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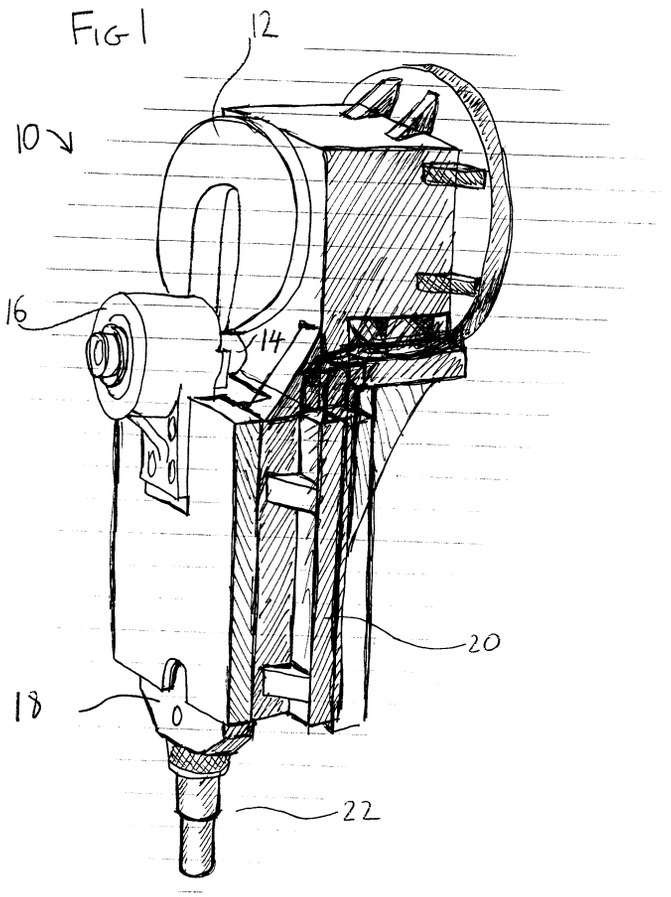
(54) Press with cam drive

(57) A press (10) for installing bush type fasteners into substrates such as apertured sheet material, comprising a cam follower (14) operable to drive a pressing device such as a tool (22) towards an operable pressing location, and a driven cam (12) having a cam surface for effecting movement of the cam follower (14) and a recess for receiving the cam follower (14) within the cam (12).

FIG 1



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Description

[0001] Invention relates to a press and in particular, but not exclusively, a press for installing bush type fasteners into substrates such as aperture sheet material for example for use in fastening components of an article along an assembly line.

[0002] It is known to provide hydraulic presses comprising an oil reservoir, pump and hydraulic ram as well as various control devices which effect control of the movement of a pressing tool carried by the ram in order to locate and/or install a fastener in a substrate at an operable pressing location on the pressing machine.

[0003] However, such hydraulic presses suffer from various drawbacks including the requirement for a large storage tank for hydraulic fluids such as oil, slow speed of operation due to the build up of pressure before releasing the hydraulic ram, excessive noise, a large stroke or length of travel of the tool which has inherent safety problems, and difficulties in repair and maintenance. Also, hydraulic presses suffer from the drawback that the pressing tool is virtually under its full maximum load throughout its entire stroke which again provides inherent safety problems.

[0004] The present invention seeks to provide a press which overcomes or at least mitigates one if not more of the above problems or other problems of the prior art. According to one aspect of the invention there is provided a press for installing bush type fasteners into substrates such as aperture sheet material, comprising a cam follower operable to drive a pressing device such as a tool towards an operable pressing location, and a driven cam having a cam surface for effecting movement of the cam follower and a recess for receiving the cam follower within the cam. The recess is preferably located between the leading and tailing edge of the cam surface and/or provides no camming action of its own.

[0005] Beneficially therefore the length or travel or stroke of the cam follower and hence tool under load from the driven cam is minimised to the eccentricity of the cam surface whilst the cam allows greater travel of the cam follower without exerting the load thereon by enabling the cam follower to be received in the recess.

