



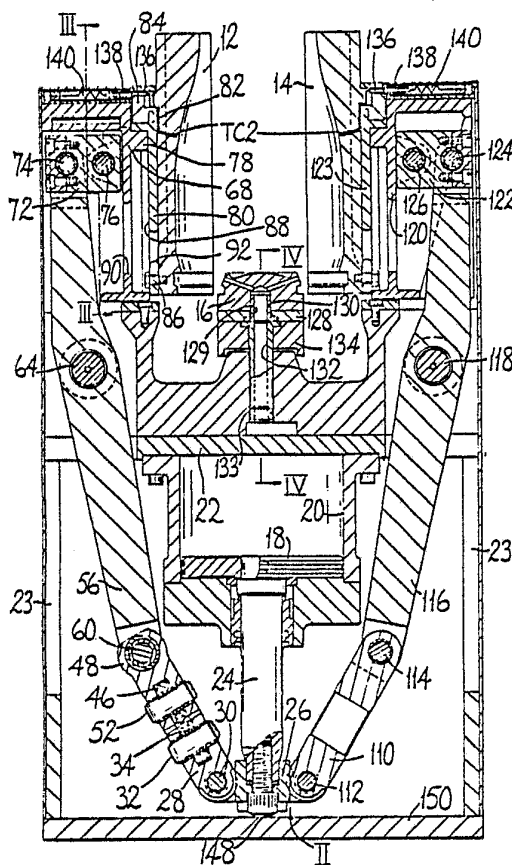
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<p>(21) International Application Number: PCT/GB82/00049 (22) International Filing Date: 22 February 1982 (22.02.82) (31) Priority Application Number: 8106259 (32) Priority Date: 27 February 1981 (27.02.81) (33) Priority Country: GB (71) Applicant (for all designated States except US): EM-HART INDUSTRIES, INC. [US/US]; 426 Colt Highway, Farmington, CT 06032 (US). (72) Inventors; and (75) Inventors/Applicants (for US only): BRAITHWAITE, David [GB/GB]; 34 Sandbeck Road, Doncaster (GB). JONES, Stanley, Peter [GB/GB]; Strafford House, Bride Church Lane, Tickhill, Nr. Doncaster (GB).</p>		<p>(74) Agents: DRURY, Peter, Lawrence et al.; P.O. Box 88, Belgrave Road, Leicester LE4 5BX (GB). (81) Designated States: AU, JP, US. Published With international search report.</p>

(54) Title: MOULD OPENING AND CLOSING MECHANISM

(57) Abstract

A mould opening and closing mechanism for opening and closing three moulds simultaneously. Moving means (18, 20) operable to move mould portions (12) is connected to the mould portions (12) via a system of links which serves to equalise the mould closing pressures of the three moulds. The system of links comprises a link (34) centrally connected to the moving means (18, 20) which equalises the pressure between one mould and a further link (46) and the further link (46) equalises the pressure between the other two moulds.



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2 Mould opening and closing mechanismTechnical Field

This invention is concerned with a mould opening and closing mechanism for use in opening and closing three
5 moulds simultaneously.

In various industries, it is necessary to open and close three moulds simultaneously. For example, when glassware containers are manufactured by an individual section machine with three containers being manufactured
10 simultaneously, gobs of glass are supplied to three parison-forming moulds at a moulding station of the machine and the completed parisons are transferred to three further moulds at a blowing station of the machine to be blown into the finished containers. At both stations of such a machine,
15 it is necessary to provide a mould opening and closing mechanism for use in opening and closing three moulds simultaneously at appropriate times in the cycle of operation of the machine.

20 Background Art

Existing mould opening and closing mechanisms for use in opening and closing three moulds simultaneously by moving a portion of each mould relative to further portions of that mould comprise three mould portion supports each

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1 arranged to support a portion of a mould, three levers each
of which is pivotal on a fixed pivot and each of which is
pivotaly connected to one of the mould portion supports,
and moving means connected to the levers and operable to
5 cause the levers to pivot about the fixed pivots so that
the mould portion supports are moved and the mould portions
are moved away from or towards further mould portions
thereby opening or closing the moulds. It is desirable
that such a mechanism should operate rapidly and accurately
10 and should close the three moulds with substantially equal
pressures. However, the problem of providing substantially
equal closing pressures to three moulds with rapidly and
accurately operating mechanism as hitherto only been
solved partially.

15 Disclosure of Invention

According to the invention the moving means of
the mould opening and closing mechanism is connected to
the three levers by a system of links comprising a link
pivotaly connected at a central region thereof to the
20 moving means, the link being pivotaly connected on one
side of the central region thereof to a first of the levers
and also being pivotaly connected on the other side of the
central region thereof and half the effective distance
therefrom to a further link of the system, the further
25 link being pivotaly connected to a second and a third of
the levers on opposite sides of and at equal effective
distances from its pivotal connection to the link.

