

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
22 November 2007 (22.11.2007)

PCT

(10) International Publication Number
WO 2007/133401 A1

(51) International Patent Classification:

B29C 31/04 (2006.01) **B29C 43/08** (2006.01)
B29C 43/34 (2006.01)

(21) International Application Number:

PCT/US2007/009918

(22) International Filing Date: 24 April 2007 (24.04.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

11/431,785 10 May 2006 (10.05.2006) US

(71) Applicant (for all designated States except US):
OWENS-ILLINOIS CLOSURE INC. [US/US]; One
Michael Owens Way, Perrysburg, OH 43551-2999 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **WILLINGHAM, Wendell, D.** [US/US]; 24380 Sun-air Blvd., Perrysburg, OH 43551 (US). **MATTICE, Daniel, L.** [US/US]; 1680 E.400 N., Columbia City, IN 46725 (US). **THOMPSON, David, C.** [US/US]; 12731 Witmer Road, Grabill, IN 46741 (US).

(74) Agent: **SMITH, Susan, L.**; Three O-I Plaza, One Michael Owens Way, Perrysburg, OH 43551-2999 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM,

AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

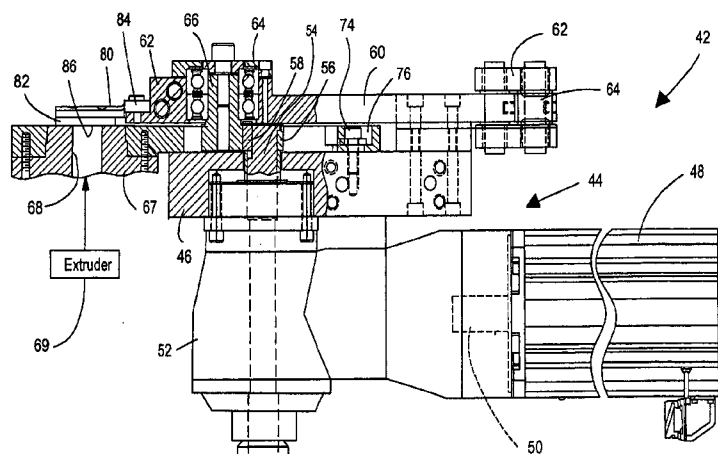
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

[Continued on next page]

(54) Title: APPARATUS FOR SEVERING MOLD CHARGES IN A COMPRESSION MOLDING MACHINE



(57) Abstract: An apparatus for severing mold charges of molten plastic exiting an orifice (68) along an orifice axis includes a motor system (44) that provides a rotary output around an axis offset from the orifice axis. A blade arm (60) is eccentrically coupled to the rotary output of the motor system for motion in a plane at an angle to the orifice axis, preferably perpendicular to the orifice axis. A knife blade (82) is coupled to the blade arm and disposed to oscillate in a closed path (94), preferably an elliptical path, that intersects the orifice axis so that the knife blade engages and severs molten plastic exiting the orifice along the orifice axis. A control arm (62) preferably is pivotally coupled to the blade arm and to a point that is fixed with respect to the orifice axis to control motion of the blade arm and the knife blade. The motor system preferably is mounted on a base (46), and has an output shaft (54) that extends through the base and a hub (56) coupled to the output shaft. The blade arm is pivotally coupled to the hub eccentrically of the shaft. The knife blade preferably has a cutting edge (86) that is at an angle to the blade arm.

WO 2007/133401 A1



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

**APPARATUS FOR SEVERING MOLD CHARGES IN A
COMPRESSION MOLDING MACHINE**

The present disclosure relates to a machine for compression molding plastic articles, such as closure shells or sealing liners within closure shells, and more particularly to an apparatus for severing mold charges for placement in the molds of the compression molding machine.

