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AUSTRALIA

PATENTS ACT 1990

PATENT REQUEST: STANDARD PATENT

We, OWENS-ILLINOIS CLOSURE INC., being the person identified below as the Applicant, request the grant of a patent to the person identified below as the Nominated Person, for an invention described in the accompanying standard complete specification.

Full application details follow.

Applicant: OWENS-ILLINOIS CLOSURE INC.

Address: One SeaGate, Toledo, Ohio 43666, United States of America

Nominated Person: As above

Address: As above

Invention Title: "PLASTIC PELLETT DELIVERY SYSTEM"

Name of actual inventor: Keith W. INGPAM

BASIC CONVENTION APPLICATION DETAILS:

Application Number: 08/095,463

Country: United States of America

Country Code: US

Date of Application: 22nd July, 1993

Basic Applicant: Keith W. Ingram

Drawing number recommended to accompany the abstract: Figure 4

Address for service is: SHELSTON WATERS
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0047875 19/07/94 Attorney Code: SW

DATED this 18th Day of July, 1994
OWENS-ILLINOIS CLOSURE INC.

by

Leon K. Allen

Full Institute of Patent Attorneys of Australia
To: The Commissioner of Patents
WODEN ACT 2606

File: 17531
Fee: \$195.00

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NOTICE OF ENTITLEMENT

We, OWENS-ILLINOIS CLOSURE INC.

of One SeaGate, Toledo, Ohio 43666, United States of America, being the applicant in respect of an Application for an invention entitled:

PLASTIC PELLET DELIVERY SYSTEM

state the following:-

1. The person nominated for the grant of the patent has entitlement from the actual inventor/s by assignment.
2. The person nominated for the grant of the patent has entitlement from the applicant/s of the basic application/s listed on the patent request form by assignment.
3. The basic application/s listed on the patent request form is/are the first application/s made in a Convention country in respect of the invention.


.....
(Signature)

July 7, 1994

.....
(Date)

Name: H. G. BRUSS

Title: Assistant Secretary

File: 16628 AUST

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55 CLARENCE STREET, SYDNEY, AUSTRALIA



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- (56) Prior Art Documents
US 4800792
EP 164099

(57) Claim

1. A pellet delivery system comprising

an extruder nozzle comprising a body having an orifice through which an extrudate is delivered and an arcuate concave substantially cylindrical surface intersected by said orifice,

a rigid cutting knife having a free edge,

a rotating shaft rotatable about an axis parallel to the longitudinal axis of the cylindrical surface,

means for mounting said rigid cutting knife on said shaft such that a free edge of said cutting blade is moved past said orifice surface and engages said surface,

said means for mounting said rigid cutting knife being such that said knife has limited angular movement circumferentially along its free edge which engages said surface,

said means for mounting said cutting knife including means yieldingly urging said cutting knife in a direction corresponding to the direction of rotation of said shaft such that when said shaft is rotated, said surface is engaged by the free edge of the cutting knife, the cutting knife is deflected angularly with respect to said shaft in the direction opposite to the direction of rotation and the free edge moves radially inwardly to conform to the arcuate cylindrical surface and sever a pellet from the extrudate.

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4. The method for providing delivery of a pellet comprising
 - providing an extruder nozzle comprising a body having an orifice through which an extrudate is delivered and an arcuate concave substantially cylindrical surface intersected by said orifice,
 - providing a rigid cutting blade having a free edge,
 - providing a rotating shaft rotatable about an axis parallel to the longitudinal axis of the cylindrical surface,
 - mounting said rigid cutting blade on said shaft such that a free edge of said cutting blade is moved past said orifice surface and engages said surface,
 - providing a resiliently supporting means for said rigid cutting blade on said shaft wherein said blade has limited angular movement circumferentially along its free edge which engages said surface and is yieldingly urged in a direction corresponding to the direction of rotation of the shaft such that when the shaft is rotated, said blade is rotated,
 - supplying extrudate through the orifice of said nozzle,
 - rotating such shaft such that said surface is engaged by the free edge of the cutting blade and the cutting blade is deflected angularly with respect to said shaft in the direction opposite to the direction of rotation and the free edge moves radially inwardly to conform to the arcuate cylindrical surface and sever a pellet from the extrudate.

