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Datasheet for the decision of 12 November 2021

Case Number: T 1666/17 - 3.2.08

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Title of invention:
DIE CUSHION DEVICE FOR PRESS MACHINE

Patent Proprietor:
AIDA ENGINEERING, LTD.

Opponents:
Voith Patent GmbH
Schuler Pressen GmbH
Moog GmbH
Bosch Rexroth AG

Headword:

Relevant legal provisions:
EPC Art. 56

Keyword:
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Catchword:

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Beschwerdekammern

Boards of Appeal

Chambres de recours

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Case Number: T 1666/17 - 3.2.08

D E C I S I O N
of Technical Board of Appeal 3.2.08
of 12 November 2021

Appellant: (Opponent 1)	Voith Patent GmbH St. Pöltener Str. 43 89522 Heidenheim (DE)
Representative:	Dr. Weitzel & Partner Patent- und Rechtsanwälte mbB Friedenstrasse 10 89522 Heidenheim (DE)
Appellant: (Opponent 2)	Schuler Pressen GmbH Schuler-Platz 1 73033 Göppingen (DE)
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Appellant: (Opponent 3)	Moog GmbH Hanns-Klemm-Strasse 28 71034 Böblingen (DE)
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Appellant: (Opponent 4)	Bosch Rexroth AG Rexrothstrasse 3 97816 Lohr am Main (DE)
Representative:	Winter, Brandl - Partnerschaft mbB Alois-Steinecker-Straße 22 85354 Freising (DE)

Respondent: (Patent Proprietor)	AIDA ENGINEERING, LTD. 2-10 Ohyama-cho, Midori-ku Sagamihara-shi Kanagawa, 252-5181 (JP)
Representative:	Grünecker Patent- und Rechtsanwälte PartG mbB Leopoldstraße 4 80802 München (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 8 June 2017 rejecting the opposition filed against European patent No. 1882534 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chairwoman	P. Acton
Members:	C. Vetter
	C. Schmidt

Summary of Facts and Submissions

I. The appeals were filed by the opponents (appellants) against the decision of the opposition division to reject the oppositions filed against the patent in suit (hereinafter "the patent").

II. The opposition division had decided that

(1) the subject-matter of the claims as granted was novel and involved an inventive step,

(2) the patent disclosed the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art, and

(3) the subject-matter of the patent did not extend beyond the content of the application as filed.

III. Oral proceedings were held before the Board.

IV. The appellants (opponents) requested that the decision under appeal be set aside and that the patent be revoked.

The respondent (patent proprietor) requested that the appeals be dismissed, i.e. that the patent be maintained as granted (main request), or that the patent be maintained on the basis of one of auxiliary requests 1-5, filed with the reply to the grounds of appeal dated 27 February 2018, or one of the auxiliary requests labelled "Main Request'" to "Auxiliary Request 5'", filed with its letter dated 22 September 2021, whereby the requests with an apostrophe follow the

requests with the corresponding numbering without an apostrophe.

V. Claim 1 of the main request reads as follows (feature designation in square brackets added by the Board):

[M1] A die cushion apparatus of a press machine (100), comprising:
[M2] a fluid hydraulic cylinder (130) that supports a cushion pad (128);
[M3] a fluid hydraulic pump/motor (140) having a discharge opening that is connected through a first pipe (134) to a pressure chamber (130b) on a cushion pressure production side of the fluid hydraulic cylinder (130);
[M4] an electric motor (150) that is connected to a rotating shaft of the fluid hydraulic pump/motor (140);
[M5] a control device that controls the electric motor (150) to control a die cushion pressure; and
[M6] a regeneration device that regenerates energy required for a die cushioning action that the cushion pad (128) receives when die cushioning of the press machine (100) is effected as electrical energy through the fluid hydraulic cylinder (130), the fluid hydraulic pump/motor (140) and the electric motor (150), characterized in that: the die cushion apparatus further comprises:
[M7] a pressure detector (136) that detects a pressure of the pressure chamber (130b) on the cushion pressure production side of the fluid hydraulic cylinder (130); and
[M8] a die cushion pressure command device that outputs a die cushion pressure command that is previously set, and
[M9] the control device controls a torque of the electric motor (150) so that the die cushion pressure

is a pressure that corresponds to the die cushion pressure command based on the die cushion pressure command and the pressure that is detected by the pressure detector (136).