5 Background and Summary of the Disclosure

Machines for compression molding closure shells, or compression molding sealing liners within closure shells, typically include a turret or carousel that rotates around a vertical axis. A plurality of molds are provided around the periphery of the turret, in the form of male and female mold sections that are aligned along vertical axes parallel to the axis of turret rotation. Cams drive one or both of the mold sections of each pair between an open position, in which a molded part is stripped from the mold and a charge of molten plastic material is placed into the mold, and a closed position in which the mold sections are brought together to compression mold the shell or liner. In a liner machine, premade shells are placed in a nest when the mold sections are open, and a charge or pellet of liner material is placed within the mold before the mold is closed. U.S. patents that illustrate machines of this type for compression molding plastic closure shells include 5,670,110, 5,989,007, 6,074,583 and 6,478,568. U.S. patents that illustrate machines of this type for compression molding sealing liners within closure shells include 5,451,360. U.S. patent document 2006/0233904A1 discloses a vertical wheel compression molding machine, which rotates around a horizontal axis, for compression molding closure shells or sealing liners within closure shells.

10

15

20

The present disclosure involves a number of aspects that can be implemented separately from or in combination with each other.

An apparatus for severing mold charges of molten plastic exiting an orifice along an orifice axis, in accordance with one aspect of the present disclosure, includes a motor system that provides a rotary output around an axis offset from the orifice axis. A blade arm is eccentrically coupled to the rotary output of the motor system for motion in a plane at an angle to the orifice axis, preferably perpendicular to the orifice axis. A knife blade is coupled to the blade arm and disposed to oscillate in a closed path, preferably an elliptical path, that intersects the orifice axis so that the knife blade engages and severs molten plastic exiting the orifice along the orifice axis. A control arm preferably is pivotally coupled to the blade arm and to a point that is fixed with respect to the orifice axis to control motion of the blade arm and the knife blade. The motor system preferably is mounted on a base, and has an output shaft that extends through the base and a hub coupled to the output shaft. The blade arm is pivotally coupled to the hub eccentrically of the shaft. The knife blade preferably has a cutting edge that is at an angle to the blade arm.

Brief Description of the Drawings

The disclosure, together with additional objects, features, advantages and aspects thereof, will best be understood from the following description, the appended claims and the accompanying drawings, in which:

FIG. 1 is an elevational view of a compression molding machine in accordance with an exemplary implementation of the present disclosure;

FIG. 2 is a front elevational view on an enlarged scale of an apparatus for severing mold charges of molten plastic in accordance with an exemplary embodiment of the disclosure in the molding machine of FIG. 1;

FIG. 3 is a top plan view of the apparatus illustrated in FIG. 2;

FIG. 4 is an end elevational view of the apparatus illustrated in FIGS. 2-3; and

FIG. 5 is a schematic diagram that illustrates operation of the apparatus in FIGS.

2-4.

5 Detailed Description of Preferred Embodiments

FIG. 1 illustrates an exemplary machine 20 for compression molding plastic closure shells. Machine 20 includes a wheel 22 mounted on a shaft 24 between spaced supports 26. Shaft 24 is coupled by a pulley 30 and a belt 32 to a motor for rotating shaft 24 and wheel 22 around a horizontal axis. Wheel 22 includes a support 34 extending radially from shaft 24.

10 Support 34 may comprise a disk or the like, or may be in the form of a plurality of angularly spaced spokes. A plurality of angularly spaced molds 36 are disposed around the periphery of wheel 22, preferably on both sides of the wheel. All of the molds 36 preferably are identical. An apparatus 38 is provided for removing molded parts from the compression molding machine, and an apparatus 40 is provided for placing mold charges into the molding machine. With molds 15 36 mounted on both sides of wheel 22 as is preferred, there will be a removal apparatus 38 on each side of the wheel and a placement apparatus 40 on each side of the wheel. Each placement apparatus 40 preferably includes an apparatus 42 for severing mold charges in accordance with the present disclosure.

An exemplary embodiment of apparatus 42 is illustrated in greater detail in FIGS. 20 2-4, and includes a motor system 44 that preferably is suspended from a base 46. Motor system 44 preferably includes an electric servo motor 48 having a motor output shaft 50 coupled through a right-angle gear reducer 52 to a motor system output shaft 54 that extends through base 46. A hub 56 is coupled to shaft 54 above base 46, and a key 58 prevents rotation of hub 56 with respect to shaft 54. A blade arm 60 has a hub 62 coupled by bearings 64 to a shaft 66 that

extends upwardly from hub 56. Shaft 66 of hub 56 is parallel to but eccentrically offset from the axis of shaft 54. An orifice plate 67 is coupled to support 46 and has an orifice 68 that receives a stream of molten plastic extrudate from an extruder 69. Orifice plate 67 preferably is stationarily mounted to base 46, and orifice 68 preferably has an orifice axis that is parallel to but
5 offset from the axes of shafts 54, 66. Orifice 68 may be circular, as illustrated in FIG. 3, or of any other suitable geometry.