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C O M P L E T E S P E C I F I C A T I O N

FOR A STANDARD PATENT

O R I G I N A L

Name of Applicant: OWENS-ILLINOIS CLOSURE INC.

Actual Inventor: Keith W. INGRAM

Address for Service: SHELSTON WATERS
55 Clarence Street
SYDNEY NSW 2000

Invention Title: "PLASTIC PELLETT DELIVERY SYSTEM"

The following statement is a full description of this invention,
including the best method of performing it known to us:-

This invention is related to plastic pellet delivery systems and particularly to such systems for delivering a predetermined precise quantity of plastic for use in compression molding plastic closures and compression molding liners in plastic closures.

Background and Summary of the Invention

In the manufacture of plastic closures by compression molding and the provision of liners in plastic closures, it is common to utilize pellet delivery systems. Typical patents showing such systems are: 2,640,033, 3,458,897, 3,676,029, 3,828,637, 3,955,605, 4,080,136, 4,157,048, 4,269,584, 4,277,431, 4,440,704, 4,800,792 and 4,978,288.

In one type of system which has been used as shown in United States patents 4,080,136 and 4,277,431, a flexible and resilient blade is moved along a surface surrounding the extrusion nozzle and after it moves past the surface snaps to accelerate the pellet to the place of use. It has been found that such a system is difficult to set up and requires substantial attention. Furthermore, it requires frequent adjustment. In addition, it has limited life and must be replaced rather frequently.

It is an object of the present invention to overcome or at least ameliorate one or more of the deficiencies of the prior art.



According to a first aspect of the invention there is provided a pellet delivery system comprising:

an extruder nozzle comprising a body having an orifice through which an extrudate is delivered and an arcuate concave substantially cylindrical surface intersected by said

5 orifice,

a rigid cutting knife having a free edge,

a rotating shaft rotatable about an axis parallel to the longitudinal axis of the cylindrical surface,

10 means for mounting said rigid cutting knife on said shaft such that a free edge of said cutting blade is moved past said orifice surface and engages said surface,

said means for mounting said rigid cutting knife being such that said knife has limited angular movement circumferentially along its free edge which engages said surface,

15 said means for mounting said cutting knife including means yieldingly urging said cutting knife in a direction corresponding to the direction of rotation of said shaft such that when said shaft is rotated, said surface is engaged by the free edge of the cutting knife, the cutting knife is deflected angularly with respect to said shaft in the direction opposite to the direction of rotation and the free edge moves radially inwardly to conform to the arcuate cylindrical surface and sever a pellet from the extrudate.

20 According to a second aspect of the invention there is provided a method for providing delivery of a pellet comprising:

providing an extruder nozzle comprising a body having an orifice through which an extrudate is delivered and an arcuate concave substantially cylindrical surface intersected by said orifice,

25 providing a rigid cutting blade having a free edge,

providing a rotating shaft rotatable about an axis parallel to the longitudinal axis of the cylindrical surface,

mounting said rigid cutting blade on said shaft such that a free edge of said cutting blade is moved past said orifice surface and engages said surface,

30 providing a resiliently supporting means for said rigid cutting blade on said shaft wherein said blade has limited angular movement circumferentially along its free edge

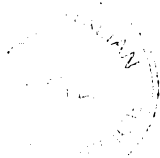


which engages said surface and is yieldingly urged in a direction corresponding to the direction of rotation of the shaft such that when the shaft is rotated, said blade is rotated, supplying extrudate through the orifice of said nozzle,

rotating such shaft such that said surface is engaged by the free edge of the cutting
5 blade and the cutting blade is deflected angularly with respect to said shaft in the direction opposite to the direction of rotation and the free edge moves radially inwardly to conform to the arcuate cylindrical surface and sever a pellet from the extrudate.

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Description of the Preferred Embodiments

A preferred embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

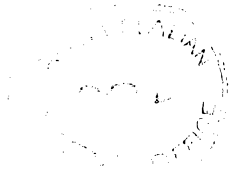
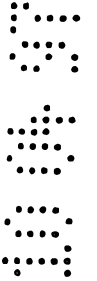
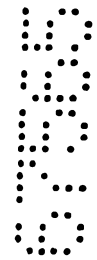
FIG. 1 is an elevational view of a pellet delivery system embodying the invention;

5 FIG. 2 is a part sectional plan view thereof;

FIG. 3 is a part sectional end view thereof;

FIG. 4 is a fragmentary part sectional partly diagrammatic end view of a portion of the apparatus; and

FIG. 5 is fragmentary part sectional end view of a modified form of apparatus.