Claim 1 of auxiliary request 1 differs therefrom in that the features of granted dependent claim 3 are incorporated, according to which

[M10] a plurality of sets of the fluid hydraulic pump/ motor (140a, 140b, 140c) and the electric motor (150a, 150b, 150c) are provided, and the respective discharge openings of the plurality of fluid hydraulic pump/ motors (140a, 140b, 140c) are commonly connected to the first pipe (134).

Claim 1 of auxiliary request 2 differs from claim 1 according to the main request in that the features of granted dependent claim 12 are incorporated, according to which the die cushion apparatus further comprises

[M11] an angular velocity detector (152) for detecting a rotational angular velocity of the electric motor (150),
wherein the control device uses an angular velocity signal that is detected by the angular velocity detector (152) as an angular velocity feedback signal for ensuring dynamic stability of the die cushion pressure.

Claim 1 of auxiliary request 3 differs from claim 1 according to auxiliary request 2 in that the features of granted dependent claim 15 are incorporated, according to which the die cushion apparatus further comprises

[M12] a slide speed detector that detects a sliding speed of a slide (110) of the press machine or an angular velocity detector (116) that detects an angular velocity of a drive shaft (112) of the press machine, wherein the control device uses a slide speed signal that is detected by the slide speed detector or an angular velocity signal that is detected by the angular velocity detector (116) in compensation for ensuring dynamic stability in die cushion pressure control.

Claim 1 of auxiliary request 4 is a combination of claim 1 of auxiliary requests 1 and 2, i.e. the features **[M10]** and **[M11]** of granted dependent claims 3 and 12 are incorporated into claim 1.

Claim 1 of auxiliary request 5 is a combination of claim 1 of auxiliary requests 1 and 3, i.e. the features **[M10]**, **[M11]** and **[M12]** of granted dependent claims 3, 12 and 15 are incorporated into claim 1.

Claim 1 of the auxiliary requests labelled "Main Request'" to "Auxiliary Request 5'" is identical to claim 1 of the respective requests labelled "Main Request" to "Auxiliary Request 5". The requests with an apostrophe differ from the requests without an apostrophe only in the dependent claims.

VI. In the present decision, reference is made to the following documents:

OP11 DE 43 09 641 A1
OP29 US 6 379 119 B1

VII. The appellants' arguments, as far as they are relevant to the present decision, can be summarised as follows:

Starting from OP11 as the closest prior art, the subject-matter of claim 1 of all of the requests is rendered obvious by OP29 and, where applicable, by common general knowledge.

VIII. The respondent's arguments, as far as they are relevant to the present decision, can be summarised as follows:

The subject-matter of claim 1 of all of the requests is based on an inventive step since the skilled person had no motivation to apply the teachings of the cited references to a die cushion apparatus of OP11.

Reasons for the Decision

1. Main request - inventive step

1.1 It is undisputed that document OP11 discloses a (references in parentheses relate to OP11)

[M1] die cushion apparatus of a press machine (column 1, lines 3-10: "einen hydraulisch verfahrbaren Gegenhalter"), comprising:
[M2] a fluid hydraulic cylinder (column 7, lines 1-14; figure 1: "Plungerzylinder 21") that supports a cushion pad ("Stützplatte 19");
[M3] a fluid hydraulic pump/motor (column 7, lines 30-45; figure 1: "hydrostatische Maschine 30") having a discharge opening that is connected through a first pipe ("Leitung 33") to a pressure chamber on a cushion pressure production side of the fluid hydraulic cylinder (21);
[M4] an electric motor ("Drehstrommotor 32") that is connected ("feste Kupplung 31") to a rotating shaft of the fluid hydraulic pump/motor (30); and
[M6] a regeneration device (column 8, lines 6-10; column 1, lines 54-58; figure 1: "hydrostatische Maschine 30", "Drehstrommotor 32") that regenerates energy required for a die cushioning action that the cushion pad (19) receives when die cushioning of the press machine is effected as electrical energy through the fluid hydraulic cylinder (21), the fluid hydraulic pump/motor (30) and the electric motor (32).

