be employed, and to issue a joint protocol about their understanding as to what should be done, when and under what conditions, including any disagreement they might have.

On the 9 July 1991, the Appellant submitted a report giving more information on the previous tests conducted by Dr. Mount, ~~so that the Respondents could repeat these~~ tests. He also proposed to carry out these tests again in the presence of the Respondents.

On the 12 August 1991, Respondent I asked the Appellant to provide film samples and to give additional data about the tests of Dr. Mount. The Appellant provided the requested information a few days later and asked for an agreement on a joint protocol before releasing film samples.

On the 26 October 1991, Respondent I criticized the Appellant's tests and filed the results of comparative tests made with his own film samples produced by following the parameters given in the Appellant's affidavit and report. The same Respondent moreover submitted three technical opinions of an independent expert, Doctor G. Zachmann, professor in the polymer field at the University of Hamburg. These opinions concern the comparative tests of Dr. Mount, the influence of a coextrusion process when compared to an in-line coating process for the metallization of polymer films, and the significance of different ethylene contents.

On the 11 November 1991, Respondent II submitted also the results of own comparative experiments made on the basis of the Appellant's tests, but, this time, by measuring the metal adhesion according to the method described in the patent in suit. No difference was found between the coextruded produced sample film and the in-line coated one. No metal lift was detected in each sample. Criticisms on the Appellant's tests were also submitted.

On the 27 January 1992, the Appellant expressed regret about the absence of a joint protocol, since such a protocol would have been necessary in view of the discrepancies between the experiments.

On the 30 June 1992, a communication of the Board raised several questions on certain litigious points and asked for answers or comments by the parties.

On 10 November 1992, both Respondents answered by mainly repeating their arguments.

On the 10 March 1993, the Appellant replied to some of the questions and submitted a new affidavit of Dr. Mount, describing comparative tests, which were similar to the previous ones but employed the metal adhesion test of the patent in suit. According to the results, the metal film of the patent showed a superior bond strength accompanied by 100% metal pick-off. On 8 November 1993, Respondent II criticized the new tests submitted by the Appellant.

VI. The arguments of the Appellant can be summarized as follows:

Document (5) addresses the problem of metallizing a biaxially oriented polypropylene film, but teaches in

this respect to avoid a high degree of molecular orientation, which causes poor adhesion. For this reason the two layers are differently stretched. In contradiction to this, the layers are coextruded according to the invention before being biaxially stretched, so that a same orientation of the layers is obtained.

Document (11) is concerned with a completely different problem. The reheating of an oriented polypropylene to its softening point in order to seal it with itself or with another polyolefin film results in the ~~polypropylene molecules returning to their original~~ random position distribution which causes the film to shrink and tear. This problem is not present when metallization occurs, since lower temperatures are used. The skilled person, seeking to metallize a film, has therefore no reason to consider this document. Moreover, it teaches to corona discharge the core layer, and not the copolymer outer layer. The use of the copolymer disclosed in Document (11) is also criticized in Document (5).

The deterioration of the films in the experiments of Respondent II has apparently to do with the apparatus sealer used by this Respondent, whereas the Appellant has used the "Sentinel" sealer as described in an exhibit attached to the first Appellant's affidavit. A joint protocol would have avoided such discrepancies.

The tests of Respondent I compare either different ethylene contents of the outer layer or two processes, i.e. coextrusion and in-line coating, which are employed to produce the laminate, and thus concern isolated features of the claims, and not the whole combination of features of these claims.

VII. The Respondents substantially argued as follows:

Document (5) teaches to extrude the outer layer onto a monaxially oriented core layer. Thus, the outer layer is also pulled in the longitudinal direction. Both layers are then transversely stretched, so that they both are finally biaxially stretched. It is not a "voluntary" biaxial orientation of the outer layer, but nevertheless the result is a bi-orientation. The claims of the patent in suit, particularly the product Claim 3, do not specify the degree of orientation. A biaxial orientation of the layers is therefore not new.