Blade arm 60 has an extension that overlies base 46. A control arm 62 preferably is pivotally connected at one end to blade arm 60 and at an opposing end to an arm 64 that is coupled to base 46. A knife 80 is mounted on the opposing end of blade arm 60. Knife 80
10 preferably includes a knife blade 82 mounted on an L-shaped blade support 84, which in turn is mounted, preferably replaceably mounted, on blade arm 60. The geometry of knife 80 may be such that the cutting edge 86 of blade 68 is at an angle to the axis of blade arm 60, preferably an outward angle as illustrated in FIG. 3. This outward angle tends to push the severed pellet away from the blade arm, which facilitates pick-up by mechanism 40 (FIG. 1). Other cutting edge
15 geometries can be employed, such as parallel to (e.g., colinear with) the axis of arm 60, curved or V-shaped. Cutting edge 86 preferably rides along the upper surface of orifice plate 67, as best seen in FIG. 2, to sever mold charges flushed with the surface of the orifice plate. Orifice plate 67 preferably is adjustably mounted on base 46 by means of arcuate slots 74 and fasteners 76. Knife blade 82 can be of any suitable material.

20 FIG. 5 is a schematic diagram that illustrates motion of blade arm 60 and knife blade 82. As hub shaft 66 orbits in a circular path 90 around the axis of motor system output shaft 54, the position of the pivotal connection between blade arm 60 and control arm 62 describes an arcuate path 92. Control arm forces knife blade 82 to travel in an elliptical path 94 that intersects orifice 68, preferably at a position spaced furthest from the axis of shaft 54. As

the knife blade continues travel in the direction 96, the knife blade clears the extruder orifice, and the severed mold charge of molten plastic is picked up by placement apparatus 40 (FIG. 1) and placed within a mold 38, as described in greater detail in the above-referenced copending applications.

5 The disclosure has been presented in conjunction with an exemplary embodiment, and a number of modifications and variations have been discussed. Other modifications and variations readily will suggest themselves to persons of ordinary skill in the art in view of the foregoing discussion. For example, although the disclosure has been presented in conjunction with a horizontal axis vertical wheel compression molding machine, it will be apparent that the
10 apparatus for severing mold charges of the present disclosure can be used equally as well in conjunction with vertical axis carousel-type machines for placing mold charges into the molds of the machine. The disclosure is intended to embrace all such modifications and variations as fall within the spirit and broad scope of the appended claims.

Claims

1.

1 Apparatus for severing mold charges of molten plastic exiting an orifice (68) along
2 an orifice axis, which includes:

3 a motor system (44) that provides a rotary output around an axis offset from said
4 orifice axis,

5 a blade arm (60) eccentrically coupled to said rotary output of said motor system
6 for motion in a plane at an angle to said orifice axis, and

7 a knife blade (82) coupled to said blade arm and disposed to oscillate in a closed
8 path (94) that intersects said orifice axis so that said knife blade engages and severs molten
9 plastic exiting said orifice along said orifice axis.

2.

1 The apparatus set forth in claim 1 including a control arm (62) coupled to said
2 blade arm and to a point that is fixed with respect to said orifice axis.

3.

1 The apparatus set forth in claim 2 wherein said control arm (62) is pivotally
2 coupled to said blade arm (60) and is pivotally coupled to said point that is fixed with respect to
3 said orifice axis.

4.

1 The apparatus set forth in claim 1 wherein said axis of said rotary output is parallel
2 to said orifice axis.

5.

1 The apparatus set forth in claim 1 wherein said plane is perpendicular to said
2 orifice axis.

6.

1 The apparatus set forth in claim 1 including a base (46), said motor system being
2 mounted on said base.

7.

1 The apparatus set forth in claim 6 wherein said motor system includes an output
2 shaft (54) and a hub (56) coupled to said shaft, said blade arm (60) being pivotally coupled to said
3 hub eccentrically of said output shaft.