[0006] Preferably means are provided for enabling gravity location of the pressing device at a position proximal the operable pressing location and/or tool position wherein the cam follower is substantially removed from the recess in the cam. Beneficially therefore the load on the tool is substantially equal to the weight of the tool and connected components such as cam follower which is considerably less than the load which might be exerted on the tool during a fastener installation operation which might be in the order of 4 to 8 tonnes for example.

[0007] Preferably, the gravity location means comprises co-operating components associated with the cam follower and cam respectively, such as slider and slider guide. Preferably the length of the recess is in the order of the diameter of the cam follower or greater. Preferably, the recess is in the order of 2 or more times the diameter of the cam follower.

[0008] Preferably the length of the recess is sufficient to enable alignment of the axis of rotation of the cam follower and the axis of rotation of the driven cam beneficially therefore to provide that if the cam is driven when the cam follower is in this stowed position, it does not effect movement of the cam follower and hence does not effect movement of the tool.

[0009] Preferably, the eccentricity of the cam surface is less than 5 millimetres and more preferably in the order of less than 2 millimetres. Beneficially therefore the stroke of the tool under operable load is less than the thickness of a finger. Preferably the cam is a rising cam with maximum eccentricity achieved at greater than 180° of rotation and preferably at about 270° of rotation.

[0010] Preferably a position sensor is provided in operable communication with a controller thereby to ensure that the cam follower is substantially removed from the recess before actuation of the driven cam can commence. Preferably two position sensors are provided and the controller conducts a logic test to ensure that both sensors detect substantial removal of the cam follower from the recess within a predetermined time period before actuation of the driven cam plate can take place. Preferably the sensors are located adjacent to one another and/or preferably at substantially the same axial position with respect to the axis of travel of the cam follower. Preferably the pre-determined time is less than half a second and more preferably in the order of 100 milliseconds or less. In a preferred form, the pre-determined time is in the order of 50 milliseconds.

[0011] Preferably the controller is programmed with a logic sequence such that actuation of the driven cam only occurs if sensors 1 and 2 detect movement of the cam follower substantially out of the recess within a predetermined time of one another thereby to effect a switch such as a change of state of a monostable device, and power to the driven cam only continues as long both sensors are closed and the switch or monostable is in its activated state. Preferably, as soon as one of the sensors opens power to the driven cam is removed and the switch or monostable is reset.

[0012] Preferably means are provided to enable alignment of the cam recess in a desired position such as vertical thereby to enable gravity feed of the cam follower and pressing tool to a lower, operable position. Preferably the location means comprises a lobed annulus fixedly attached to the drive shaft to the cam, and a sensor for detecting the position of the lobe about the circumference of the annulus. The sensor can be an induction sensor for example and the lobe can be metallic radial protrusion from the annulus. Preferably two lobes are provided substantially adjacent to one another and separated by a recess. Preferably, the recess is relatively narrow and/or the annulus is located on the shaft so as to indicate the top dead centre position of the cam, or other preferred location for the removal of the cam

follower from the recess, when the sensor detects the recess between the lobes. Preferably the recess is in the order 10° of the circumference wide. Preferably the lobe or lobes is/are in the order of 25 degrees of the circumference in width.

[0013] Preferably means is provided to reposition the cam follower in the recess. The means can be a ram such as a pneumatic ram.

[0014] Another aspect of the invention provides a fastener installing machine comprising one or more of the features of the press discussed above.

[0015] Another aspect of the invention provides a cam having a recess for receiving a cam follower.

