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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 335/88 - 3.2.2

Anmeldenummer / Filing No / N° de la demande : 82 902 987.5

Veröffentlichungs-Nr. / Publication No / N° de la publication : 0 090 863

Bezeichnung der Erfindung:
Title of invention:
Titre de l'invention : Injection molding apparatus

Klassifikation / Classification / Classement : B29F 1/00; B29F 1/06

ENTSCHEIDUNG / DECISION

vom / of / du 4 April 1990

Anmelder / Applicant / Demandeur : Nissei Plastics Industrial Co., Ltd.

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Art. 56

Schlagwort / Keyword / Mot clé : "Closest state of the art: same type of moulding machine";
"Inventive step - yes".

Leitsatz / Headnote / Sommaire

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Case Number : T 335/88 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal 3.2.2
of 4 April 1990

Appellant : Nissei Plastics Industrial Co., Ltd.
2110 Ohazaminamyo, Sakakimachi, Hanishina-gun
Nagano-ken 389-06 (JP)

Representative : M. M. Bruder
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Decision under appeal : Decision of Examining Division 094 of the European Patent Office dated 11 December 1987 refusing European patent application No. 82 902 987.5 pursuant to Article 97(1) EPC

Composition of the Board :

Chairman : G. Szabo
Members : C. Andries
L. Mancini

Summary of Facts and Submissions

I. European patent application No. 82 902 987.5 (publication number 0 090 863) filed on 7 October 1982, as an international application PCT/JP82/00 402 (publication number WO 83/01 224) was refused by a decision of the Examining Division 094 dated 11 December 1987 and dispatched on 7 March 1988.

II. The reason given for the refusal was that the subject-matter of the, at that time valid, independent Claim 1 did not involve an inventive step in view of the prior art as disclosed in

D1: FR-A-1 268 617;
D2: I.I. Rubin "Injection Molding", 1973, John Wiley & Sons, New York; pages 4 and 5, Figs. 1-1 to 1-3;
D3: US-A-2 271 063.

III. The Appellant lodged an appeal against this decision on 22 April 1988, paying the appeal fee on the same date. The Statement of Grounds was submitted on 21 June 1988.

IV. In reply to communications of the Board of Appeal the Appellant submitted the following documents

Description: pages 1, 1a, 2, 3 and 5 to 23 filed with letter dated 5 February 1990;
pages 4 and 4a filed with letter dated 26 February 1990;

Claims: 1 (first part consisting of pages 24, 25, 26 and 26a filed with letter dated 26 February 1990, and second part consisting of line 1 of page 27 filed with letter dated 16 February 1990);
2 to 4 and 5 (partly: up to the end of page 27) filed with letter dated 16 February 1990;
5 (partly: from page 28) and 6 filed with letter dated 5 February 1990;

Drawings: Figs. 1 to 12 filed with letter dated 4 September 1989.

The independent Claim 1 on file reads as follows:

"An injection molding machine for synthetic resins including
- a machine bed (3)
- a clamping mechanism (1) provided on said machine bed (3) which comprises:
  - a pair of plates (11,13) disposed to be moved toward and away from each other through a guide member (12) such as a tie rod, and by way of a clamping plunger (15),
  - molds (14) mounted on opposed surfaces of and between said plates (11,13),
  - said clamping plunger (15) being driven by a driving system (16) for moving axially,
  - fixed member (10), at the rear of the movable plate (13) to retain a part of said driving system (16) as it drives the clamping plunger (15),

- an injection mechanism (2) near to said clamping mechanism (1) provided on said machine bed (3) which comprises:

. an injection heating cylinder (21) facing toward said clamping mechanism (1) and accomodating an injection screw (20) therein integral with an extended shaft (26),
. means (23,24,25,27,37) for advancing said extended shaft (26) and injection screw (20),

characterized in that:

- an electric reversible servo-motor (40) is mounted on said housing (22) and is selectively connected with a first transmission shaft (30), and permanently connected with another transmission shaft (31,46), respectively engaging first gear means (17,35) for transmitting rotation of said motor (40) to said clamping plunger (15), and engaging second gear and screw means (23,24,25,27,37) for advancing said injection screw (20) through the injection heating cylinder (21), said clamping plunger (15) being provided with threads which co-operate with an internally threaded part of said rotary driving system (16), said second gear and screw means comprising:
  = a rotary member (23,24) located at the rear of said injection screw (20), at the side thereof away from the clamping mechanism, parallel to the extended shaft (26),
  = a member (25) meshing with a threaded portion of said rotary member (23,24),
  = a first gear (27) fixedly connected to said rotary member (23),.
  = a second gear (37) meshing with gear (27).

. a first clutch (32) is provided for selectively driving the first transmission shaft (30) and consequently the clamping mechanism (1) from the motor (40),

. a second clutch (39) is provided between said other transmission shaft (31,46) and said second gear and screw means (23,24,25,27,37) for causing the axial movement of the injection screw (20)

- one plate (11) of the pair of plates (11,13) is fixed on said machine bed (3)

- the injection mechanism (2) comprises a housing (22) provided on said machine bed (3)

- the clutches (32,39) are electromagnetically operated and mounted on the other transmission shaft (31,46) permanently connected to said servo-motor (40)

- third gear means (28,36) are coupled between the extended shaft (26) and said other transmission shaft (31,46) permanently connected to the servo-motor (40), through a third electromagnetically operated clutch (38), mounted on said other transmission shaft (31,46) for rotating said injection screw (20)

- the second gear and screw means comprise within said housing (22):