Even if it is considered that the outer layer is oriented in a single direction only, this difference *vis-à-vis* biorientation plays in fact no physical and chemical rôle for the bond strength between the metal coating and the laminate. This is confirmed by the Dr. Zachmann's first opinion, according to which the orientation of the copolymer outer layer is lost when, according to the Dr. Mount's affidavit, such an orientation takes place at a temperature of 162°C, i.e. well above the melting point of the copolymer. Such a layer cannot be distinguished from a unoriented layer. It remains, consequently, as a single difference the ethylene content, which, according to the second opinion of the expert, plays also no function for the said bond strength. The tests conducted by Respondent II confirm this opinion. The Appellant himself agrees with this point, since he finds no difference in the strength bond between samples having different ethylene contents, when using the usual adhesion test of the patent in suit, as is shown in his first affidavit, Point 6a.

Moreover, the teaching of document (5) does not go against biaxial orientation per se. This document only teaches that a biaxially oriented polypropylene shows

bad adhesion properties, but says nothing in this respect about other plastics. To avoid this drawback of polypropylene films, Document (5) discloses the application of an outer layer on the polypropylene core layer, and more particularly of a copolymer of ethylene and propylene, which shows improved adhesion properties. When, on the other hand, the skilled person learns from Document (11) (or (3)) that a coextruded and then biaxially oriented composite film, comprising a polypropylene core layer and an ethylene-propylene copolymer outer layer with an ethylene content being between 2% to 6%, exhibits a good adhesion to the base polypropylene film and improved heat-sealing characteristics, it is obvious for him to employ such a laminate in a metal coating process according to Document (5), which teaches that the problems for heat-sealable layers and for metal layers are the same. Claim 1 of Document (3), moreover, mentions an amorphous copolymer outer layer. The use of a corona discharge treatment for improving the adhesion is well-known : it is mentioned in Documents (5) and (11).

The tests provided by the Appellant are to be challenged for several reasons: Contradictions appear between the affidavit and the report, Moreover, parameters, like the "surface wettability" or "adhesive property" of the aluminium layer (metal layer), which strongly depends on the time and storage conditions of the metallized films, are missing. The metal pickoff determination based on visual observation is very doubtful. Sample films used in these tests, moreover, have different structure (random or block polymers), which are not comparable. The results of these tests are therefore meaningless.

VIII. The Appellant requested that the decision under appeal be set aside and that a patent be maintained as granted. If necessary, further oral proceedings were asked for.

The Respondents requested that the appeal be dismissed and the revocation of the patent be confirmed. Further, oral proceedings were also asked for, as an auxiliary request.

Reasons for the decision

1. The appeal is admissible.
2. The requests for further oral proceedings by all parties are rejected since the parties and the subject are the same. The purpose of continuing the proceeding in writing after the first oral hearing was to provide further clarifications with regard to the ~~same~~ facts. The Appellant and the Respondents since had ample opportunities to present their views (Article 116 EPC).
3. The novelty of the subject-matters of the independent claims was, in any case, not disputed by the Respondents. None of the documents cited discloses the claimed range for ethylene range content of the copolymer outer layer.
4. *The closest state of the art and the problem to be solved.*

The closest prior art is represented by Document (5). According to this prior art, a method of producing an eventually metal coated oriented polypropylene film comprises the step of applying by extrusion, at least on one side of a polypropylene core layer after it has undergone a uniaxial stretching, an ethylene propylene copolymer outer layer and, then, stretching the resulting laminate in a second, i.e. transverse direction. The copolymer outer layer contains not more than 15 percent by weight of ethylene, with the balance

essentially propylene. Since the outer layer had not been stretched in the first, i.e. axial direction, it is only insignificantly oriented in this direction. A second stretching operation requires a temperature higher than the temperature employed for the first stretching operation. Since it has not been already stretched and because of this use of high temperatures, due to the high molecular mobility, the outer layer is less oriented than the core layer in the second, i.e. transverse direction. The use of slip agent is not mentioned in this document.

~~Such a laminate is described as displaying an improved~~ adhesion to subsequently applied heat-sealing layers or metal layers, although the aim of this document is mainly to improve the adhesion between the core layer and outer layer. A test for determining the bonding strength, that is to say the force at which the metal coating begins to separate from the laminate, is also disclosed. Example 6 of this prior art gives an ethylene content of 7% and, in this example as well as in Example 1, the laminate is passed through an electrical corona discharge before being coated with a subsequent layer.

5. *The technical problem*

The object of the patent in suit is to provide similar oriented polypropylene film laminate having enhanced adhesion to a metallized coating.