Description

5 Referring to FIG. 1, the pellet delivery system comprises a cutter assembly 20 that is mounted by the parallel links 21 of a parallelogram linkage which are pivoted to the cutter 20 and a base 22. A fluid cylinder 23 extends between the base 22 and one of the links 21 to move the cutter assembly to and from position. Stops 24, 25 are provided for controlling the movement in each direction. Each stop 24, 25 includes a shock absorber.

10 Referring to FIGS. 2-4, the cutter delivery assembly 20 includes a servo motor 26 that drives a shaft 27 supported by bearings 28, 29 to rotatably mount a removable blade holder 30. The blade holder 30 is mounted on shaft 27 by an integral shaft 31 that has an end formed with a radial key that engages a complementary key in the shaft 27. The shaft 31 is locked to shaft 27 by a collet 32 on shaft 27 that has a collet nut 33 threaded thereon.

15 The blade holder 30 has a hole 34 bored eccentrically to receive a pivot post 35 which, in turn has a slot 35a for receiving a rigid cutter blade or knife 36. The blade 36 has limited circumferential movement, being yieldingly urged in the direction of rotation by spaced plungers 37 that are urged toward the blade by springs 38 mounted in a bracket 39 such that the blade 36 is held against a stop surface on the pivot
20 blade holder 30. The cutter blade 36 is adapted to move past
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a nozzle block 40 through which extrudate such as plastic material is directed out of a nozzle 41. The slot 35a on the pivot post 35 extends axially and has a flat side 42 and an opposed side 43 with an integral axial rib 44. The cutter blade 5 36 has an inner end with a complementary cross section that is slightly smaller to limit circumferential movement of the cutter blade 36. This cross section includes a flat side 45 and an opposed side 46 having an axial groove 47.

As the blade holder 30 rotates the free edge 36a of the cutter blade 36 is projected substantially radially onto 10 the arcuate concave surface 41a of the nozzle 41 and is deflected angularly with respect to the blade holder 30 in a direction counter to the direction of rotation thereby providing a substantially constant force of the blade 36 against the nozzle surface 41a. As the blade 36 moves across the nozzle orifice 41, 15 a pellet of extrudate is severed from the nozzle 41 and then upon further rotation of the blade holder 30 the free edge 36a of the blade 36 moves past the surface 41a and the yielding force of the plungers 37 deflect the pellet toward the work station, in this case a mold or the interior of a closure (not 20 shown).

In the form shown in FIG. 5, the yielding force on the blade 36b is provided by a flat spring 50 engaging the surface of the blade.

The axis of rotation of the shaft 27 and the blade holder 30 are adjustably displaced from the arc center of the cylindrical surface 41a of the nozzle block 41.

5 The blade 36 and pivot post 35 could, alternatively, be manufactured as one piece, and in the shape of a key hole in cross section. The circular section of the post would function as the blade shaft forming the pivoting point of the blade.

10 The pivot post 35 is eccentrically mounted on the blade holder 30 in the order of 0.150 in., being housed in a bore within, and eccentric to the axis of rotation of the blade holder 30.

15 The two plungers 37 actuated by compression springs function on the blade 36 to preload the rotation of the blade 36 in the same direction as the rotation of the blade 36 for cutting and holding the blade 36 against a mechanical stop on the blade holder 30. Thus the blade 36 can be pivoted about the center of the pivot post 35 in a direction opposite the rotation for cutting, only by compressing the springs 38.

20 The drive shaft 27 is bearing mounted and driven by the servo motor 26 at a rotational speed proportional to the rate of delivery of the mold or closure to which the pellet is delivered.

25 Relative sliding movement of the cutter assembly 20 to the nozzle assembly 52 is provided in order to clear the

cutter 36 from the extrudate while extruding material during
set up and while not rotating the cutter. Also relative movement
of the whole cutter assembly and nozzle assembly to the machine
frame is provided such that extrudate can exit the nozzle 41
5 and fall to a collecting area away from the cap delivery means.