In a preferred mould opening and closing mechanism,
in order to improve the accuracy of the mould closing, the
30 three mould portion supports are mounted on linear slide-
ways extending towards and away from the further mould
portions. For ease of construction, a central one of the
three mould portion supports is mounted on a slideway and
the slideways of the other two supports are formed on the
35 central support.



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1 In order to enable the mould opening and closing
mechanism to move further portions of the moulds, in the
preferred mould opening and closing mechanism, the moving
means is also connected to three further levers each of
5 which is pivotal on a fixed pivot and each of which is
pivotally connected to a further mould portion support
arranged to support one of the aforementioned further
mould portions so that operation of the moving means is
effective to move the mould portions and the further mould
10 portions towards or away from each other.

Brief description of Drawings

In the accompanying drawings:

Figure 1 is a cross-sectional view of a moulding
station which incorporates a mould opening and closing
15 mechanism according to the invention, the line I-I in
Figure 2 indicating the section on which Figure 1 is
taken, the station being shown in a mould open condition;

Figure 2 is an underneath view of the moulding
station taken in the direction of the arrow 2 in Figure 1
20 and showing the station in a mould closed condition;

Figure 3 is a sectional view taken on the line
III-III in Figure 1; and

Figure 4 is a sectional view taken on the line
IV-IV in Figure 1.

25 Best mode of carrying out the invention

The moulding station shown in the drawings
comprises a mould opening and closing mechanism for use
in opening and closing three moulds simultaneously by
moving a first portion 12 and a second portion 14 of each
30 mould into engagement with each other and with a bottom
mould portion 16 of that mould to form a completed mould.
The mould portions 12, 14 and 16 close around a parison of

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1 glass which is then blown to the shape of a cavity defined
by the mould portions 12, 14 and 16. The moulding station
is, thus, intended to form part of an individual section
glassware container forming machine but it is to be
5 understood that the invention could equally be applied to
the parison moulding station of such a machine or to
another suitable machine. The three mould portions 12
are arranged in a straight line as are the mould portions
14 and the bottom mould portions 16.

10 The mould opening and closing mechanism comprises a
piston 18 and cylinder 20 assembly; the cylinder 20 of which
is mounted on the underside of and depends from a support
plate 22 which is supported by a framework 23 of the
mould station. The piston and cylinder assembly 18, 20
15 is operable to move a piston rod 24 thereof which depends
from the piston 18. A crosshead 26 is fixedly mounted on
the piston rod 24 to be moved therewith. The crosshead 26
is pivotally connected on one side thereof (the left viewing
Figures 1 and 2) to a system of links.

20 The system of links comprises a first link 28
which is pivotally mounted on a horizontal pivot pin 30
mounted on the crosshead 26. The first link 28 carries a
pivot pin 32 on which a second link 34 of the system of
links is pivotally mounted. The second link 34 (see
25 Figure 2) is pivoted about a central region thereof on the
pin 32 and is also pivoted on two further pivot pins 36
and 38. The link 34 is therefore pivotally connected at
a central region thereof to the piston and cylinder
assembly 18, 20. The pivot pin 36 forms a pivotal
30 connection between the link 34 and a third link 40 of the
system of links at an end portion of the link 34. The
link 40 is also pivotally connected to a first lever 42
of the mechanism by means of a pivot pin 44. The

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1 pivot pin 38 is on the opposite side of the pivot pin 32
to the pivot pin 36 and forms a pivotal connection between
the second link 34 and a fourth link 46 of the system.
The effective distance between the pivot pins 32 and 38
5 is half that between the pivot pins 32 and 36 (see
Figure 2). Thus, the link 34 is pivotally connected on
one side of the central region thereof to the lever 42
and on the other side of the central region thereof and
half the effective distance therefrom to the link 46.
10 The fourth link 46 is pivotally connected at a central
region thereof to the second link 34 by the pivot pin 38
and also has pivotal connections, on opposite sides of
the central region thereof and equi-distant therefrom,
to a fifth 48 and a sixth 50 link of the system. The
15 pivotal connection between the fourth 46 and the fifth 48
links is by means of a pivot pin 52 and the pivotal
connection between the fourth 46 and the sixth 50 links
is by means of a pivot pin 54. The fifth link 48 and
the sixth link 50 are respectively pivotally connected
20 to a second lever 56 and a third lever 58 of the mechanism
by means of pivot pins 60 and 62.

