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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte MANABU IKEYA,¹
MAKOTO ISHIKAWA, REO FUJITA, SEIJI TAKAMOTO,
and SHIGEKI INOUE

Appeal 2018-002605²
Application 14/122,086
Technology Center 1700

Before MARK NAGUMO, GEORGE C. BEST, and JEFFREY R. SNAY,
Administrative Patent Judges.

NAGUMO, *Administrative Patent Judge.*

DECISION ON APPEAL

Manabu Ikeya, Makoto Ishikawa, Reo Fujita, Seiji Takamoto, and Shigeki Inoue (“Ikeya”) timely appeal under 35 U.S.C. § 134(a) from the

¹ The real party in interest is identified as The Japan Steel Works, Ltd. (Appeal Brief, filed 15 June 2017 (“Br.”), 2.)

² Heard 22 August 2019. The Official Transcript will be made of record in due course.

Final Rejection³ of all pending claims 1 and 5–13.⁴ We have jurisdiction.
35 U.S.C. § 6. We reverse.

OPINION

A. Introduction⁵

The subject matter on appeal relates to processes of kneading materials such as plastics, especially in a twin screw extruder. According to the '086 Specification, in prior art twin-screw extruders, before the material is kneaded, it is completely melted by holding the material in the melt-kneading portion as long as possible. When the production quantity is diminished, however, excessive kneading energy may be applied to the material to be kneaded, which may lead to increased production costs and degraded melted material. (Spec. 4, ll. 2–5.) Prior art attempts to alleviate this problem are said to include shortening the melt-kneading portion of the

³ Office Action mailed 14 November 2016 (“Final Rejection”; cited as “FR”).

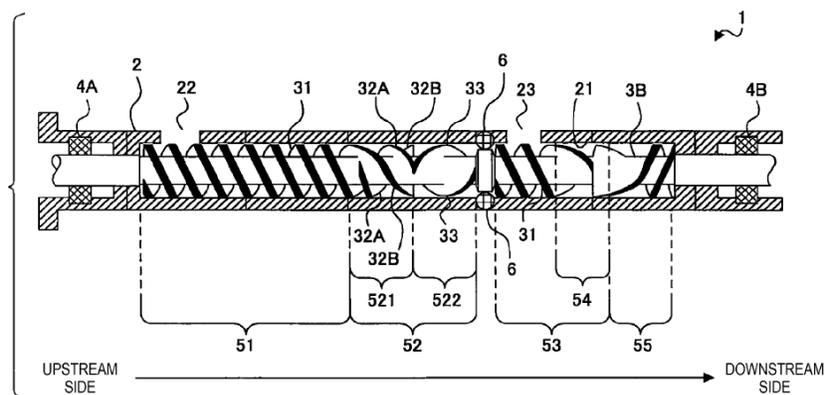
⁴ Claims 2 and 14 were cancelled in an amendment filed 14 February 2017, under 37 C.F.R. § 1.116, after the Final Rejection. Independent claims 1, 5, and 10 were amended to incorporate the limitations recited in claim 2. These amendments were entered, and notice was given that the rejection based on anticipation by Heck of the independent claims and certain dependent claims would be converted to an obviousness rejection, further in view of Vandergrift. (Advisory Action entered 17 March 2017; full cites *infra* at nn. 11–13.)

⁵ Application 14/122,086, *Material kneading apparatus and material kneading method*, filed 25 November 2013 as the national stage under 35 U.S.C. § 371 of PCT/JP2012/063908, filed 30 May 2012, claiming the benefit of an application filed in Japan on 30 May 2011. We refer to the “’086 Specification,” which we cite as “Spec.”

apparatus, and altering the twisting angle of the return blade portion. (*Id.* at ll. 5–15.) However, when the quantity of material to be processed is increased, the kneading energy is said to become insufficient, and “it becomes difficult to completely melt the material to be kneaded, which leads to an increased failure of the melted material.” (*Id.* at ll. 21–24.)

Ikeya seeks patent protection for an apparatus (independent claims 1 and 10) and a method of kneading material (independent claim 5) that are said to overcome these problems. A comparison of the specific energy (power consumption/processing capability) (Spec. 17, l. 18) at low quantities (200 kg/h) and at high quantities (500 kg/hr) for an apparatus of the invention (*see* Figure 7, not reproduced here) shows relatively small changes compared to an apparatus having a conventional melt-kneading section. Thus, processing by the inventive apparatus is said to be more efficient, and is said to result in a higher quality product.

