

Internal distribution code:

- (A) [] Publication in OJ
(B) [] To Chairmen and Members
(C) [X] To Chairmen

D E C I S I O N
of 20 February 1998

Case Number: T 0763/92 - 3.2.5

Application Number: 85903384.7

Publication Number: 0188622

IPC: B29C 45/50

Language of the proceedings: EN

Title of invention:

Screw-rotating injection mechanism for injection molding machines

Patentee:

Fanuc Ltd.

Opponent:

Battenfeld GmbH

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Continuation of appeal proceedings after withdrawal of opposition (the appellant is the patent proprietor)"
"Inventive step (yes)"

Decisions cited:

T 0629/90

Catchword:

-



Case Number: T 0763/92 - 3.2.5

D E C I S I O N
of the Technical Board of Appeal 3.2.5
of 20 February 1998

Appellant: Fanuc Ltd.
(Proprietor of the patent) 3580, Shibokusa Aza-Komanba, Oshinomura
Minamitsuru-gun
Yamanashi 401-05 (JP)

Representative: Billington, Lawrence Emlyn
Haseltine Lake & Co.
Imperial House
15-19 Kingsway
London WC2B 6UD (GB)

Respondent: Battenfeld GmbH
(Opponent) Scherl 10
Postfach 1164/1165
58527 Meinerzhagen (DE)

Representative: Müller, Gerd, Dipl.-Ing.
Patentanwälte
Hemmerich-Müller-Grosse
Pollmeier-Valentin-Gihske
Hammerstrasse 2
57072 Siegen (DE)

Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 19 June 1992
revoking European patent No. 0 188 622 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: W. Weiß

Members: M. Ceyte
C. Holtz

Summary of Facts and Submissions

I. The Appellant is proprietor of European patent No. 0 188 622 (application No. 85 903 384.7).

Claim 1 as granted reads as follows:

"1. A screw-rotating/injection mechanism of an injection molding machine, comprising a screw shaft (1) having a screw at a distal end thereof, a pressure plate (4) to which a drive shaft (1') is rotatably fixed, said drive shaft (1') being fixed to a rear portion of the screw shaft (1), a first transmission unit (10, 9, 13, 15) for rotating the screw shaft (1), a plurality of threaded shafts (8, 8') engaging with the pressure plate (4), and a second transmission unit (11, 11', 16, 14) for rotating the threaded shafts (8, 8')

characterised in that

said threaded shafts (8, 8') are respective ball screws which engage with respective ball nuts (7, 7') provided in the pressure plate (4);

and in that a spline shaft (5) is formed on the drive shaft (1') at a rear side of the drive shaft (1') with respect to the pressure plate (4),

a nut (6) is spline-coupled to the spline shaft (5),

the first transmission unit (10, 9, 13, 15) couples the nut (6) to a screw rotating motor (M1), and the second transmission unit (11, 11', 16, 14) couples rear end portions of the ball screws (8, 8') to an injection servo motor (M2) so that the ball screws

(8, 8') are driven simultaneously by the injection servo motor (M2)."

II. The patent was opposed by

Battenfeld GmbH
Scherl 10
D-5882 Meinerzhagen

on the ground of lack of inventive step.

The following state of the art was inter alla submitted:

E1: EP-A-0 090 863.

III. By a decision posted on 19 June 1992 the Opposition Division revoked the European patent.

It was of the opinion that the subject-matter of granted claim 1 lacked an inventive step in the light of document E1 and common general knowledge.

IV. On 17 August 1992 the Appellant lodged an appeal against this decision, with the appeal fee being paid at the same time.

The Statement of Grounds of Appeal was filed on 28 October 1992.

The Appellant requested that the decision under appeal be set aside and the European patent be maintained as granted.

V. In its response to the statement setting out the grounds of appeal, the Respondent submitted the further document:

E5: US-A-3 262 154 (cited in the search report established on the original European patent application).

By letter dated 14 February 1998 it withdrew its opposition.

Reasons for the Decision

1. The appeal is admissible.

2. *Procedural matters*

It is well established jurisprudence of the Boards of Appeal that withdrawal of the opposition in appeal proceedings does not affect the appeal proceedings if the appellant is the patent proprietor (see e.g. decision T 629/90, OJ EPO 1992, 654). The respondent (opponent) ceases to be party to the appeal proceedings in respect of the substantive issues.

3. *Novelty*

The Board is satisfied that the subject-matter of claim 1 is novel over the cited documents.

Since this was never disputed during the opposition and

appeal proceedings, there is no need for further detailed substantiation of this matter.

4. *Inventive step*

- 4.1 Claim 1 as granted has been formulated so as to state in its pre-characterising portion all the features of the claimed subject-matter which are known from document E1 acknowledged as closest prior art in the European patent. The known screw rotating/injecting mechanism according to Figure 8 of this document is provided with a screw shaft having a rear portion thereof connected to a drive shaft which cooperates with a pressure plate. The drive shaft is provided with a screw rotating gear driven by a servo motor via a first transmission shaft and a first clutch member. Two threaded shafts are mounted parallel to the screw shaft and its extended drive shaft. The pressure plate is meshed with said threaded shafts, each having a screw advancing gear driven by the said servo motor via a second transmission shaft and a second clutch member.

As convincingly submitted by the Appellant, this known mechanism involves many problems:

Firstly the screw rotating gear is positioned in front of (i.e. on the screw side) of the pressure plate. With such an arrangement, the length of the threaded shafts which are rotated to drive the pressure plate forward must be of a length sufficient to accommodate both the length of the screw rotating gear and the amount of travel required for the pressure plate to carry out injection operations.