The three levers 42, 56 and 58 are each connected
at a lower end portion thereof to the system of links,
as described above, and are mounted for pivotal move-
25 ment about a central region thereof on horizontal pivots
provided by pins 64 (Figure 1) which are supported by
the framework 23, each lever 42 56 and 58 being pivotal
on a separate pin 64. At an upper end portion thereof,
each of the levers 42, 56 and 58 is pivotally connected
30 to one of three mould portion supports 66, 68 and 70
which each support one of the mould portions 12 (see
also Figure 3). The connections between the levers 42,
56 and 58 and the supports 66, 68 and 70 are identical,

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1 each lever being pivotally connected to a block 72 by
means of a pin 74 and the block 72 being pivotally
connected to the support 66, 68 or 70 by means of a pin
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5 The piston and cylinder assembly 18, 20 provides moving
means of the mechanism connected to the levers 42, 56 and
58 and operable to cause the levers to pivot about the
pivot pins 64 so that the mould portion supports 66, 68
and 70 are moved and the mould portions 12 are moved away
10 from or towards the further mould portions 14, thereby
opening or closing the moulds. The purpose of the system
of links 28, 34, 40, 46, 48 and 50 is to cause the moving
means to apply substantially equal pressure to the three
levers 42, 56 and 58 so that substantially equal mould
15 closing pressures will be achieved. Downwards movement
of the crosshead 26 (it is shown in its lowermost position
in the drawings) by the action of the piston and cylinder
assembly 18, 20 causes the levers 42, 56 and 58 to pivot
about the pins 64 (anti-clockwise viewing Figure 1)
20 thereby moving the blocks 72 and the supports 66, 68 and
70 to the left. Since the supports 66, 68 and 70 carry
the mould portions 12, the mould portions 12 also move
to the left away from the mould portions 14 so that the
moulds are opened. On the other hand, upwards movement
25 of the crosshead 26 by the action of the piston and cylinder
assembly 18, 20 causes the levers 42, 56 and 58 to pivot
about the pins 64 (clockwise) thereby moving the mould
portions 12 towards the mould portions 14 and closing the
mould. The system of links 28, 34, 40, 46, 48 and 50
30 acts to equalise the pressure between the three sets of
mould portions 12 and 14 since the second link 34 equalises
the pressure between the pivot pins 36 and 38 because of
the two-to-one ratio of the distances between the pins 36 and
32 and the pins 38 and 32, and the fourth link 46 equalises

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1 the pressure between the pivot pins 52 and 54.

The three mould supports 66, 68 and 70 are each arranged to support one of the mould portions 12. Each support 66, 68 and 70 has a projection 78 (Figure 1) which
5 is T-shaped in plan view (not shown) and on to which an intermediate support 80 is removably mounted with the projection 78 received in a T-shaped slot (not shown) in the support 80. The projection 78 is a loose fit in the T-shaped slot to allow the support 80 to move slightly
10 sideways relative to the support 66, 68 or 70. A portion of the support 80 projects above the projection 78 to support the support 80 on the support 66, 68 or 70. The intermediate support 80 has an upstanding lip portion 82 over which a hook portion 84 of the mould portion 12 fits
15 to mount the mould portion 12 on the support 80 and hence on the support 66, 68 or 70. A bolt 86 also interconnects the intermediate support 80 and the mould portion 12. The support 66, 68 or 70 and the intermediate support 80 define a space 88, beneath the projection 78, which serves
20 to insulate the mould portion 12 from the support 66, 68 or 70. In the operation of the machine, cooling air is blown between the levers 42, 56 and 58 into the space 88 through an aperture 90 in the support 66, 68 or 70 and on to the mould portion through an aperture 92 in the inter-
25 mediate support 80. The air passing through the aperture 92 finally passes between cooling fins 94 (Figure 3) of the mould portion 12.

The three mould portion supports 66, 68 and 70 are each mounted on a linear slideway so that operation
30 of the piston and cylinder assembly 18, 20 is arranged to pivot the levers 42, 56 and 58 about their pivots 64 to cause the mould portion supports 66, 68 and 70 to move along the slideways to bring the mould portions 12

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1 supported thereby into engagement with the mould portions
14. The central one 68 of the supports 66, 68 and 70
comprises a plate 96 (Figure 3). The plate 96 extends
above the other two supports 66 and 70 and has two
5 depending portions 98 at end portions thereof which are
each secured to a slide rail 100 which is slideable in
a groove 102 in the framework 23. The rails 100 and
the grooves 102 provide the slideway of the central
support 68. The slideway of the support 66 is provided
10 by one of the slide rails 100 which enters a groove 104
in the support 66 and by a slide rail 106 mounted on the
central support 68 which enters a groove 108 in the support
66. The slideway of the support 70 is provided in
identical manner to that of the support 66. Thus, the
15 central support 68 is mounted on a slideway, formed by
the rails 100 and the groove 102 and the slideways of the
other two supports 66 and 70 are formed on the central
support 68. This arrangement allows the supports 66, 68
and 70 to move relative to one another to equalise the
20 mould closing forces.