Operation:

The cutter drive shaft 27 is driven at a rotational
speed proportional to the rate of delivery of the molds or caps.
The extrudate is allowed to stabilize at a controlled delivery
10 rate proportional to the rate of delivery of the molds or caps.
The nozzle is then moved to engage the blade 36 with the nozzle
41, and its position is fixed by the adjustment screw 51 such
that the normal path of the blade tip would cause an interference
with the nozzle of about 0.015 in., for example.

15 The nozzle 41 has a generally cylindrical surface,
and has a tangential surface portion 41a at the entry position
of the cutter blade 36 to allow for the entry of the blade 36.
As the blade 36 contacts the entry area of the nozzle 41, the
tip 36a of the blade 36 is held back by friction, and as the
20 drive shaft 27 continues to rotate, the blade 36 pivots within
its eccentric bushing in a direction relatively opposite that
of the cutter shaft rotation and in opposition to the springs
38. This action causes the blade tip 36a to move in toward the
center of the drive shaft 27, and this in turn results in an

effective reduction in the arc radius subscribed by the blade tip 36a, until the subscribed arc matches the generally cylindrical surface 41a of the nozzle 40. If the generally cylindrical surface 41a of the nozzle 41 is not exactly concentric to the axis of the cutter drive shaft 27, then the tip 36a of the blade 36 accommodates this variation by pivoting of the blade 36 in either the direction of rotation under spring pressure or in the reverse direction by the action of friction with the nozzle.

10 When the cutting is complete, and the cutter blade 36 leaves the nozzle 41, the plungers 34 extend, and cause a "flip" action to the blade 36 which helps to release the pellet from the blade 36.

15 When the cutting action is stabilized, the whole cutter and nozzle assembly is moved in toward the cap delivery system, and the pellets are directed into the moving cap in preparation for molding.

20 It can thus be seen the pellet delivery system provides a pellet cutting knife 36 that engages and transverses a nozzle from which a continuous stream of extrudate is being supplied from an extruder and/or pump and thereby cleanly cut the extrudate into individual pellets without stringing the material. In order to avoid fatigue breakage or weakening of the blade, it is desirable to use a blade of solid construction, and this necessitates a means to ensure that the blade can slide over

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the nozzle surface and yet maintain a minimum, controlled interference with the nozzle. To achieve this, the blade is mounted on an axis which is eccentric to the axis of the drive shaft, such that any pivoting of the solid blade about its own axis will displace the tip of the blade, relative to the centerline of the drive axis, in a radial direction. To establish a primary position of the blade relative to the drive axis, and further to provide resilience against (pivoting) deflection of the blade about its mounting axis, a spring means is used to act as a torsional bias to the blade.

By choice of geometry, the apparatus automatically compensates for cutter wear, and for variability in the setting of the drive axis relative to the nozzle (cutter engagement). Deflection of the cutter as it engages the nozzle and the simultaneous radially inward movement of the blade tip ensures a substantially consistent force of the blade against the nozzle, for varying amount of adjustment of the drive shaft displacement from the nozzle and/or blade tip wear.

Compared to a flexible steel blade, the present apparatus has the following advantages:

- 1) Rigid blade is less susceptible to breakage, and will not fatigue.
- 2) Device is less dependent upon operator skill in setting the device, and needs less attention.