1.2 The respondent argued that OP11 does not disclose a pressure detector (feature **[M7]**). The pressure control ("Druckregelung") mentioned in column 7, line 32, could be a valve that opens when a predetermined pressure is

reached. However, the term "Druckregelung" (pressure control) requires a control circuit in which the actual value of the pressure in the pressure chamber is fed back. In order to obtain the actual pressure value, some kind of pressure detector is necessary. The pressure control ("Druckregelung") mentioned in column 7, line 32, therefore also implicitly discloses feature **[M7]**, which is

[M7] a pressure detector that detects a pressure of the pressure chamber on the cushion pressure production side of the fluid hydraulic cylinder (21).

1.3 The respondent further argued that OP11 does not disclose a command device (feature **[M8]**), because OP11 describes the pressure control ("Druckregelung") only in connection with the lifting of the cushion pad (column 7, lines 49-53: "Zum Heben des Tauchkolbens 21") and not for the cushion pressure operation as required by claim 1.

However, the claim does not require more than the command device *per se*, and in particular it does not require a link to a cushion pressure *operation*. Besides, the pressure in OP11 that is reached when lifting the cushion pad is also the pressure during the cushion pressure operation (OP11, column 7, lines 60-64). Therefore, OP11 also implicitly discloses feature **[M8]**, which is

[M8] a die cushion pressure command device that outputs a die cushion pressure command that is previously set (column 7, lines 49-53: "steigt der Druck bis auf den durch die Druckregelung vorgegebenen Wert an").

1.4 OP11 does not disclose that

[M5] the control device controls the electric motor (32) *to control a die cushion pressure*; or that **[M9]** the control device controls a torque of the electric motor (32) so that the die cushion pressure is a pressure that corresponds to the die cushion pressure command based on the die cushion pressure command and the pressure that is detected by the pressure detector.

The subject-matter of claim 1, therefore, is novel over the disclosure of OP11.

1.5 The technical effect resulting from the distinguishing features **[M5]** and **[M9]** can be seen to be an improved responsiveness of the pressure control of the die cushion apparatus.

The objective technical problem, therefore, can be formulated as the provision of a die cushion apparatus with improved responsiveness of the pressure control (see also the patent, paragraph [0020]).

1.6 Document OP29 relates to a set-up similar to that of OP11, comprising a pump driven by an electric motor, the pump being connected to a hydraulic actuator.

OP29 addresses the above problem by suggesting a drive system with higher control quality which is suitable for use in systems that need accurate and dynamic control of pressure such as presses (OP29, abstract; column 3, line 64 - column 4, line 2).

OP29 states that electric power control is faster than hydraulic power control (OP29, column 2, lines 19-24). Therefore, to solve the above problem, it teaches controlling the hydraulic pressure and flow of the pump

by means of power transistors which generate the currents energising the coils of the motor (OP29, column 6, lines 24-36). It is undisputed that in the set-up of OP29 the electrical current provided to the electric motor corresponds to its torque. Consequently, OP29 renders obvious that the control device controls the electric motor to control a die cushion pressure (feature **[M5]**), wherein the control device controls a torque of the electric motor so that the die cushion pressure is a pressure that corresponds to the die cushion pressure command based on the die cushion pressure command and the pressure that is detected by the pressure detector (feature **[M9]**).

1.7 The respondent argued that the skilled person *could* have combined the teaching of OP29 with that of OP11. However, in the respondent's view, the skilled person *would* not have applied the teaching of OP29 to a die cushion apparatus of OP11 due to the lack of incentive to do so. Moreover, starting from the embodiment in figure 9 of OP11, the skilled person had no motivation to modify only the lower part of the apparatus, i.e. the cushion pad part, while maintaining its upper part, i.e. the plunger part.

1.8 Regarding the latter argument, as pointed out by the appellants, claim 1 does not define the way in which the plunger is driven. Consequently, for the assessment of inventive step it is irrelevant whether the skilled person starts from an embodiment where the plunger is driven by hydraulics, as for example in figures 5 to 9 of OP11, or by a crank shaft, as for example in figures 1-4 and 10 of OP11. Moreover, all of the embodiments shown in OP11 are equally suitable starting points in terms of cushion pressure control, since for all of

these embodiments a pressure detector is implicitly disclosed (see point 1.2 above).

1.9 Improving responsiveness of the pressure control is a problem that applies to hydraulic apparatuses in general. Starting from a die cushion apparatus of OP11, therefore, the skilled person would have considered the teaching of OP29, especially since OP29 explicitly mentions the wide applicability range of its teaching, including presses and injection moulding machines (OP29, column 2, lines 54-63; column 3, line 64 - column 4, line 4).