In addition to its connection to the system of
links 28, 34, 40, 46, 48 and 50, the crosshead 26 is
pivotally connected to a further link 110 on the right
hand side thereof (viewing Figures 1 and 2). The cross-
25 head 26 has a pivot pin 112 mounted thereon on which the
link 110 is pivoted. The link 110 is also pivotally
connected, by means of a pivot pin 114 to three further
levers 116. The three further levers 116 are each
connected at a lower end portion thereof to the link 110
30 and are mounted for pivotal movement about a central
portion thereof on a horizontal fixed pivot pin 118,
all three levers 116 being pivoted on the same pin 118,
the pin 118 is supported by the framework 23. At upper
end portions thereof, the three levers 116 are pivotally

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1 connected to a further mould portion support 120 which
is arranged to support the three mould portions 14.
The connection between each lever 116 and the support 120
is identical and identical to that between the levers 42,
5 56 and 58 and the supports 66, 68 and 70, each lever 116
being pivotally connected to a block 122 by means of a
pin 124 and the block 122 being pivotally connected to
the support 120. The support 120 is mounted in a linear
slideway (not shown) similar to that of the support 68
10 for movement towards or away from the support 66, 68 and
70. The support 120 carries three intermediate supports
123 which are identically arranged to the intermediate
supports 80 and carry the three mould portions 14. The
arrangement is such that operation of the piston and cylinder
15 assembly 18, 20 is effective to cause the three mould
portion supports 66, 68 and 70 and the further mould portion
support 120 to move simultaneously towards each other so
that the mould portions 12 and 14 supported thereby move
into engagement to form three moulds. The piston and
20 cylinder assembly 18, 20 thus forms moving means effective
to move the mould portions 12 and the mould portions 14
towards or away from each other. The mould opening and
closing mechanism is capable of rapid and accurate
operation and achieves substantially equal mould closing
25 pressures.

When the mould portions 12 and 14 engage one
another, they also engage the aforementioned bottom
mould portion 16. Each bottom mould portion 16 is
supported by a plate 128 which has apertures 129 in which
30 hollow bosses 130 are received. Each hollow boss 130
extends into the mould portion 16 and is a loose fit in
the aperture 129 so that the boss 130 and the mould portion
16 can move slightly relative to the plate 128 to accommodate
itself better to the mould portions 12 and 14. The interior.

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10.

1 of the boss 130 communicates with a vacuum pipe 132 so
that vacuum can be applied to the mould portion 16 if
desired. The central one of the pipes 132 is mounted
in a support 134 on which the plate 128 rests and extends
5 into a vertical bore in a portion 135 of the framework
23, with a seal 133 sealing the gap between the pipe 132
and the bore. The two end pipes 132, however, (see
Figure 4) are formed in vertical spindles 137 which are
clamped to the support 134 by screws 131 and are slideable
10 vertically in the portion 135. The spindles 137 carry
the support 134. The support 134, and hence the mould
portion 16, is vertically adjustable by vertical move-
ment of the spindles 137 between limits set by two stop
screws 139 which project upwardly from the portion 135.
15 Each of the spindles 137 has a screw-threaded lower portion
141 which is threadedly-received in a threaded bore 143
in a gear 145 mounted for rotation in a recess in the
support 135 so that, when the gears 145 are rotated, the
spindles 141 and hence the mould portions 16 are moved
20 vertically. A worm 147 meshes with both gears 145 so
that, when the worm 147 is turned by means of a fitment
149, the gears 145 and hence the spindles 141 are moved
together. The support 134 is thus vertically adjustable
by adjustment means to alter the height of the plate 128
25 to suit different sizes of mould.

When the mould portions 12 and 14 are at their
furthest distance apart i.e. in a mould open position
(as shown in Figure 1), electrical contact members 136
mounted on the mould portions 12 and 14 make electrical
30 contact with electrical contact members 138 mounted on the
framework 23 and urged by springs 140 towards the contact
members 136. Thus, when the moulds are fully open,
there is electrical contact between the contact members

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1 136 and 138. The contact members 136 are connected to
temperature sensing means in the form of a thermocouple
embedded in the mould portion 12 or 14 (the thermocouples
TC2 of the central mould portions 12 and 14 are shown in
Figure 1). In order to facilitate removal and replacement
5 of the mould portions 12 and 14, a crosshead 26 carries
two spring devices 148 (Figures 1 and 2). The devices
148 press on a plate 150 of the framework 23 when the
mould portions 12 and 14 are in the mould open
condition (Figure 1) so that, when air pressure is removed
10 from the cylinder 20 for mould portion removal, the
devices 148 move the crosshead 26 upwards and hence move
the mould portions 12 and 14 slightly towards one another
breaking the contact between the contact members 136 and
138. The thermocouples TC2 can be used to control the
15 temperature of the moulds formed by the portions 12, 14
and 16 by regulating the supply of cooling air thereto.