[0016] An embodiment of the invention will now be described, by way of example only, with the reference to the accompanying drawings, in which:

Figure 1 is a schematic perspective view of part of the press according to the invention;

Figures 2 and 3 are side and front elevation views respectively of the press shown in Figure 1 in a stowed position;

Figures 4 and 5 are side and front elevation views respectively of the press shown in Fig 1 when the cam follower is in a lowered operable position;

Figures 6 and 7 are front and side elevation views of the driven cam;

Figures 8, 9 and 10 are schematic front elevation views of the relative positions of the cam follower and cam at different stages in the operation of the press;

Figures 11 and 12 schematic front and side elevation views respectively of a location mechanism forming part of the press according to the invention; and

Figure 13 is a schematic block diagram of components forming part of the press according to the invention.

[0017] Referring to Figures 1 to 5 there is shown a press 10 according to the invention comprising a driven cam 12 and a cam follower 14. Cam follower 14 is rotatably journalled in a bearing 16 which is attached to slider plate or plunger 18. Slider plate 18 is received in a recess or guide forming part of a slider housing 20 which forms part of the main body of the press 10.

[0018] Slider plate 18 comprises means for attaching press tool thereto, and referring generally to Figure 1 it can be seen that the press 10 operates to enable sliding motion of tool 22 up and down (in the orientation shown) when cam 12 rotates to effect vertical movement of follower 14 and hence tool 22 thereby to effect pressing action on a fasteners (not shown) at an operable pressing location (also not shown) of the press 10.

[0019] Referring to Figures 2 to 5, it can be seen that in more detail press 10 comprises driven cam 12 which is attached to a drive shaft 30 which in turn is driven by a motor. Shaft 30 is journalled in a housing 32 which is connected to guide housing 20 thereby forming the main body of press 10 fixedly attached to the shaft 30 is a lobed annulus 34 above which is positioned a sensor 36. Referring to Figure 11 and 12 it can be seen that lobed annulus 34 comprises a pair of lobes 35 and 37 separated by a recess 38. In a preferred form, the circumferential length of lobes 35 and 37 in the order of 25 degrees and the length of recess 38 is in the order of 10 degrees. Accordingly, circumferential length between the leading and trailing edges of lobes 35 and 37 is in the order of 300 degrees.

[0020] Referring again to Figures 1 to 5, it can be seen that press 10 further comprises position sensors 24 and 26 for detecting a shoulder 48 forming part of bearing 16. The positional sensors 24 and 26 can for example be optical or inductive sensors. In a preferred form, the sensors are positioned at substantially the same axial position with respect to the axis of movement of follower 14 along its vertical path. A ram 46 such as a pneumatic ram is provided which is attached at one end to the body and at the other end to bearing 16. Ram 46 effects lifting of bearing 16 and cam follower 14 after a stroke. There is further provided a chuck or other receiving device 44 connected to slider plate 18, for receiving a tool 22.

[0021] Referring to Figures 6 and 7, it can be seen that cam 12 comprises a channelled recess 50 having a width slightly greater than the diameter of cam follower 14 and a length of approximately twice the diameter of cam follower 14 but wherein the curved end of the recess 50 is approximately the radius of cam follower 14 beyond the centre of rotation at bore 52. Further bores 54 are provided for locating the cam onto the end of drive shaft 30, for example using threaded bolts. Cam 12 further comprises a cam surface 56 which extends from the radiused ends of channel 50 through approximately 300 degrees of the circumference of cam 12. Preferably, the cam surface is provided on the periphery of cam 12. The eccentricity of the cam surface 56 is preferably rising in an anti-clockwise direction. Preferably the maximum extent, or most eccentric region, of cam surface 56 is substantially at 90 degrees to axis A (or 270° to the start position). The cam surface 56 can go through a local minimum at the upper edge along axis A shown in Figure 6.