- 3) Rigid blade can be manufactured from any of several material choices to suit application.
- 4) Consistent blade engagement independent of cutter engagement setting.
- 5) 5) More substantial mounting than flexible blade, having better alignment to nozzle.
- 6) 6) Better control of pellet placement due to less variability in blade engagement.
- 7) 7) Means to continually compensate for variance in the radius of the arc swept by the tip of a rigid blade as the tip contacts a substantially cylindrical surface. This variance being a result of axis displacement of the cutter drive shaft from the said cylindrical surface, or eccentricity of the cylindrical surface to the axis of rotation or undulations in the cylindrical surface.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. A pellet delivery system comprising
an extruder nozzle comprising a body having an orifice through which an extrudate
is delivered and an arcuate concave substantially cylindrical surface intersected by said
5 orifice,
a rigid cutting knife having a free edge,
a rotating shaft rotatable about an axis parallel to the longitudinal axis of the
cylindrical surface,
means for mounting said rigid cutting knife on said shaft such that a free edge of
10 said cutting blade is moved past said orifice surface and engages said surface,
said means for mounting said rigid cutting knife being such that said knife has
limited angular movement circumferentially along its free edge which engages said
surface,
said means for mounting said cutting knife including means yieldingly urging said
15 cutting knife in a direction corresponding to the direction of rotation of said shaft such
that when said shaft is rotated, said surface is engaged by the free edge of the cutting
knife, the cutting knife is deflected angularly with respect to said shaft in the direction
opposite to the direction of rotation and the free edge moves radially inwardly to
conform to the arcuate cylindrical surface and sever a pellet from the extrudate.
20 2. The apparatus set forth in claim 1 wherein said body of said nozzle includes a
substantially tangential surface in advance of said orifice that is engaged by the free edge
of the knife as it is moved toward and across the orifices.
3. The apparatus set forth in claim 2 wherein said means for mounting said cutting
knife on said shaft includes a knife holder mounted eccentrically on said shaft, a slot in
25 said knife holder engaged by said cutting knife and spring means interposed between
said knife holder and said cutting knife.
4. The method for providing delivery of a pellet comprising
providing an extruder nozzle comprising a body having an orifice through which
an extrudate is delivered and an arcuate concave substantially cylindrical surface
30 intersected by said orifice,
providing a rigid cutting blade having a free edge,

providing a rotating shaft rotatable about an axis parallel to the longitudinal axis of the cylindrical surface,

mounting said rigid cutting blade on said shaft such that a free edge of said cutting blade is moved past said orifice surface and engages said surface,

5 providing a resiliently supporting means for said rigid cutting blade on said shaft wherein said blade has limited angular movement circumferentially along its free edge which engages said surface and is yieldingly urged in a direction corresponding to the direction of rotation of the shaft such that when the shaft is rotated, said blade is rotated, supplying extrudate through the orifice of said nozzle,

10 rotating such shaft such that said surface is engaged by the free edge of the cutting blade and the cutting blade is deflected angularly with respect to said shaft in the direction opposite to the direction of rotation and the free edge moves radially inwardly to conform to the arcuate cylindrical surface and sever a pellet from the extrudate.

5. A pellet delivery system substantially as herein described with reference to the accompanying drawings.

DATED this 9 Day of April 1997

OWENS-ILLINOIS CLOSURE INC.

Attorney: JOHN B. REDFERN
Fellow Institute of Patent Attorneys of Australia
of SHELSTON WATERS

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ABSTRACT OF THE DISCLOSURE

A plastic pellet delivery system including an extruder nozzle (40) having an orifice (41) and an arcuate surface (41a) adjacent the orifice and rigid cutting knife (36) which is eccentrically mounted on a shaft (27) that is positioned and is rotated adjacent the orifice (41) to move the rigid knife (36) eccentrically into and out of engagement with the nozzle surface (41a). The cutting knife (36) is mounted for limited yielding pivotal movement relative to the eccentric mount such that it will deflect angularly with respect to the eccentric mount as it is engaging the nozzle surface (41a) such that the free edge (36a) of the knife blade tip is moved radially inwardly as the eccentric mount is rotated providing a substantially constant force of the blade (36) against the nozzle surface (41a).