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12.

1 Claims:

1. A mould opening and closing mechanism for use in opening and closing three moulds simultaneously by moving a portion of each mould relative to further portions 5 of that mould, the mechanism comprising three mould portion supports (66, 68, 70) each arranged to support a portion of a mould (12), three levers (42, 56, 58) each of which is pivotal on a fixed pivot (64) and each of which is pivotally connected to one of the mould portion supports 10 (66, 68, 70), and moving means (18, 20) connected to the levers (42, 56, 58) and operable to cause the levers (42, 56, 58) to pivot about the fixed pivots (64) so that the mould portion supports (66, 68, 70) are moved and the mould portions (12) are moved away from or towards further 15 mould portions (14) thereby opening or closing the moulds, characterised in that the moving means (18, 20) is connected to the three levers (42, 56, 58) by a system of links comprising a link (34) pivotally connected at a central region thereof to the moving means (18, 20), 20 the link (34) being pivotally connected on one side of the central region thereof to a first (42) of the levers and also being pivotally connected on the other side of the central region thereof at half the effective distance therefrom to a further link (46) of the system, the 25 further link (46) being pivotally connected to a second (56) and a third (58) of the levers on opposite sides of and at equal effective distances from its pivotal connection to the link (34).

-30 2. A mould opening and closing mechanism according to claim 1, characterised in that the three mould portion supports (66, 68, 70) are mounted on linear slideways (100, 102, 104, 106, 108) extending towards and



13.

1 away from the further mould portions (14).

3. A mould opening and closing mechanism according to claim 2, characterised in that a central one (68) of the three mould portion supports is mounted on
5 a slideway (100, 102) and the slideways (104, 106, 108) of the other two supports (66, 70) are formed on the central support (68).

4. A mould opening and closing mechanism
10 according to any one of claims 1 to 3, characterised in that the moving means (18, 20) is also connected to three further levers (116) each of which is pivotal on a fixed pivot (118) and each of which is pivotally connected to a further mould portion support (120)
15 arranged to support one of said further mould portions (14) so that operation of the moving means (18, 20) is effective to move the mould portions (12) and the further mould portions (14) towards or away from each other.