[0022] Referring now to Figure 13, the schematic diagram shows a controller 60 at the heart of the control system for operating the press. Controller 60 can be a mini controller, microprocessor or other programmable device. User controls are provided such as an on button 62, reset button 64, manual button 66, automatic button 68, and actuator button 70. Also shown is a motor 72 for driving cam 12 via shaft 30 on instructions from control-

ler 60. Preferably, motor 72 is a three phase motor which can be driven using a three phase inverter taking supply from single phase mains electricity for example. The use of such a three phase motor enables controller 60 to control the speed, acceleration and deceleration, direction and stopping point of the motor and hence cam 12. Controller 60 is further operably in communication with sensor 30 for determining the orientation of cam 12 and with position sensors 24 and 26 for determining the location of cam follower 14. Controller 60 further operably activates a valve 74 allowing actuation of pneumatic ram 46 from a pressurised gas supply 76.

[0023] Figures 8, 9 and 10 show the relative orientation of cam 12 and follower 14 throughout the operation of the press as now described.

[0024] In its rest or stowed position, cam follower 14 is located substantially in axial alignment with drive shaft 30 and is held in position through the action of pneumatic ram 46. The position of cam 12 shown in Figures 2 and 3 is the top dead centre position and is determined by controller 60 using sensor 36 which locates recess 38 between lobes 35 and 37. When turned on through actuation of buttons 62 and in manual mode through actuation of button 66, compression of actuation button 70 closes valve 74 and pneumatic ram 46 acts as a simple pneumatic damper allowing cam following 14 to move downwardly out of recess 50 in cam 12 under the weight of the cam follower 14, bearing 16, slider plate 18 and tool 22 for example.

[0025] Controller 60 interrogates sensors 24 and 26 to determine if they detect shoulder 48 of bearing 16 as it falls downwardly. If sensors 24 and 26 detect the shoulder within a predetermined time limit, such as less than 0.1 of a second and the sensors remain closed (or otherwise indicate the presence of shoulder 48 in a lowered position) then controller 62 actuates motor 72 effecting rotation of cam 12 in either a clockwise direction. Accordingly, by setting the length of tool 22 and other components accordingly, it is possible for tool 22 to be proximal the fastener as cam surface 56 engages cam follower 14 when the cam 12 begins to rotate. Of course, in the embodiment shown where the cam rises anti-clockwise, the cam is driven clockwise but of course the opposite orientation of the cam is possible and hence it is also possible to drive the cam in an anti-clockwise direction. Indeed, beneficially both directions of movement of the motor are possible to enable re-setting of the system. Preferably also, in a manual mode it is possible for an operator manually to move the cam forward and backwards (anti-clockwise or clockwise) for ease of setting.

[0026] Movement of cam 12 through 360 degrees effects a vertical movement of cam follower 14 and hence tool 22 through the extent of eccentricity of the cam. When or just before the top dead centre position is again detected by sensor 36 and controller 60, power is removed from shaft 30 by de-activating motor 72 and valve 74, having been opened at any stage after engagement of follower 14 with cam surface 56 during the rotation of the cam, effects movement of cam follower 14 back into recess 50 thereby clearing tool 22 away from the operable pressing location of the press. Preferably, controller 60 reduces the power of motor 72 at the beginning and end of the rotation of cam 12. This can be achieved by causing shaft 30 to rotate at a slower speed when sensor 36 detects either of lobes 36 or 37.

[0027] When operated in this manual mode, the operator positions the substrate and fastener beneath the tool and then presses the actuation button 70 to recommence the release of follower 14 from recess 50 and so on. If an automatic fastener feeding mechanism is used the automatic mode button 68 can actuated and the operation controlled by controller 60 having means for ensuring the fastener is located beneath the tool before commencing the pressing cycle. Of course this mode can be run without an automatic feeder also.

Claims

1. A press for installing bush type fasteners into substrates such as apertured sheet material, comprising a cam follower operable to drive a pressing device such as a tool towards an operable pressing location, and a driven cam having a cam surface for effecting movement of the cam follower and a recess for receiving the cam follower within the cam.

2. A press according to Claim 1 wherein the recess is located between the leading and trailing edge of the cam surface, and preferably wherein the recess does not provide a camming action of its own.

3. A press according to Claim 1 or 2 wherein the stroke of the cam follower is approximately the extent of eccentricity of the cam surface.