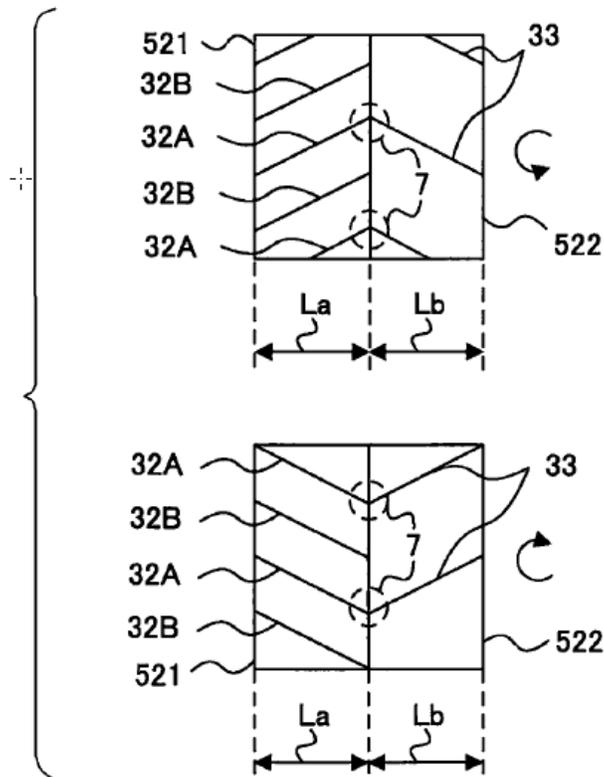
An embodiment of the claimed apparatus **1**⁶ is illustrated in Figure 4, below.



{ Figure 4 shows a twin screw extruder in cross section }

⁶ Throughout this Opinion, for clarity, labels to elements are presented in bold font, regardless of their presentation in the original document.

Material (e.g., plastic pellets) is introduced at material loading opening **22** and transported downstream by transporting blades **31** of screw **3B**⁷ to melt-kneading portion **52**, which comprises kneading element **521** (which in turn comprises sending blades **32A** and **32B**), and kneading element **522** (which in turn comprises returning blades **33**). Sending blades **32A** are “end-face coupled” with returning blades **33**, as further illustrated in Figure 5, below.



{Figure 5 illustrates melt-kneading sections **52** of screw **3A** (top) and of screw **3B** (bottom), showing the downstream end of sending screw **32A** engaging the upstream side of return screw **33** at **7**. The downstream end of sending screw **32B** is separate from, i.e., does not engage, the upstream side of return screw **33**}

⁷ Screw **3A** is behind screw **3B** in this projection, and rotates in the opposite direction, with the helicity of all elements inverted relative to screw **3B**.

That is, the “terminal ends of the blades (downstream side end portions of sending blades **32A**) coincide with corresponding beginning ends of the returning blades **33**.” (Spec. 13, ll. 5–9.) Sending blades **32A** are said to “engage” the upstream end of return blade **33**. (*Id.* at ll. 9–11.) In contrast, the downstream end of sending blades **32B** are separated from the upstream end of return blade **33**: sending blades **32B** do not engage with return blade **33**.

Gases evolved during the melt-kneading in section **52** are released through ventilation opening **23**; the material is kneaded again in kneading section **54**; and the kneaded material is extruded through material discharging opening **24** in discharging portion **55**. (Spec. 10, ll. 16–24; *see also* Figures 2 and 3, not reproduced here).

Claim 1 is representative and reads:

A material kneading apparatus [**1**] comprising:

- a screw [**3**] inserted into a cylinder [**2**],
an inside [**21**] of which a material is loaded, and
the screw is rotatably supported at both
an end portion [**4A**] on an upstream side and
an end portion [**4B**] on a downstream side or
at the end portion [**4A**] on the upstream side, in the
cylinder;
- a first kneading blade [**521**] comprising
a plurality of sending blades [**32**] that are
helically provided on the screw and
configured to send the material toward the
downstream side upon rotation of the screw; and
- a second kneading blade [**522**] comprising
a return blade [**33**] that is helically provided on the
screw and is configured to return the material,

which has been sent toward the downstream side by the first kneading blade **[521]**, toward the upstream side, the second kneading blade **[522]** having a smaller number of starts of screw threads than the number of starts of screw threads of the first kneading blade **[521]**, wherein a plurality of the return blades **[33]** are provided on the screw,

*wherein the plurality of sending blades **[32]** comprises a first blade **[32A]** and a second blade **[32B]**, wherein an end of the return blade **[33]** at the upstream side engages **[7]** an end of the first blade **[32A]** at the downstream side, and wherein the end of the return blade **[33]** at the upstream side is separated from an end of the second blade **[32B]** at the downstream side.*

(Claims App., Br. 12; some formatting, emphasis, and bracketed labels to elements in Figures 3–5 added.)

It may be noted that, aside from bearings **4A** and **4B**, all recited limitations refer to elements in melt-kneading section **52**.