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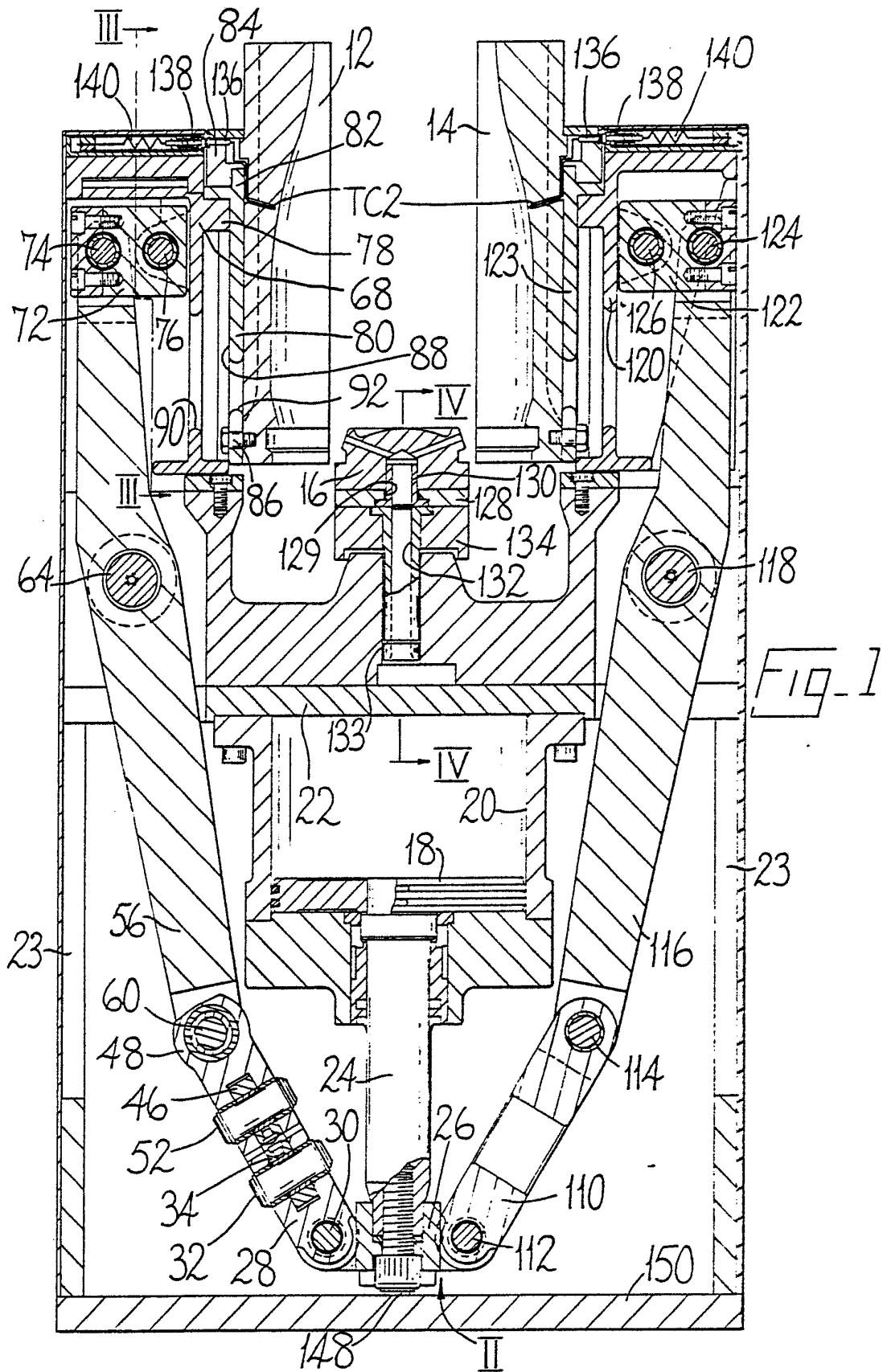
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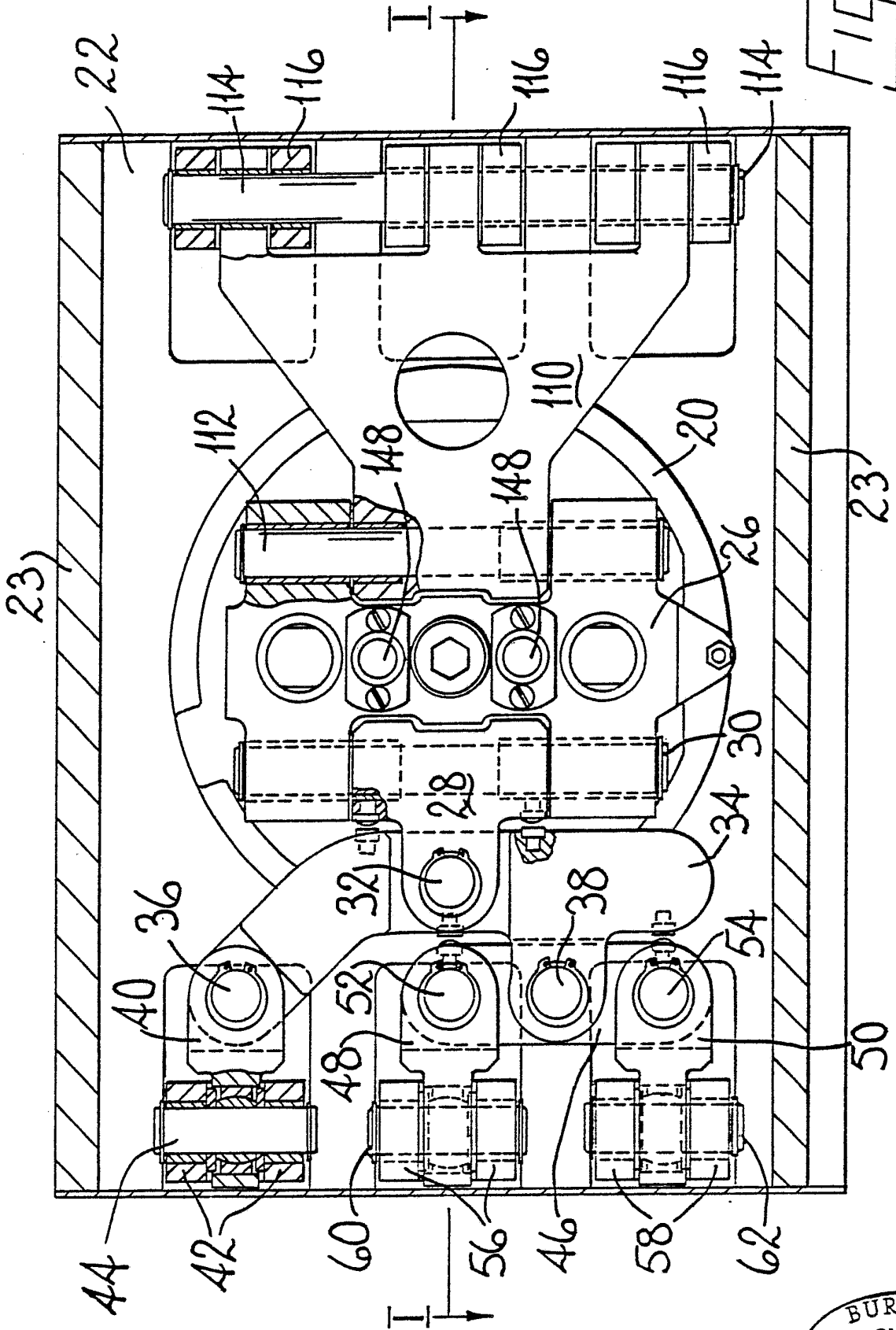