8.

1 The apparatus set forth in claim 7 wherein said motor system (44) includes a servo
2 motor (48) and a gear reducer (52) coupling said servo motor to said output shaft (54).

9.

1 The apparatus set forth in claim 1 wherein said closed path (94) is elliptical.

10.

1 The apparatus set forth in claim 9 wherein said knife blade (82) has a cutting edge
2 (86) at an outward angle to said blade arm.

11.

1 Apparatus for severing mold charges of molten plastic exiting an orifice (68) along
2 an orifice axis, which includes:
3 a motor system (44) that provides a rotary output around an axis parallel to and
4 offset from said orifice axis,
5 a blade arm (60) eccentrically coupled to said rotary output of said motor system
6 for motion in a plane perpendicular to said orifice axis,
7 a control arm (62) pivotally coupled to said blade arm and to a point that is fixed
8 with respect to said orifice axis, and
9 a knife blade (82) on said blade arm disposed to oscillate in a closed elliptical path
10 (94) that intersects said orifice axis so that said knife blade engages and severs molten plastic
11 exiting said orifice along said axis.

12.

1 The apparatus set forth in claim 11 wherein said knife blade has a cutting edge
2 (86) at an angle to said blade arm (60).

13.

1 The apparatus set forth in claim 12 including a base (46), said motor system (44)
2 being mounted on one side of said base and said blade arm and said knife blade being disposed
3 on an opposing side of said base from said motor system.

14.

1 The apparatus set forth in claim 13 wherein said motor system includes an output
2 shaft (54) that extends through said base and a hub (56) coupled to said shaft, said blade arm
3 being pivotally coupled to said hub eccentrically of said shaft.

15.

1 The apparatus set forth in claim 14 wherein said motor system includes a servo
2 motor (48) and a gear reducer (52) coupling said servo motor to said output shaft.