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FIG. 1

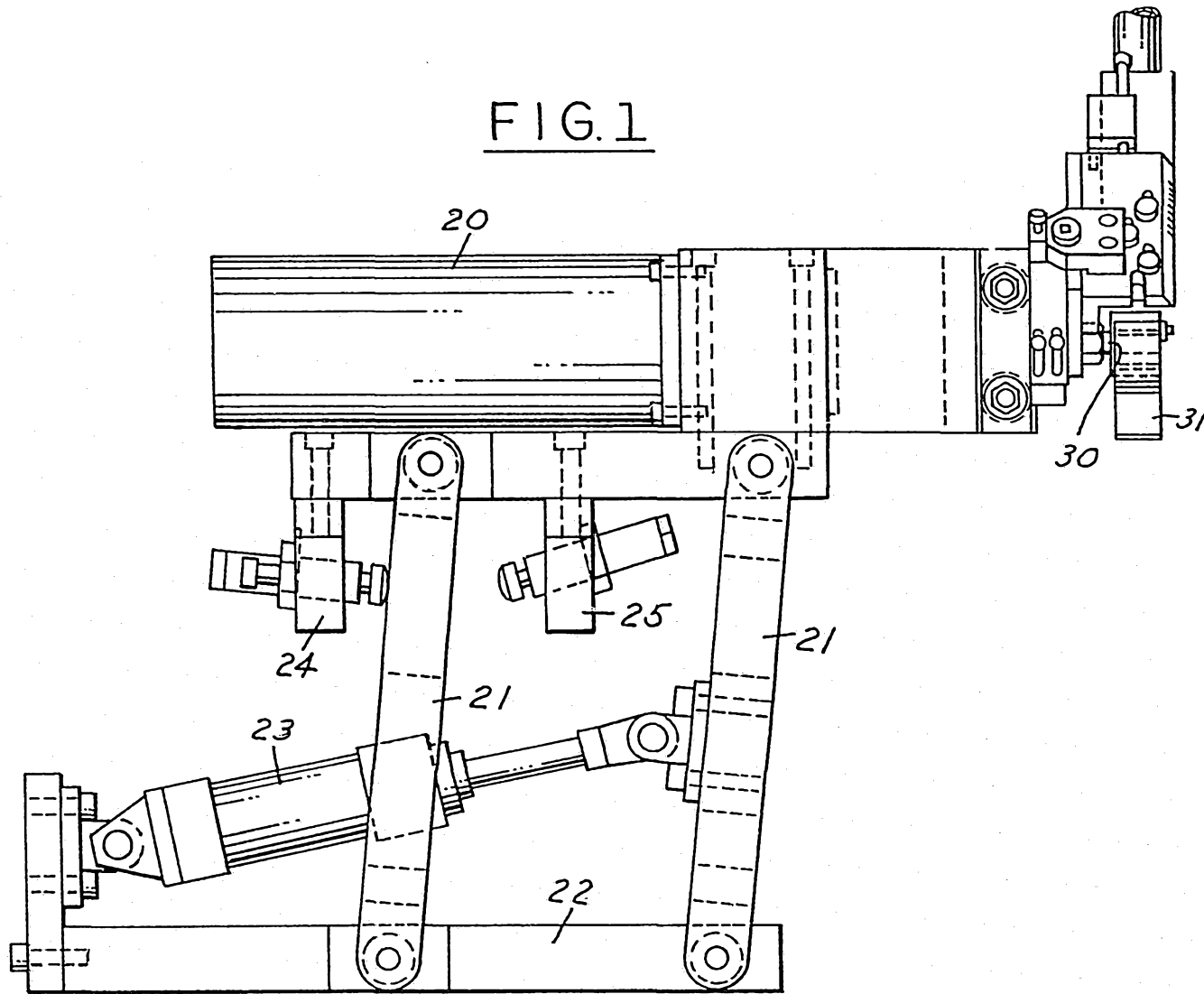