Secondly when the second clutch member is energised, the first clutch member is de-energised and the two screw advancing gears are rotated through the second transmission shaft so as to move the pressure plate and the screw shaft in the forward direction. Thereafter, when the second clutch member is de-energised and the first clutch member is energised, the screw rotating gear is rotated with the rotation of the first transmission shaft to rotate the drive shaft and the screw. Hence, the known device requires a complicated system and thus a complex control to disconnect the screw from the screw rotating mechanism upon injection operation and vice versa to disconnect the screw from the screw advancing or injection mechanism upon rotating operation.

Finally, the injection molding machine disclosed in that document uses a single servo motor to rotate the screw and to operate injection, so that control of these two operations cannot be easily performed.

4.2 Therefore, the technical problem to be solved by the present invention is to provide a screw rotating/injection mechanism apt to overcome the above drawbacks observed in the closest prior art, i.e. which is mechanically less complicated while allowing an easier injection and rotation control as well as the use of threaded shafts for displacing the pressure plate which can be shorter and hence easier and cheaper to manufacture.

4.3 These three partial problems are in essence solved by

the following features defined in the characterising part of claim 1:

- (i) a nut is spline-coupled to a spline shaft constituting a rear portion of the drive shaft,
- (ii) the nut is rotated by a screw rotating motor (M1) through the first transmission unit to rotate the screw shaft,
- (iii) the threaded shafts are respective ball screws threadably engaged with respective ball nuts provided in the pressure plate, and
- (iv) the ball screws are rotated by an injection servo motor (M2) through the second transmission unit to move the screw shaft forward, thereby performing injection.

4.4 As a result of the characterising feature (i) i.e. the fact that the spline shaft is an extension of the drive shaft which cooperates with the pressure plate, the screw rotation drive is delivered via the nut which is behind the pressure plate. The first feature (i) thus requires the screw rotating drive to be behind the pressure plate.

In the invention, screw rotating drive is delivered from behind the pressure plate to the nut splinecoupled to the spline shaft which is fixed to the rear portion of the drive shaft. Thus, the rotating drive delivery is accomplished in a "straight through manner" with no screw rotating gear on the screw shaft, drive shaft or

saline shaft.

Furthermore, with the screw rotation drive behind the pressure plate, the length of the threaded shafts which are rotated to drive the pressure plate forward need be sufficient only to accommodate the amount of travel required for the pressure plate to carry out injection operation. This means that within the present invention the threaded shafts can be shorter and hence cheaper to manufacture.

4.6 As to the issue whether the claimed teaching involves an inventive step in view of document E5 and common general knowledge, the following is to be noted.

4.6.1 The document E5 shows a conventional injection melding machine, where an electric motor is used as a drive unit for rotating the screw via a rotating gear mounted on the extended drive shaft of the screw. The rear portion of the extended drive shaft cooperates with an hydraulic unit used as a drive unit for moving the screw forward, thereby performing injection. Apart from the provision of a screw rotating drive unit and an injection drive unit, document E5 is wholly silent with respect to the characterising features (i) to (iv). Therefore, without an ex post facto analysis a skilled person applying the teaching there to the known device according to document E1 would not arrive at the claimed solution.

4.6.2 It should be also observed that the closest prior art document E1 does not teach or suggest any way to deal with the above problems with which the European patent

is concerned. The injection molding machine proposed therein is designed so that the clamping mechanism as well as the screw rotating/injection mechanism "are operated by means of a single servo motor" (see "disclosure of the invention" at page 2). It is said that various technical advantages can be achieved by the use of a single servo motor:

"Power may be saved, the apparatus may be simplified and the machine is excellent economically. Furthermore, hydraulic oil need not be used at all and thus the power transmission efficiency increases as compared with a hydraulic system resulting in power saving as well as extremely readiness in maintenance and management of the machine" (see second paragraph of page 2 of document E1)

Accordingly, the relevant disclosure of document E1 is clearly confined to the provision of a single servo motor and gives no pointer to the claimed structure in accordance with the present invention having a screw rotating motor (M1) and an injection servo motor (M2). To assert that, in the context of the prior art represented by document E1, the skilled person would adapt two motors is to selectively ignore the unambiguous teaching of document E1 and can only be the result of ex post facto wisdom.

- 4.6.3 The opponent suggested that the claimed solution was obvious in the light of common general knowledge. That submission disregards the fact that the invention has decisive advantages (see in particular point 4.4 above) and no skilled person thought of it before.

In any case, the skilled person faced with the aforementioned problems would have to perform a series of steps in order to proceed from the known mechanism of document E1 to the claimed invention. These steps would be in essence the following:

- (a) abandoning the common drive servo motor for the clamping mechanism and the screw rotating/injection mechanism;
- (b) removing the screw rotating gear mounted on the drive shaft in front of the pressure plate, the first transmission shaft and the first clutch member;
- (c) providing a nut which is spline-coupled to a spline shaft forming the rear portion of the drive shaft;
- (d) driving the spline shaft by a screw rotating motor, to rotate the screw shaft.
- (e) removing the second clutch member and providing a second transmission unit for the screw injection operation which is separated from the first transmission unit; and
- (f) driving the threaded shafts by and injection servo motor via the second transmission unit, to move the screw shaft forward.

Thus, in order to arrive at the claimed invention, starting from the injection machine disclosed in document E1, the skilled person would have to undertake what amounts to a complete redesign of the machine of document E1 involving fundamental changes to a plurality of structural features. That may be considered as a significant indication of the presence of inventiveness.

- 4.7 Therefore in the Board's judgment, the subject-matter of granted claim 1 involves an inventive step (Article 56 EPC) and is thus allowable.
5. Dependent claims 2 to 5 concern particular embodiments of the invention claimed in claim 1 and are likewise allowable.

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 maintain the patent as granted.

The Registrar: The Chairman:

A. Townend

W. Weiß