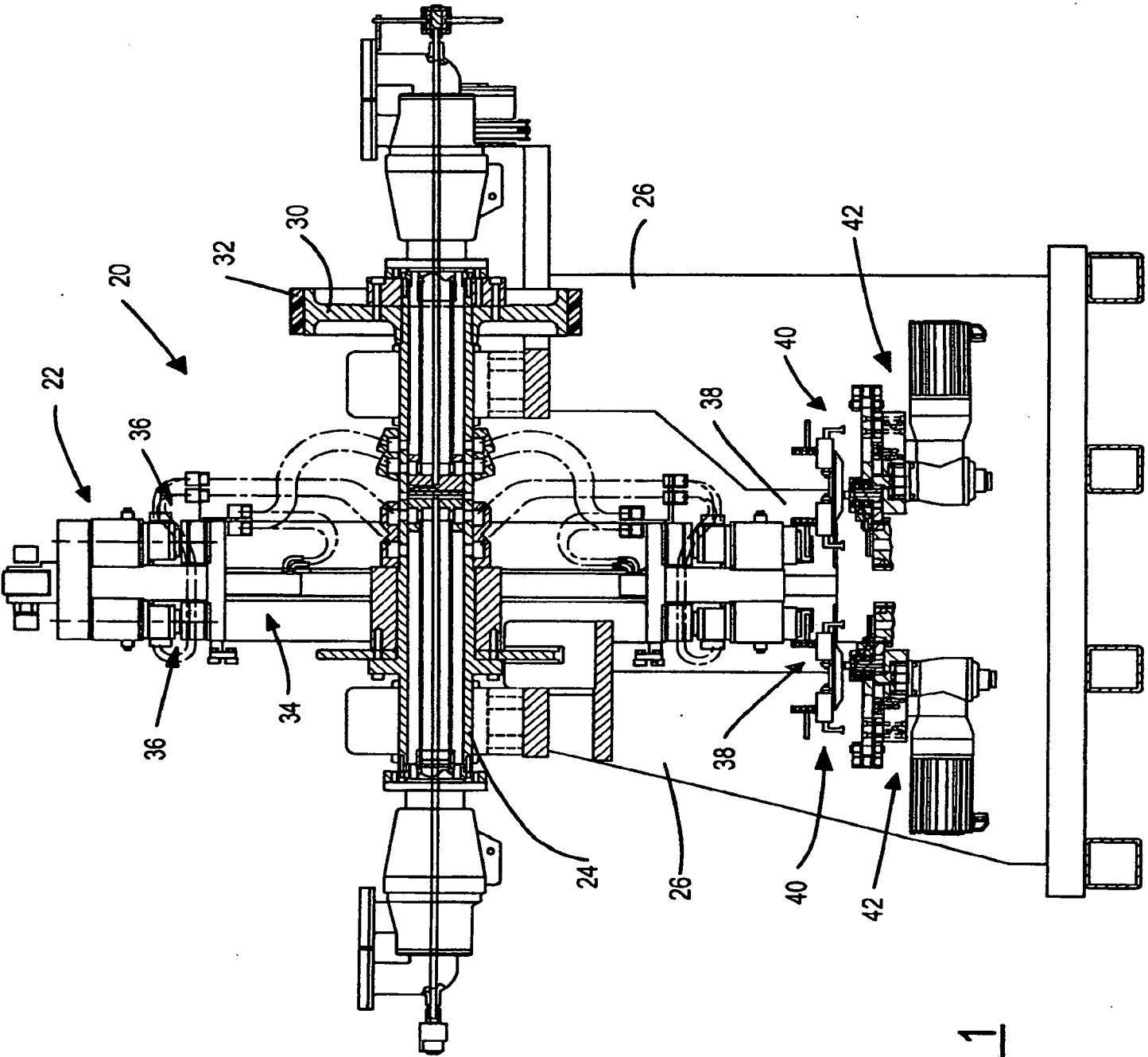


FIG. 1

2/4

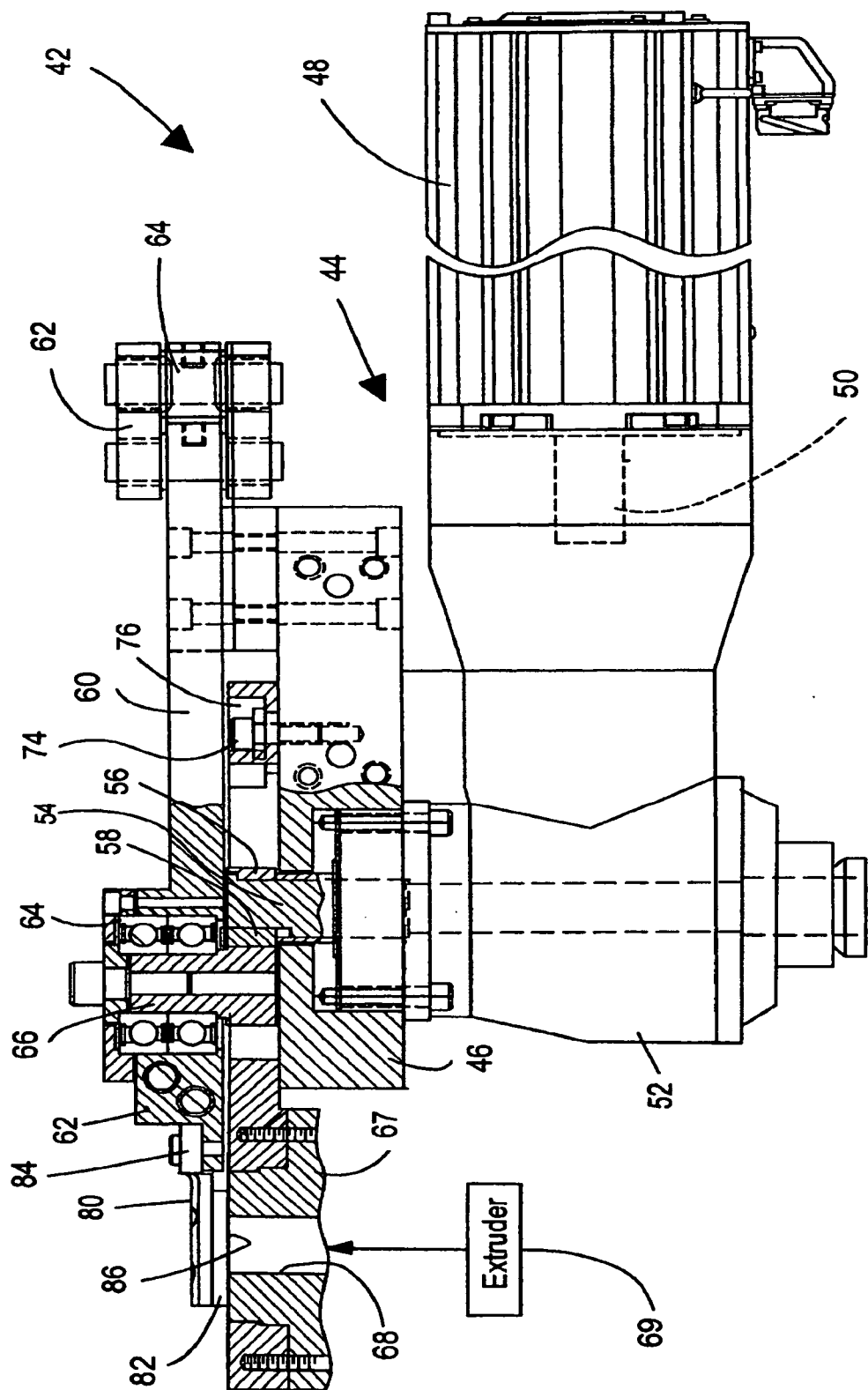


FIG. 2

3/4

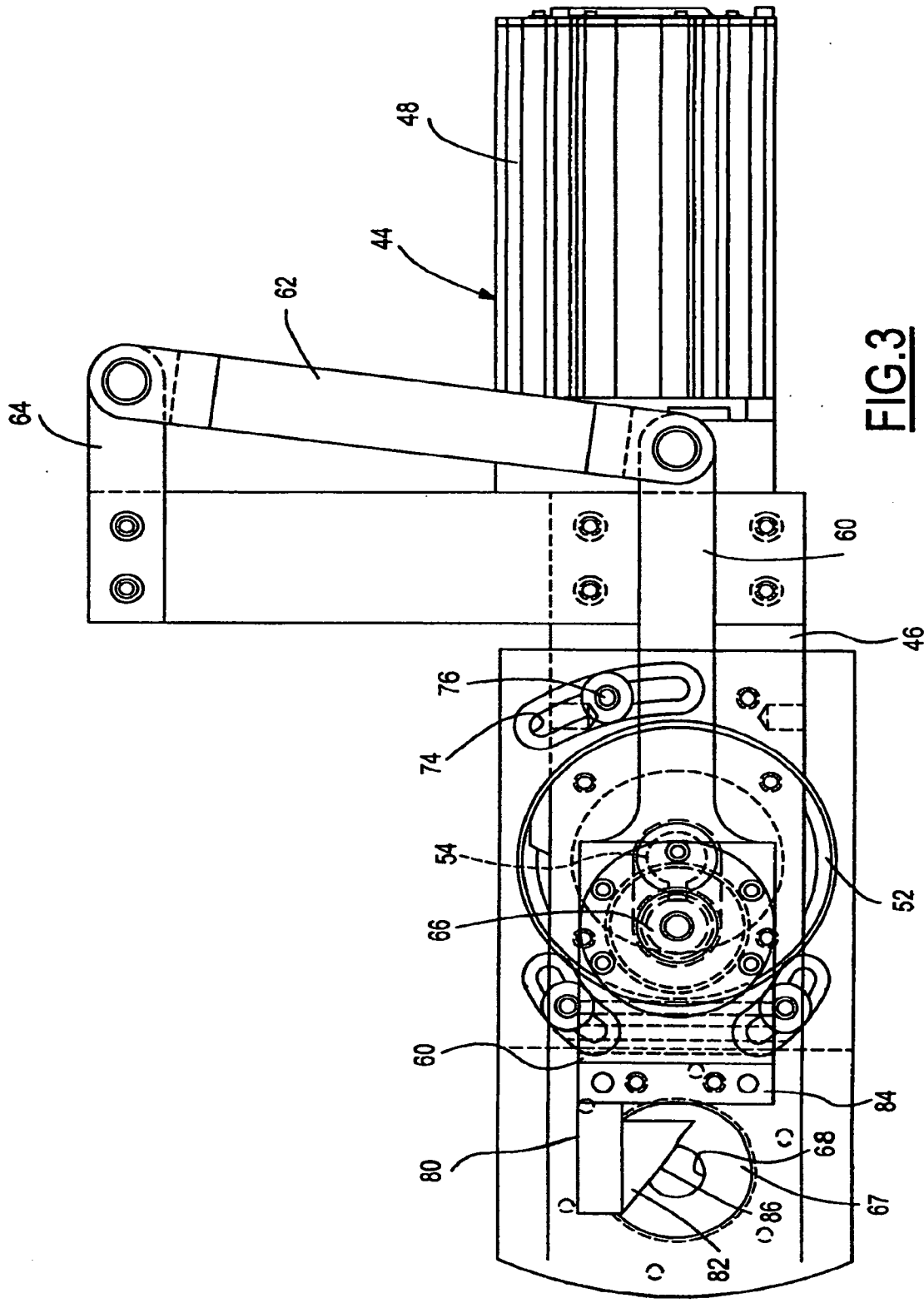


FIG. 3

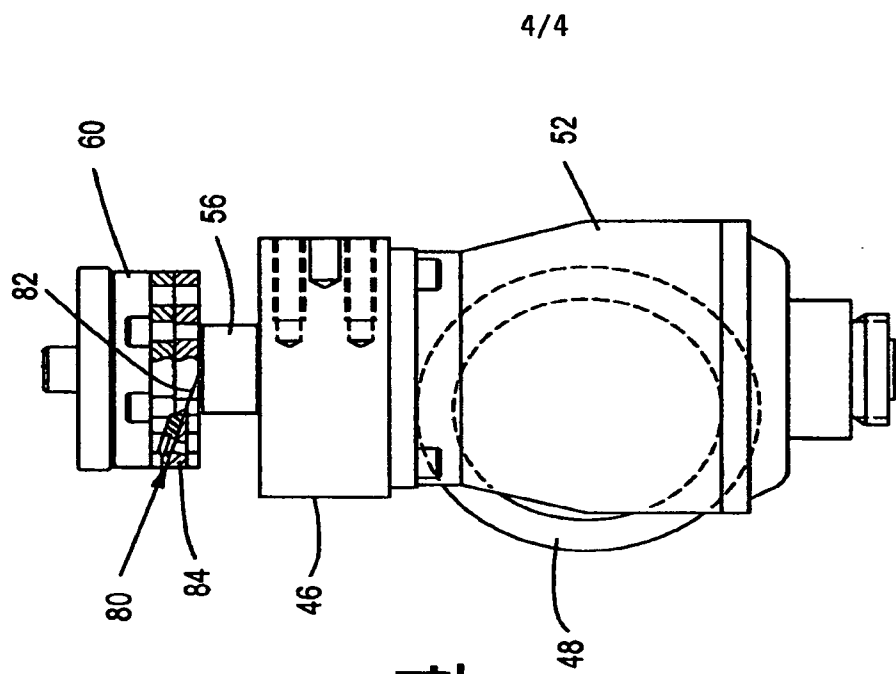


FIG. 4

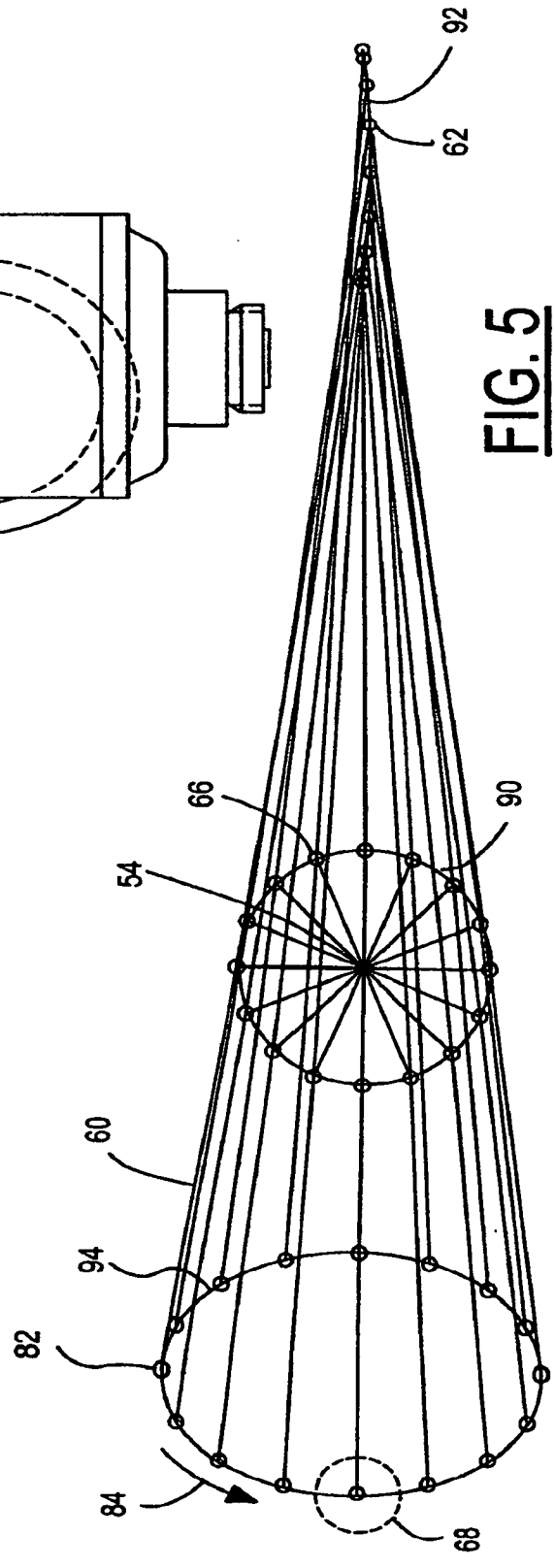


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/009918

A. CLASSIFICATION OF SUBJECT MATTER

INV. B29C31/04
ADD. B29C43/34 B29C43/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 867 081 A (EVERETT GEORGE) 18 February 1975 (1975-02-18) column 4, line 34 - line 61; figure 2 column 5, line 46 - column 7, line 41; figures	1-15