The respondent did not cite any differences between a drive system suitable for a die cushion apparatus and a drive system suitable for any other kind of hydraulic apparatus such as a press or an injection moulding machine. All these types of application require the pressure in the cylinder to be adjustable to a desired value. In a die cushion apparatus, in general, the desired value is a value that allows for a controlled slip of the steel metal blank such that the blank neither tears nor wrinkles. In a conventional press, for example, it is a value that is sufficient for shaping the workpiece without destroying it. Hence, while the pressures in a die cushion apparatus or in a press machine or an injection moulding machine might be different in terms of their absolute values, they all need to be controlled in a similar manner. This conclusion is also drawn by the patent in paragraph [0009] with regard to plastic working devices:

"Patent Document 4 discloses a plastic working device according to a hydraulic drive system that, although not a die cushion apparatus, is close thereto with respect to the outward configuration."

Therefore, the skilled person would have applied the teaching of OP29 to a die cushion apparatus of OP11.

1.10 Consequently, the subject-matter of claim 1 of the main request is rendered obvious by OP11 in combination with OP29. The same applies to claim 1 of the main request', which has identical wording.

2. Auxiliary request 1 - inventive step

2.1 OP11 does not disclose the additional feature of claim 1 of auxiliary request 1, according to which

[M10] a plurality of sets of the fluid hydraulic pump/motor and the electric motor are provided, and the respective discharge openings of the plurality of fluid hydraulic pump/motors are commonly connected to the first pipe.

2.2 This distinguishing feature leads to the technical effect that the limitations of commercially available oil hydraulic pump/motors or electric motors, in terms of their maximum oil displacement volume or maximum output torque, are overcome (patent, paragraph [0103]).

Synergistic effects with the above-identified distinguishing features **[M5]** and **[M9]** are not apparent and were not asserted by the respondent.

A partial problem, therefore, can be formulated as overcoming the limitations of commercially available oil hydraulic pump/motors or electric motors in terms of maximum output.

2.3 This partial problem is a general issue in hydraulics and is not specifically related to die cushion apparatuses. Its solution is obvious in light of common general knowledge: if a single set of hydraulic pump and electric motor does not provide sufficient output, the skilled person will add another one to the hydraulic circuit. As a result, the skilled person will provide a plurality of sets of the fluid hydraulic pump/motor and the electric motor, and connect the respective discharge openings of the plurality of fluid hydraulic pump/motors commonly to the first pipe (feature **[M10]**).

2.4 Consequently, the subject-matter of claim 1 of auxiliary request 1 is rendered obvious by OP11 in combination with OP29 and common general knowledge. The same applies to claim 1 of auxiliary request 1', which has identical wording.

3. Auxiliary request 2 - inventive step

3.1 OP11 does not disclose the additional feature of claim 1 of auxiliary request 2, according to which the die cushion apparatus further comprises

[M11] an angular velocity detector for detecting a rotational angular velocity of the electric motor, wherein the control device uses an angular velocity signal that is detected by the angular velocity detector as an angular velocity feedback signal for ensuring dynamic stability of the die cushion pressure.

3.2 This distinguishing feature leads to the technical effect that the dynamic stability of the die cushion pressure can be further improved (patent, paragraph [0073]).

The claim does not give any details on how the angular velocity of the electric motor is incorporated into the actual control of the die cushion pressure. Therefore, synergistic effects with the above-identified distinguishing features **[M5]** and **[M9]** are not apparent. They were not asserted by the respondent, either.

A partial problem, therefore, can be formulated as further improving the dynamic stability of the die cushion pressure.

3.3 As stated by the respondent, each and every signal relating to the operation of the apparatus, if taken into consideration by the control device, potentially improves the control of the die cushion pressure. It follows that, for the skilled person aiming at a further improvement of the control of the die cushion pressure, it is obvious to take into consideration particularly the angular velocity of the electric motor, since this information is directly linked to the operating speed of the hydraulic pump which generates the die cushion pressure. In line with this, OP29 teaches inputting measured parameters of the system to the controller, such as, for example, the rotary angle, speeds, currents or voltage of the motor (OP29, column 6, lines 60-66).

It is therefore obvious in light of both common general knowledge and OP29 to provide the die cushion apparatus with an angular velocity detector for detecting a rotational angular velocity of the electric motor, and to use an angular velocity signal that is detected by the angular velocity detector as an angular velocity feedback signal in the control device for ensuring

dynamic stability of the die cushion pressure (feature **[M11]**).