FIG. 2

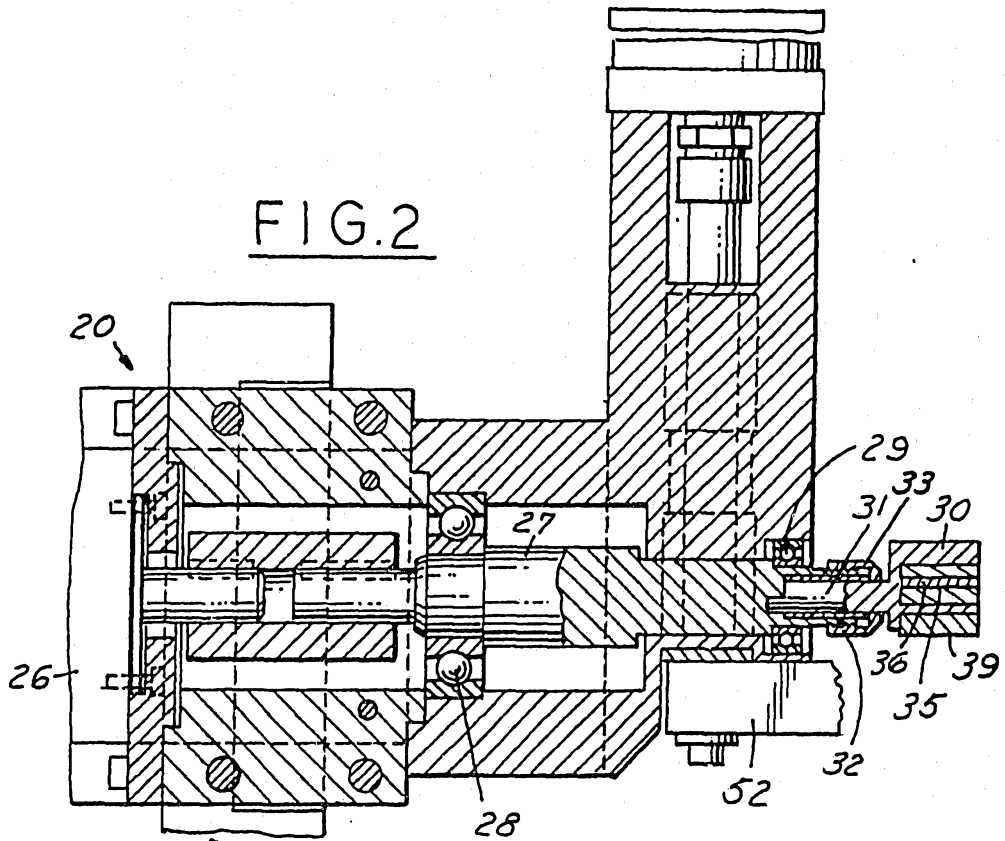


FIG. 3

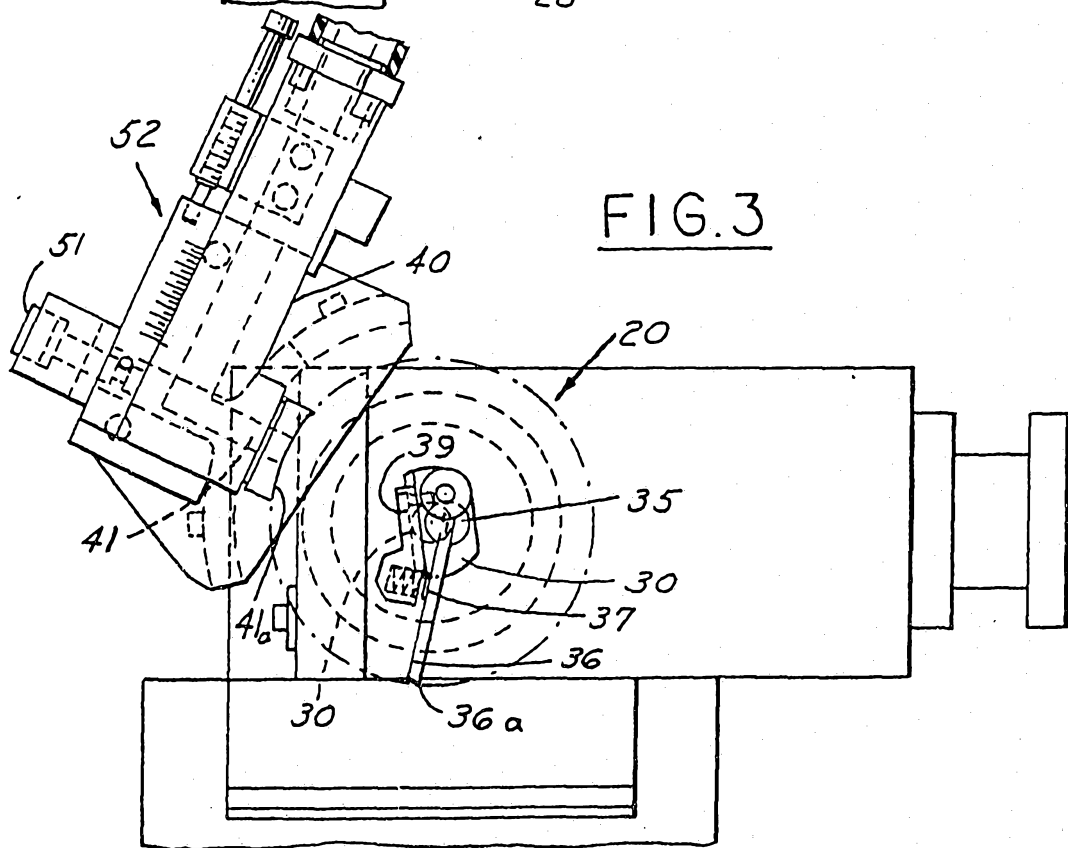