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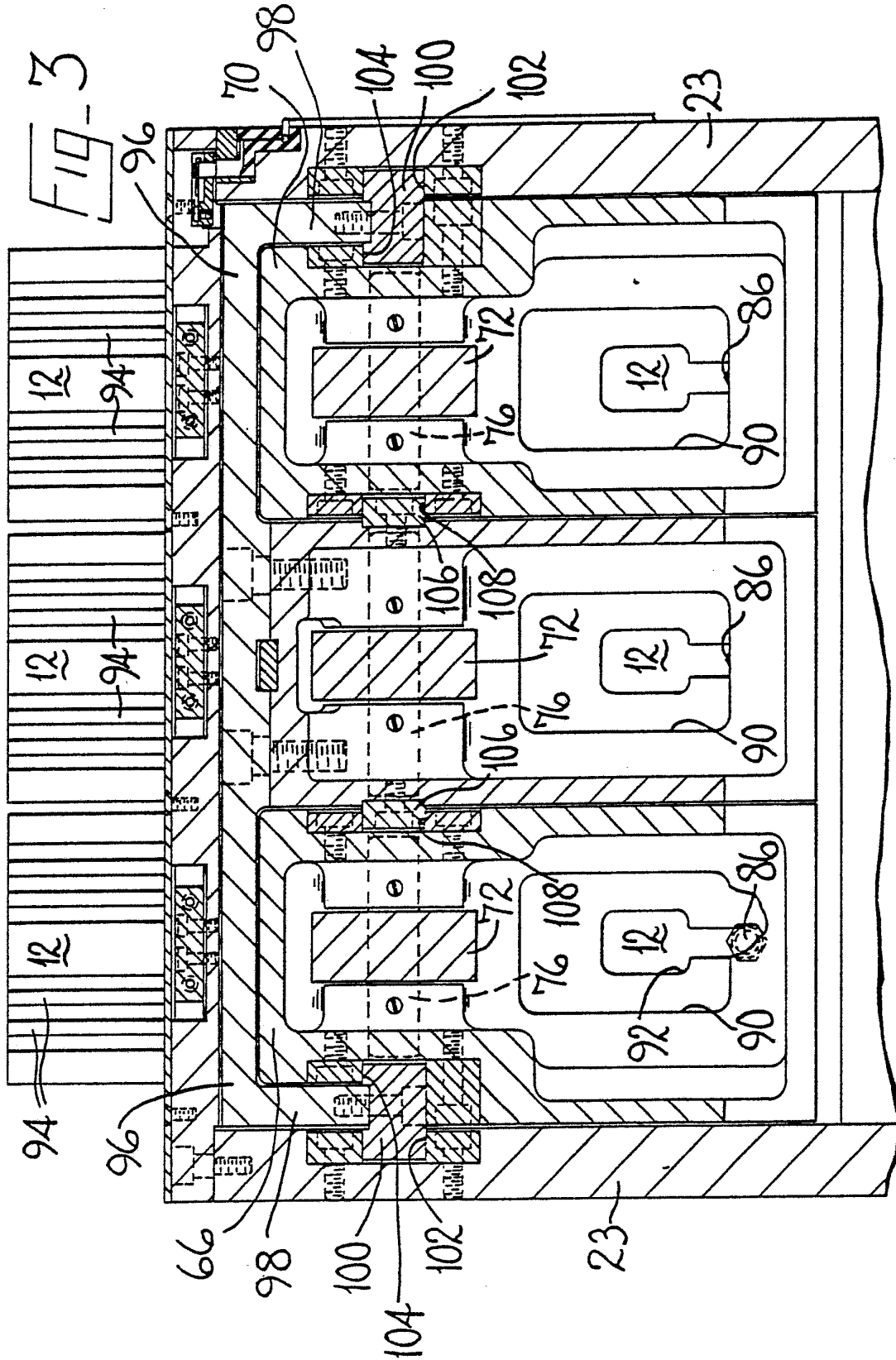