. the first rotary member (23,24) which is a rotary shaft (24) having a threaded portion (23)
. a meshing member (25) rotatably receiving the end of said extended shaft (26) and meshing with said threaded portion (23)
. said meshing member (25) and rotary member (23,24) being so construed that said rotary member (23,24) can be rotated by the withdrawal of the injection screw (20), of the extended shaft (26) and the meshing member (25), resulting from the resin pressure and the rotation of the screw (20) in the

same direction as for displacing the resin towards the injection head;

. the first gear (27) which is fixedly mounted on said first rotary shaft (24)

. the second gear (37) carrying a part of the second clutch (39) connected with the second transmission shaft (31) of said other transmission shaft (31,46) for being engaged to transmit rotation of said second transmission shaft (31) to said second gear (37)

- the first clutch (32), which is interposed between the first and the second transmission shafts (30,31), permitting a temporary stoppage of the application of a turning force of said servo-motor to the clamping mechanism

- an electromagnetically operated brake (42) which is provided for applying a clamping force on said first gear means (17,35) during said temporary stoppage."

V. The Appellant requested that the decision under appeal is set aside, and a European patent be granted on the basis of the documents defined in above point IV.

Reasons for the Decision

1. The appeal is admissible.

2. Amendments

The Board is satisfied that the present application documents do not contain subject-matter extending beyond the content of the application documents as originally filed (Art. 123(2) EPC).

2.1 In particular, the subject-matter of independent Claim 1 can be directly and unambiguously deduced from the originally filed Claims 1, 2, 4 (partly) and 5, in combination with the originally filed description and drawings.

2.2 Claims 2 and 3 can be unambiguously deduced from the originally filed description and drawings, whereas Claims 4 to 6 are based on originally filed Claims 4 (partly), 6 and 7 respectively, in combination with the originally filed description and drawings.

2.3 The amendments in the description relate to the description of the state of the art and to the object of the invention. These amendments do not give rise to any objection.

2.4 The amendments in the drawings relate to missing or incorrect reference signs, so that they do not give rise either to any objection.

3. Novelty

After examination of the cited documents, the Board is satisfied that none of them discloses an injection moulding machine having all the features as defined in Claim 1.

Since this has never been disputed, there is no need for further detailed substantiation of this matter.

Therefore, the subject-matter as set forth in Claim 1 is to be considered novel within the meaning of Art. 54 EPC.

4. Closest state of the art

4.1 The reciprocating screw machine, as disclosed in document D2 (Figs. 1-1 to 1-3), is the basis for the pre-characterising portion of present Claim 1. This can be considered as a conventional moulding machine, which constitutes in the Board's view the closest prior art.

4.2 The machines disclosed in documents D1 and D3 are different insofar as they do not comprise a rotating screw. These documents therefore represent another type of moulding machine e.g. the straight plunger type machine.

A man skilled in the art, without knowing the present application, wanting to improve the latter kind of straight plunger machines, might try to modify them, but would still obtain the same type possibly with some improvements. When starting from this type of machine, a skilled man has already made a choice rejecting the reciprocating screw type machine in principle.

4.3 Thus, contrary to the opinion expressed by the Examining Division the Board takes the view that the machine disclosed in document D2 represents the closest prior art, instead of the machine disclosed in document D1, notwithstanding the fact that the latter has additional common features with the machine according to Claim 1.

5. Problem and solution

5.1 Document D2 discloses a reciprocating screw machine, wherein both a clamping mechanism and an injection mechanism are hydraulically driven (oil).

As indicated by the Appellant, the use of oil involves many problems and requires expensive hydraulic devices.

5.2 From the description it follows that the technical problem to be solved consists not only in avoiding the difficulties arising from the use of oil for driving the clamping and the injection mechanism, but also in providing a machine which can save power and is simplified. The problem so defined contains no pointers to its solution, e.g. to the use of a single electric motor, (cf. Decision T 229/85 "Etching process/SCHMID", OJ EPO, 1987, 237).

5.3 The problem is solved by the features mentioned in Claim 1, particularly by the use of a single electric reversible servo-motor in combination with specific driving means for both the clamping means and the injection screw.

6. Inventive step

6.1 It is common knowledge for a skilled person that electric drives used in injection moulding are more efficient than hydraulic drives.

Furthermore, it is known in the same technical field of injection moulding, particularly from document D3 (Figure 2), that one electric motor alone (D3: motor 28) can be used for both clamping and injection purposes. Although such a drive was used in an injection moulding machine of the straight plunger type, a skilled person would become aware of the possibility of using only one electric motor for both purposes, particularly since document D1 also seems to suggest the use of only one electric motor (Figure 4 in combination with the second sentence of the second to last paragraph on page 1, left-hand column).

Documents D1 and D3 furthermore disclose specific power transmissions between the driving motor on the one hand and the clamping means and the injection means on the other, which allow the use of motors rotating always in the same direction.

6.2 Therefore, if a person skilled in the art, starting from the injection moulding machine according to document D2, was trying to avoid the use of hydraulic oil, he would be led to use an electric motor to actuate the clamping and the injection mechanism. He could however find nowhere any indication or encouragement in the cited documents either to use a reversible electric servo-motor, or to use the specific gear and screw means as defined in detail in present Claim 1.

Thus, in the opinion of the Board, the subject-matter of Claim 1 involves an inventive step within the meaning of Art. 56 EPC.

7. The subject-matter of Claim 1 is therefore patentable within the meaning of Art. 52 EPC, so that based on this allowable Claim 1, and dependent Claims 2 to 6, which concern preferred embodiments of the injection moulding machine according to Claim 1, and the modified description and drawings, a patent may be granted.

Order

For these reasons, it is decided that:

1. **The decision under appeal is set aside.**

2. **The case is remitted to the first instance with the order to grant a European patent on the basis of the documents as defined in above point IV.**

The Registrar: The Chairman:

S. Fabiani G. Szabo

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