4. A tool according to any of Claims 1 to 3 comprising means for enabling location of the pressing device due to gravity at a position proximal one of the operable pressing location and the tool position wherein the cam follower is substantially removed from the recess in the cam, and preferably the load on the tool is substantially equal to the weight of the tool and connected components such as cam follower prior to a fastener installation operation, and/or wherein the gravity location means comprises co-operating components associated with the cam follower and cam respectively, and/or wherein the gravity location means comprises a slider and slider guide.

5. A tool according to any preceding claim wherein the length of the recess is in the order of the diameter of the cam follower.

6. A tool according to any of Claims 1 to 4 wherein the length of recess is greater than the diameter of the cam follower, and preferably the length of the recess is in the order of two or more times the diameter of the cam follower.

7. A tool according to any preceding claim wherein the length of the recess is sufficient to enable a stowed position in which substantial alignment of the axis of rotation of the cam follower and the axis of rotation of the driven cam is provided such that when the cam is driven and the cam follower is in the stowed position, the cam does not effect movement of the cam follower sufficient to effect movement of the tool.

8. A tool according to any preceding claim wherein the eccentricity of the cam surface is less than 5 millimetres, and preferably the eccentricity of the cam surface is in the order of less than 2 millimetres.

9. A tool according to any preceding claim wherein the cam is a rising cam with maximum eccentricity achieved at greater than 180° of rotation, and preferably wherein maximum eccentricity is achieved at about 270° of rotation.

10. A tool according to any preceding claim comprising a position sensor operably in communication with a controller operable to ensure that the cam follower is substantially removed from the recess before actuation of the driven cam can commence, and preferably comprising two position sensors and the controller conducts a logic test to ensure that both sensors detect substantial removal of the cam follower from the recess within a predetermined time period before actuation of the driven cam plate can take place, and/or more preferably wherein the sensors are located adjacent to one another, and/or preferably still wherein the sensors are located at substantially the same axial position with respect to the axis of travel of the cam follower.

11. A tool according to Claim 10 wherein the pre-determined time is less than half a second, and preferably wherein the predetermined time is in the order of 100 milliseconds or less, and more preferably wherein the predetermined time is in the order of 50 milliseconds.

12. A tool according to Claim 10 or 11 wherein the controller is programmed with a logic sequence such that actuation of the driven cam only occurs if the first and second sensors detect movement of the cam follower substantially out of the recess within a pre-determined time of one another thereby to effect a switch such as a change of state of a monostable device, and power to the driven cam only continues as long as both sensors are closed and the switch or monostable is in its activated state, and preferably wherein as soon as one of the sensors opens, power to the driven cam is removed and the switch or monostable is reset.

13. A tool according to any preceding claim comprising means to enable alignment of the cam recess in a desired position, such as inverted vertical, thereby to enable gravity feed of the cam follower and pressing tool to a lower, operable position, and preferably the alignment means comprises a lobed annulus fixedly attached to the drive shaft to the cam, and a sensor for detecting the position of the lobe about the circumference of the annulus, and/or preferably the sensor comprises an induction sensor and the lobe comprises a metallic radial protrusion from the annulus.

14. A tool according to Claim 13 wherein two lobes are provided substantially adjacent to one another and separated by a recess, and preferably the recess is relatively narrow, and/or preferably the recess is in the order 10° of the circumference wide.

15. A tool according to Claim 14 wherein the annulus is located on the shaft so as to indicate the top dead centre position of the cam, or other preferred location for the removal of the cam follower from the recess, when the sensor detects the recess between the lobes.