According to Claims 1 and 3, this object is solved by the following further features:

- a) Coextruding the core layer and the outer layer, which is to be coated by a metal;

- b) biaxially orienting the thereby obtained laminate;
- c) said outer layer containing from 2 to 4% by weight of ethylene.

6. *Interpretation of Feature b)*

According to the Respondents, this feature is not new, at least in the product Claim 3, since this claim does not give any information as to the degree of orientation. On the other hand, Document (5) discloses that the outer layer is stretched in both directions, even if in one direction it is insignificantly oriented.

The Board cannot follow this conclusion. Document (5) explains the insignificant orientation nevertheless as an orientation, which is normal with unstretched polypropylene films (Column 2, lines 66,67). When an applicant specifies in a claim a biaxial orientation, it is clear that he means more than a natural or inherent orientation. Moreover, as the Appellant has indicated in the oral proceedings, Claim 3 is to be necessarily seen as a product-by-process claim, that is to say that the product of Claim 3 is to be made by the process according to Claim 1. In Claim 1, it is clearly mentioned that the core and outer layers are biaxially oriented together, once being coextruded, so that both layers undergo the same biaxial orientation. Thus, feature b) is new as such in this context.

7. *Inventive Step*

The above feature was not even implicitly suggested by Document (5), which in fact goes in the opposite direction. The Board agrees with the Respondents that Document (5), indeed, teaches explicitly that the high

degree of molecular orientation is a drawback only for a polypropylene film, but the solution of this document, i.e. the manner of providing an outer layer oriented deliberately in only one direction, with, moreover, the choice of a temperature which reduces the degree of orientation of this layer, gives implicitly the teaching that the disadvantage was also considered as relevant for the copolymer outer layer. The present invention, therefore, with the features a) and b) of Claim 1 goes against both the direct and implicit teachings of Document (5).

8. ~~Document (11), or the corresponding Document (3) is~~ directed to a heat-sealable oriented polypropylene film laminate having improved heat sealing characteristics. According to this specification, oriented polypropylene is superior in physical properties compared to unoriented polypropylene, but the ability of this kind of polymer to adhere to itself falls far below satisfactory levels after orientation, since "the reheating of oriented of oriented polypropylene to its softening point, in order to seal it, results in the polypropylene molecules returning to their original random distribution, which causes the film to shrink and tear". This difficulty was previously avoided by coating said oriented polypropylene film with heat-sealable materials and the solution of Document (11) goes further in this direction by providing as outer layer a copolymer layer containing 2% to 6%, preferably 2,8% to 3,8%, by weight of ethylene with the rest being propylene. Thus, this layer itself conforms to that specified in the claims of the present invention. The core and outer layers are preferably coextruded and then biaxially oriented. Suggestion is also made to subject the core film to corona discharge treatment before the application of the outer layer, to better anchor the layers together.

However, as seen from above, Document (11) deals with the problem of bringing an outer layer directly on the core layer in order to provide a good heat-sealable layer and what is searched is to obtain an improved bond strength between the core and outer layers. Thus, the problems to be solved are not the same as in the patent in suit and there is no suggestion in Document (11) that good adhesion properties should also be found between the described copolymer outer layer and a metal layer, which is to be attached thereon. Thus, the skilled person, facing the problem mentioned above, in Point 4, has no reason to consider this document, which does not at all address the provision of a subsequent coating of a composite film, and even less the one of a metal coating.

The fact mentioned by Respondent I that, in the other corresponding document (3), Claim 1 mentions an amorphous copolymer outer layer, cannot bring a hint in the direction of Document (5), when the whole description of Document (3) shows that a subsequent biaxial process is applied, so that the amorphous aspect mentioned in Claim 1 of this document concerns only an intermediate state of the copolymer layer. Moreover, even if the man skilled in the art had had his attention drawn on Documents (3) or (11), he should have been refrained to use the copolymer disclosed in these documents because of the biaxial orientation of said copolymer, which goes against the teaching of Document (5).

For all these reasons, the Board cannot follow the reasons given in the contested decision. In view of the problem to be solved and of the teachings of Documents (5) and (11), the combination of these documents is not obvious.