3.4 Consequently, the subject-matter of claim 1 of auxiliary request 2 is rendered obvious by OP11 in combination with OP29 and optionally common general knowledge. The same applies to claim 1 of auxiliary request 2', which has identical wording.

4. Auxiliary request 3 - inventive step

4.1 OP11 does not disclose the additional feature of claim 1 of auxiliary request 3, according to which the die cushion apparatus further comprises

[M12] a slide speed detector that detects a sliding speed of a slide of the press machine or an angular velocity detector that detects an angular velocity of a drive shaft of the press machine,
wherein the control device uses a slide speed signal that is detected by the slide speed detector or an angular velocity signal that is detected by the angular velocity detector in compensation for ensuring dynamic stability in die cushion pressure control.

4.2 This distinguishing feature leads to the technical effect that the dynamic stability of the die cushion pressure can be further improved (patent, paragraph [0061]).

The claim does not give any details on how the slide speed of the slide or the angular velocity of the drive shaft of the press machine are incorporated into the actual control of the die cushion pressure. Therefore, synergistic effects with the above-identified distinguishing features **[M5]**, **[M9]** and **[M11]** are not

apparent. They were not asserted by the respondent, either.

The partial problem, therefore, can again be formulated as further improving the dynamic stability of the die cushion pressure.

4.3 As mentioned before, every single signal relating to the operation of the apparatus, if taken into consideration by the control device, potentially improves the control of the die cushion pressure. It follows that, for the skilled person aiming at a further improvement of the control of the die cushion pressure, it is obvious to also take into consideration the slide speed of the slide or the angular velocity of the drive shaft of the press machine, since this information enables them to co-ordinate the operations of the plunger and the cushion pad.

It is therefore obvious in light of common general knowledge to further provide the die cushion apparatus with a slide speed detector that detects a sliding speed of a slide of the press machine or an angular velocity detector that detects an angular velocity of a drive shaft of the press machine, and to use a slide speed signal that is detected by the slide speed detector or an angular velocity signal that is detected by the angular velocity detector in the control device for ensuring dynamic stability in die cushion pressure control (feature **[M12]**).

4.4 Consequently, the subject-matter of claim 1 of auxiliary request 3 is rendered obvious by OP11 in combination with OP29 and common general knowledge. The same applies to claim 1 of auxiliary request 3', which has identical wording.

5. Auxiliary request 4 - inventive step

5.1 Auxiliary request 4 is a combination of auxiliary requests 1 and 2. Hence, claim 1 of auxiliary request 4 differs from the disclosure of OP11 in the above-identified distinguishing features **[M5]**, **[M9]**, **[M10]** and **[M11]**.

5.2 Synergistic effects of these distinguishing features are not apparent and were not asserted by the respondent. Therefore, the above conclusions with respect to partial problems and the obviousness of the solutions thereto apply (see points 2. and 3. above).

5.3 Consequently, the subject-matter of claim 1 of auxiliary request 4 is rendered obvious by OP11 in combination with OP29 and common general knowledge. The same applies to claim 1 of auxiliary request 4', which has identical wording.

6. Auxiliary request 5 - inventive step

6.1 Auxiliary request 5 is a combination of auxiliary requests 1 and 3. Hence, claim 1 of auxiliary request 5 differs from the disclosure of OP11 in the above-identified distinguishing features **[M5]**, **[M9]**, **[M10]**, **[M11]** and **[M12]**.

6.2 The respondent argued that a synergistic effect between these distinguishing features resulted from the additional consideration of values for the control of the cushion pressure. However, as explained above, the claim does not give any details on how the angular velocity of the electric motor or the slide speed of the slide or the angular velocity of the drive shaft of

the press machine are incorporated into the actual control of the die cushion pressure. Therefore, synergistic effects between the distinguishing features cannot be identified.

It follows that the above conclusions with respect to partial problems and the obviousness of the solutions thereto apply (see points 2., 3. and 4. above).

6.3 Consequently, the subject-matter of claim 1 of auxiliary request 5 is rendered obvious by OP11 in combination with OP29 and common general knowledge. The same applies to claim 1 of auxiliary request 5', which has identical wording.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chairwoman:

C. Moser P. Acton

Decision electronically authenticated