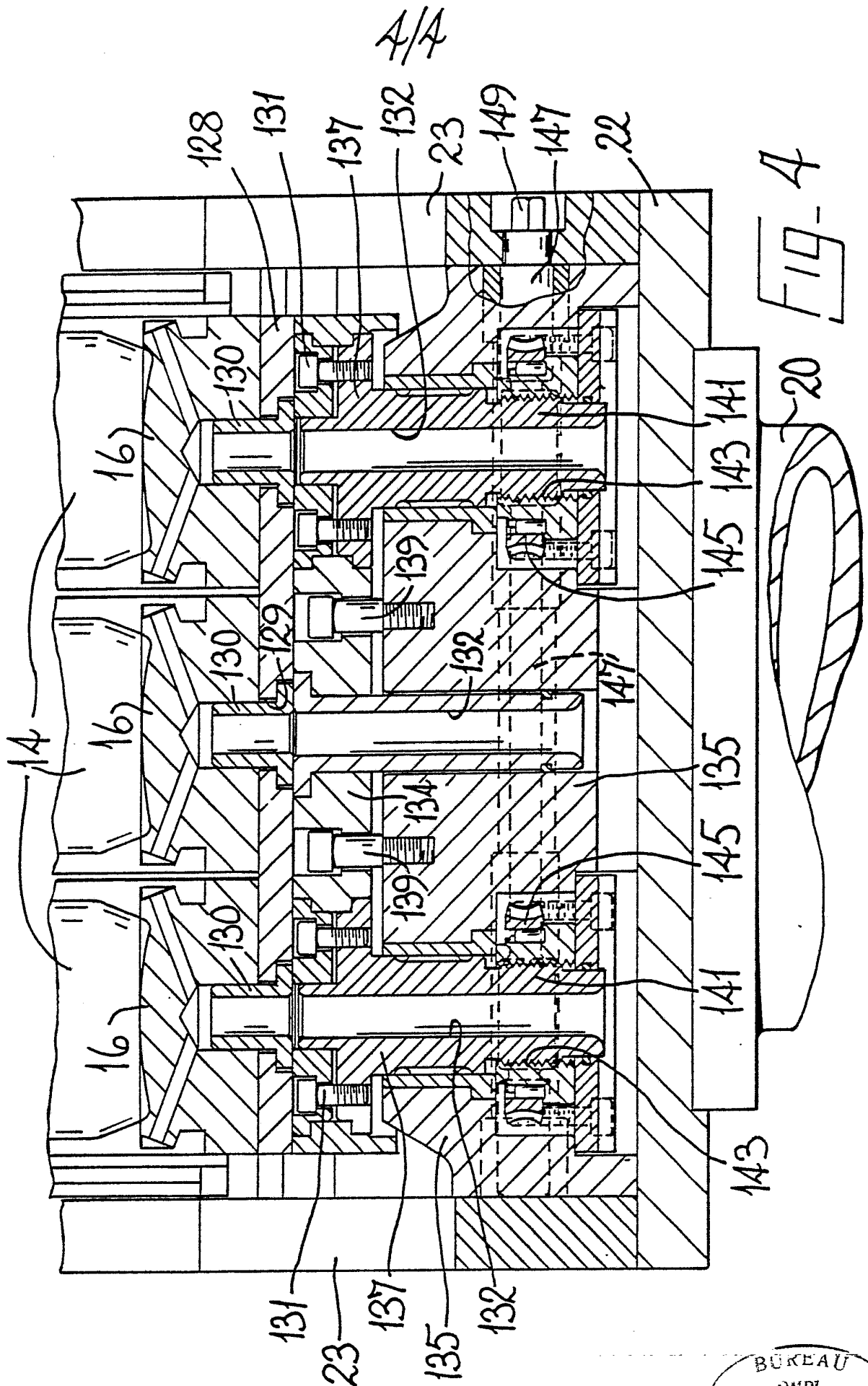
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FIG-2



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INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 82/00049

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ³		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC ³ : C 03 B 9/353; C 03 B 9/16; C 03 B 9/193		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁴		
Classification System	Classification Symbols	
IPC ³	C 03 B 9/00	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁵		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴		
Category *	Citation of Document, ¹⁶ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁸
X	US, A, 4009016 (FOSTER) 22 February 1977 see figures 4,5,7,8; columns 4-14	1-4
X	FR, A, 2383136 (OWENS-ILLINOIS) 6 October 1978 see figures 1-4; page 6, lines 23-39; pages 7-10 & US, A, 4137061	1-4
A	FR, A, 813789 (T. PEARSON) 8 June 1937 see figures 1,2; pages 2,3	1
A	US, A, 3721545 (IRWIN) 20 March 1973 see the complete specification	
<p>* Special categories of cited documents: ¹⁵</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"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</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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</p> <p>"&" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search ²	Date of Mailing of this International Search Report ²	
15th April 1982	28th April 1982	
International Searching Authority ¹	Signature of Authorized Officer ²⁰	
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