A	US 4 287 847 A (OHMI HIDEHIKO) 8 September 1981 (1981-09-08) column 2, line 1 - line 16 column 4, line 35 - line 61; figures	1,11
A	US 4 080 136 A (PELLER WILLIAM N) 21 March 1978 (1978-03-21) column 5, line 29 - column 6, line 58; figures	1,11
	----- -/--	

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- * & * document member of the same patent family

Date of the actual completion of the international search

25 September 2007

Date of mailing of the international search report

16/10/2007

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer:

Topalidis, Anestis

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/009918

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 603 964 A (ROTE B JACK [US] ET AL) 18 February 1997 (1997-02-18) column 3, line 13 - line 65; figures 6,7,10 -----	1-15
A	DATABASE WPI Week 200030 Derwent Publications Ltd., London, GB; AN 2000-343817 XP002452429 & JP 2000 108127 A (TOYO SEIKAN KAISHA LTD) 18 April 2000 (2000-04-18) abstract -----	1,11

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2007/009918

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 3867081	A	18-02-1975	NONE	
US 4287847	A	08-09-1981	AR 218387 A1 BR 7904191 A CA 1119762 A1 DE 2927827 A1 ES 482325 A1 FR 2434012 A1 GB 2024985 A IT 1122110 B JP 1420997 C JP 55009860 A JP 62021621 B MX 148633 A PH 16436 A	30-05-1980 25-03-1980 16-03-1982 24-01-1980 01-04-1980 21-03-1980 16-01-1980 23-04-1986 29-01-1988 24-01-1980 13-05-1987 19-05-1983 07-10-1983
US 4080136	A	21-03-1978	AU 502500 B2 AU 2828377 A CA 1046927 A1 DE 2739639 A1 FR 2363417 A1 GB 1552075 A JP 1379659 C JP 53041259 A JP 61047678 B	26-07-1979 01-03-1979 23-01-1979 09-03-1978 31-03-1978 05-09-1979 28-05-1987 14-04-1978 20-10-1986
US 5603964	A	18-02-1997	US 5811044 A	22-09-1998
JP 2000108127	A	18-04-2000	JP 3674337 B2	20-07-2005