The Examiner maintains the following grounds of rejection:^{8, 9, 10}

- A. Claims 1, 3, and 5–13 stand rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Heck¹¹ and Vandergrift.¹²
- A1. Claim 4 stands rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Heck, Vandergrift, and Womer.¹³

⁸ Examiner's Answer mailed 24 November 2017 ("Ans.").

⁹ Because this application claims the benefit of an application filed before 16 March 2013, the effective date of the America Invents Act, we refer to the pre-AIA version of the statute.

¹⁰ See n.4, *supra* at 2.

¹¹ Ernst Heck et al., *Process for the preparation of a foodstuff by extrusion*, U.S. Patent No. 5,891,503 (1999).

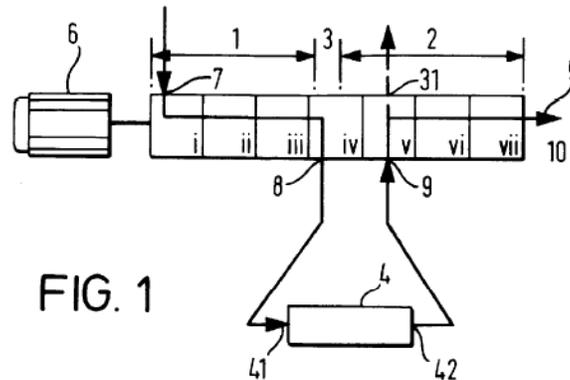
¹² Frank C. Vandergrift, *Extrusion apparatus*, U.S. Patent No. 1,762,368 (1930).

¹³ Timothy W. Womer et al., *Plasticating process, apparatus and screw with mixing*, U.S. Patent No. 6,497,508 B1 (2002).

B. Discussion

The Board's findings of fact throughout this Opinion are supported by a preponderance of the evidence of record.

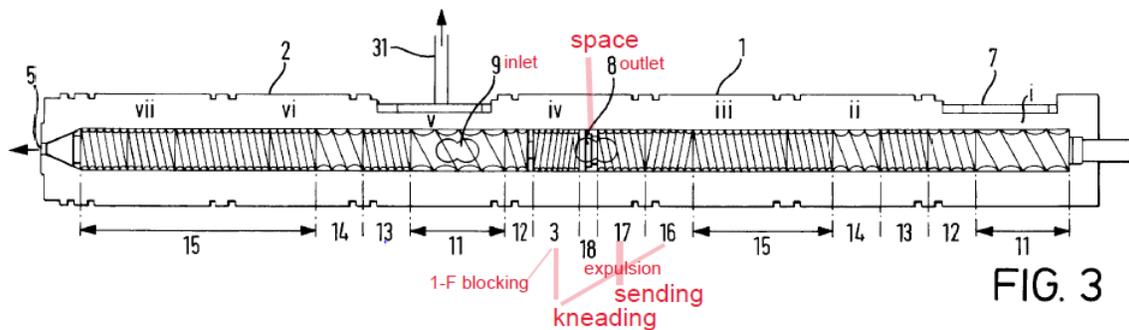
Heck describes a two-section extruder, illustrated in Figure 1, below,



{Figure 1 shows a two-section twin-screw extruder with external cooker 4}

Material (food) is introduced to section 1 of the extruder, where it is processed and pushed out at outlet 8 of compartment iv at the location of the dynamic-separation device 3. The processed food is cooked in cooker 4, and returned to the second section 2 of the extruder at inlet 9 of compartment v, where it is further processed.

In more detail, the screw in section 1 comprises, as illustrated from right to left, in Figure 3, below:



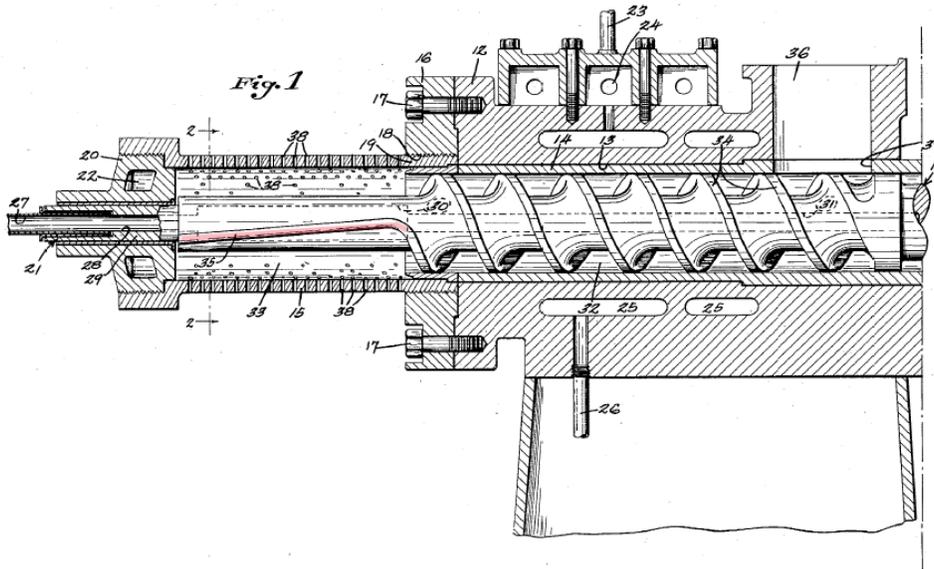
{Heck Figure 3 shows the screw of the extruder. Annotations added; small labels according to Heck; large labels according to the Examiner}