FIG. 4

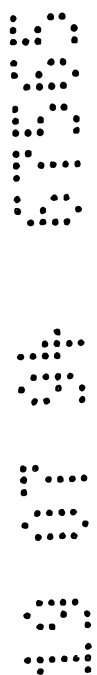
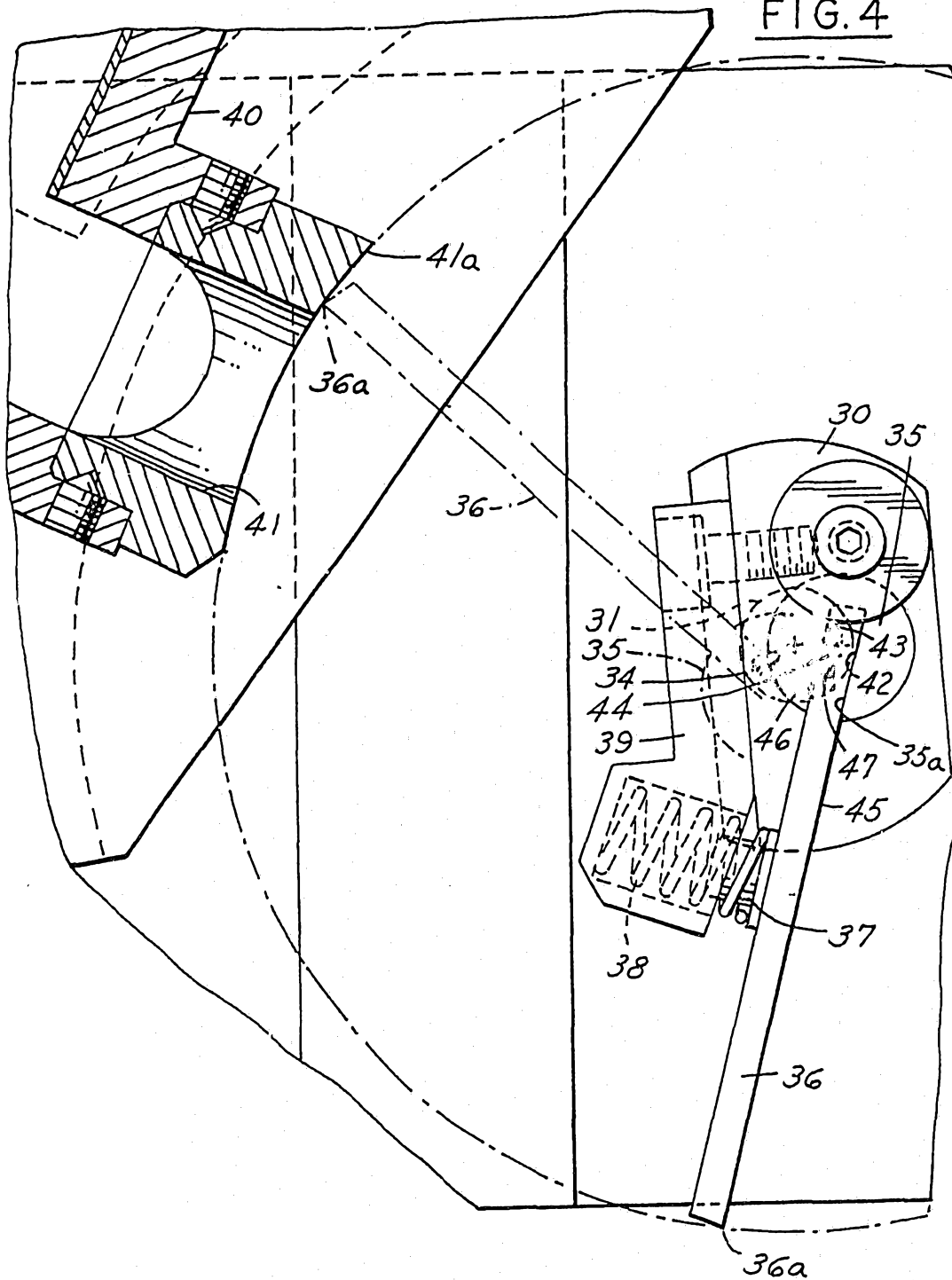


FIG.5