9. However, the Respondents have also contested the relevance of the claimed features with respect to the problem to be solved. Tests and expert's opinions were submitted to support this view. The Appellant, on the other hand, has filed the results of his own experiments to prove the improved bond strength of the metal coated laminate according to the claims of the patent in suit. Although the Board had asked the parties to issue a joint protocol about tests to be done and under what conditions, each party in fact conducted his own experiments and contradictory results were obtained.

~~The tests submitted on 26 October 1991 by Respondent I in which the films have been destroyed, are unhelpful to demonstrate the absence of advantages. The heat sealer employed in this test could have produced the mentioned drawback.~~

The Appellant, on the other hand, by providing new tests in his second affidavit, has apparently admitted the relevance of the Respondents' objections about his first tests submitted on the 12 February 1991. In the second affidavit filed on 10 March 1993, Dr. Mount, in his comments (page 3, Point 9) on his first set of tests, indicated that "with the heat sealing test used in my previous affidavit, the lower bond strengths were accompanied by a relatively low metal pick-off, demonstrating that much of the failure caused by the Suter test was between the polyester film and the metal surface, rather than between the metal layer and the underlying film substrate". Consequently, the first tests of the Appellant do not seem to be meaningful. His second set of tests, however, was still based on film samples, which were produced under the same conditions as those used in the first tests, so that the objection of the Respondents, sustained by the Dr. Zachmann's opinion, still remained valid, according to this the

temperature of 160°C employed for the second stretching, that is to say well above the melting point of the given ethylene copolymer (130° to 145°C), should have destroyed any orientation of at least the outer layer and, thus, the effect of the coextrusion and biaxial orientation steps. The Appellant has not refuted this objection.

The Board notices, however, that, in other prior art documents, higher melting points are given for ethylene-propylene random copolymer having minor amounts of ethylene. In EP-A-0 002 606, temperatures from about 141°C to about 152°C are mentioned as melting points for coextruded oriented films comprising said copolymer as outer layer, and a preheating temperature of 156°C is given for the stretching of the coextruded film in both directions. Document (3) disclose a preheating temperature of 149°C in the oven for transversely orienting the above described coextruded laminate of this prior art. It is, therefore, not possible to have a clear picture of the possible range of temperatures for either the melting point of the copolymer in question or for the stretching steps of laminate having said copolymer as outer layer.

The second opinion of the expert, Dr. Zachmann, concerning the ethylene content, deals with only one feature of the contested claims and is based on the premise that the two other features, namely the coextrusion and the biaxial orientation, do not influence the adhesion properties. But, as seen above, this matter is still unclear. The same conclusion concerns the tests of Respondent II submitted on 5 March 1991, since again these only tackle the question of the ethylene content.

The other tests conducted by Respondent II, on the basis of the data given in the report of Dr. Mount, are not convincing either, since the results are said to be obtained with no metal lift. In such a case, the same objection as for the first tests of the Appellant applies, namely that it is only the bond strength between the test film and the metal which is really measured, and not the one between the metal and the laminate base.

10. To sum up, all tests or opinions of the Respondents which concern a single feature of Claims 1 and 3 are ~~unconvincing, since these claims cover at least an~~ association of features, and the Respondents have not proven that this association per se is not a true combination of features, that is to say that features do not influence each other. The last test of Respondent, which apparently corresponds to such an attempt, is meaningless for the reason given above. Moreover, tests made without an agreement on the methodology and in the absence of the other parties are to be considered cautiously, particularly when several steps are to be followed, each requiring particular apparatuses, which have to work under given conditions and parameters, as it is the case with the present invention. The last tests provided by the Appellant were challenged by the Respondents (c.f. letter dated 8 November 1993), but this does not strengthen their own arguments. It is, therefore, not possible to base any final conclusion on these tests suggesting that no inventive step is involved.

11. In such a case, in view of the fact that the tests show contradictory results, the patent proprietor is given the benefit of the doubt in respect of the relevance of the claimed features in view of the problem to be solved (according to the jurisprudence of the Boards, see

T 219/83, OJ EPO 1986, page 211). Moreover, since, as seen above, the prior art does not suggest the subject-matter of the contested claims, said subject-matter implies an inventive step, as required by Articles 52 and 56 EPC. Hence, the patent can be maintained.

Order

For these reasons, it is decided that:

1. The impugned decision is set aside.
2. The case is remitted to the first instance with the order to maintain the patent as granted.

The Registrar:

The Chairman:



S. Fabiani



G. Szabo