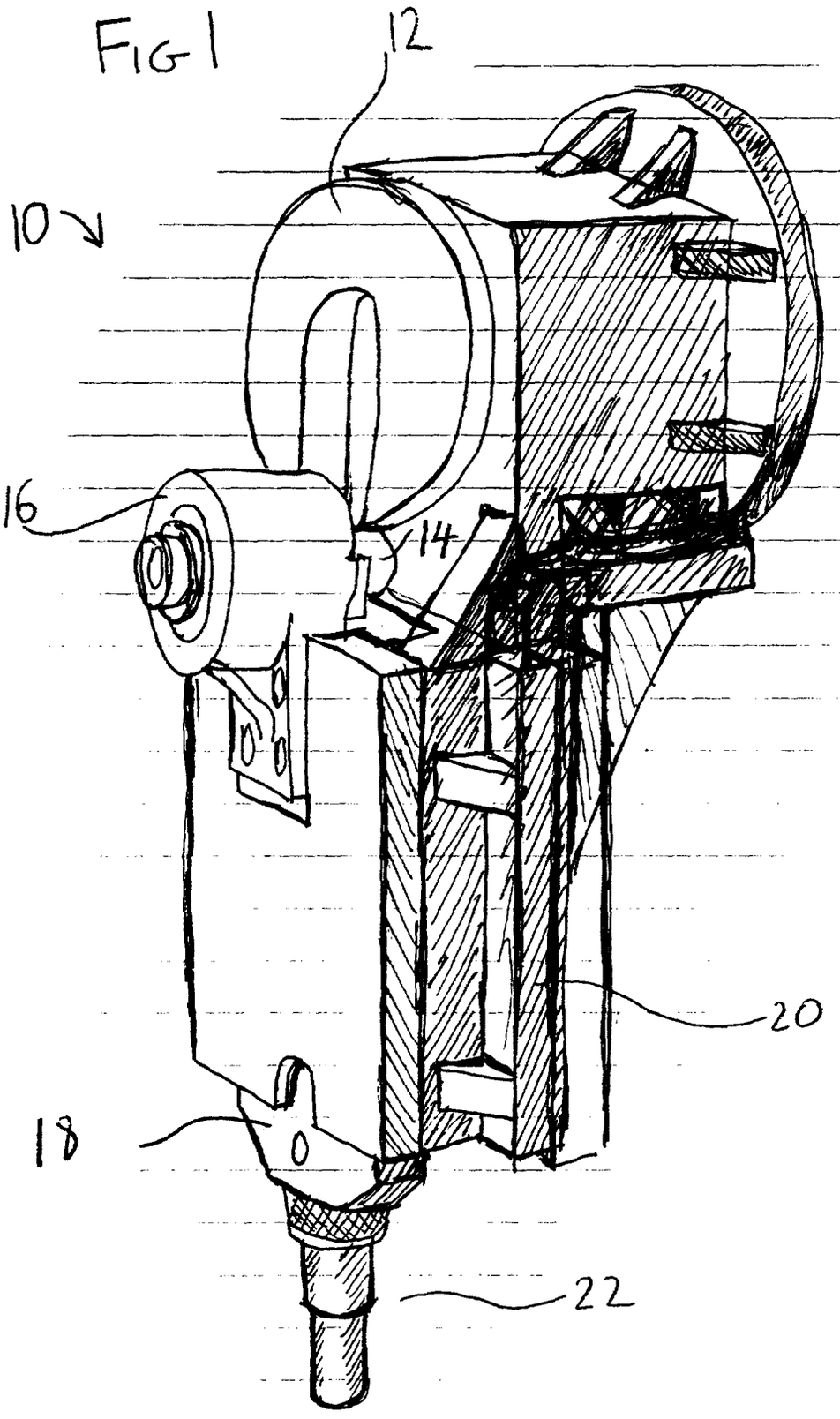
16. A tool according to any of Claims 13, 14 or 15 wherein the lobe or lobes is/are in the order of 25 degrees of the circumference in width.

17. A tool according to any preceding claim comprising means provided to position the cam follower in the recess like a ram such as a pneumatic ram.