transport zone **11**, compacting zone **12**, compression zone **13**, intermediate transport zone **14**, compression zone **15**, kneading zone **16**, compression zone **17**, expulsion zone **18**, and blocking zone **3**. Notably, all zones have the same handedness of the thread or blade, but for kneading zone **16** and blocking zone **3**, which have the opposite handedness (Heck col. 4, ll. 38–41), and expulsion zone **18**, which comprises “three-off 12.5 bilobes” (*id.* at l. 18).

The Examiner finds that Heck describes, in Figure 3, a twin screw unit having “a plurality of return blades provide on the screw (figure 3, reverse thread sections **3** and **16**).” (Ans. 3, ll. 12–13.) The Examiner finds further that Heck describes “an end of the return blade at the upstream side being separated from an end of the second blade at the downstream side (figure 5, space between sending blades in section **17** and return blades in section **3**).” (*Id.* at ll. 13–15.) Thus, using the terminology of Heck, the Examiner identifies expulsion zone **18** as a “space” between compression zone **17** and blocking zone **3**. The Examiner finds that Heck “is silent to an end of the return blade at the upstream side engaging an end of the first blade on the downstream side.” (*Id.* at ll. 15–17.)

The Examiner finds that Vandergrift teaches such an engagement between [sending] thread **34** and reverse thread **35** in the extrusion apparatus illustrated in Figure 1, reproduced on the next page.

{ Vandergrift Figure 1 is shown below }



{ Vandergrift Figure 1 shows reverse thread **35** (shading added) joining forward thread **34** }

The Examiner concludes that “it would have been obvious to have provided the apparatus of Heck with the connected blades, as in Vandergrift, for the purpose of reducing dead space in the apparatus in which blades cannot work on the material.” (Ans. 3, last three lines.)

Ikeya objects that in the device described by Heck, effective discharge is achieved by expanding the outlet (**8**) of the expulsion zone (**18**) toward the blocking zone (**3**). (Br. 7, ll. 1–3, citing Heck, col. 4, ll. 60–67.) Ikeya urges that modifying Heck to connect the screw of blocking zone **3** directly to the screw of compression zone **17**, would result in the elimination of expulsion zone **18**, “and would result in a reduction in size of the outlet (**8**), thereby preventing the ‘effective discharge’ requirement of Heck.” (Br. 7, ll. 4–7.)

The Examiner responds (Ans. 12, ll. 1–5) that Heck teaches that “it is essential” for opening **8** “to overlap the blocking zone **3**, . . . so that the substance taken up by the first flight or flights of the opposite-handed screw

can be discharged and expelled effectively” (Heck, col. 4, l. 64–col. 5, l. 2). The Examiner concludes that the full quote shows that “the effective discharge and expulsion is not based on the expulsion zone, as alleged by the Appellant, but is instead based on the overlap between the blocking zone and the discharge opening.” (Ans. 12, ll. 6–8.)

The weight of the evidence supports Ikeya. It is, on its face, extremely difficult to substantiate a statement that effective discharge and expulsion of material is not based on a zone positioned for that purpose and labeled “the expulsion zone.” The Examiner has not done so on the facts before us. Moreover, as Ikeya points out in the Reply,¹⁴ the Examiner has not come forward with evidence or analysis showing that the routineer would have regarded expulsion zone **18** as “dead space.” The overwhelming weight of the evidence of record is that the bilobes in expulsion zone **18** are designed to push processed food materials out of section **1** of the twin screw extruder into cooker **4**. Nor has the Examiner explained with any reasonable specificity why the teaching by Vandergrift of the engagement of reverse thread **35** with thread **34** would have been expected to perform satisfactorily the expulsion function of expulsion zone **18** when adapted for use in the extruder described by Heck.

The Examiner makes no findings regarding limitations recited in the remaining claims that cure the defects discussed *supra*. In summary, we are persuaded of harmful error in the appealed rejections, and we reverse.

¹⁴ Reply Brief, filed 12 January 2018 (“Reply”).

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C. Order

It is ORDERED that the rejection of claims 1 and 5–13 is reversed.

REVERSED