18. A fastener installing machine comprising a tool according to any preceding claim.

19. A cam having a recess for receiving a cam follower.

FIG 1



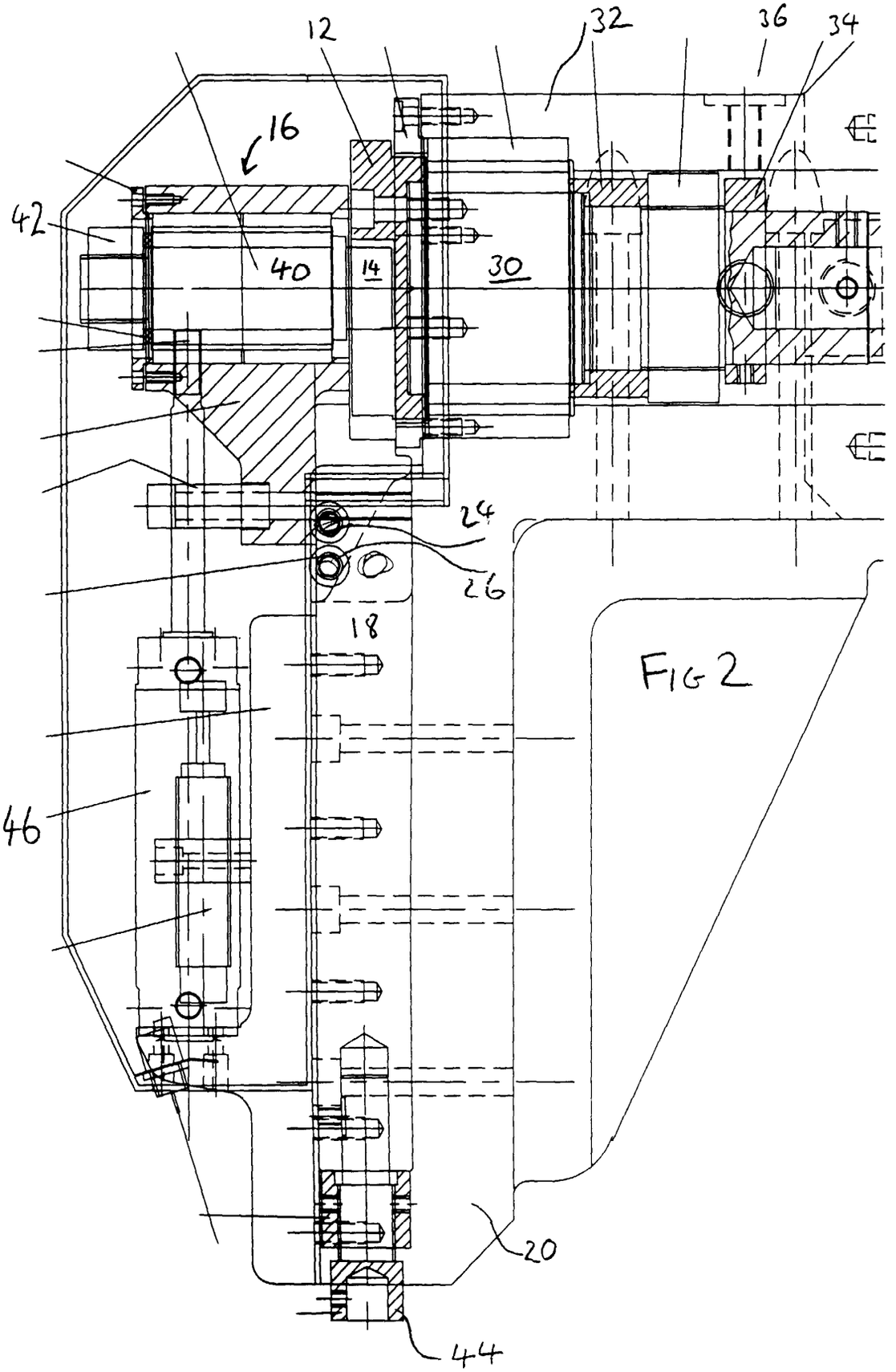


FIG 2

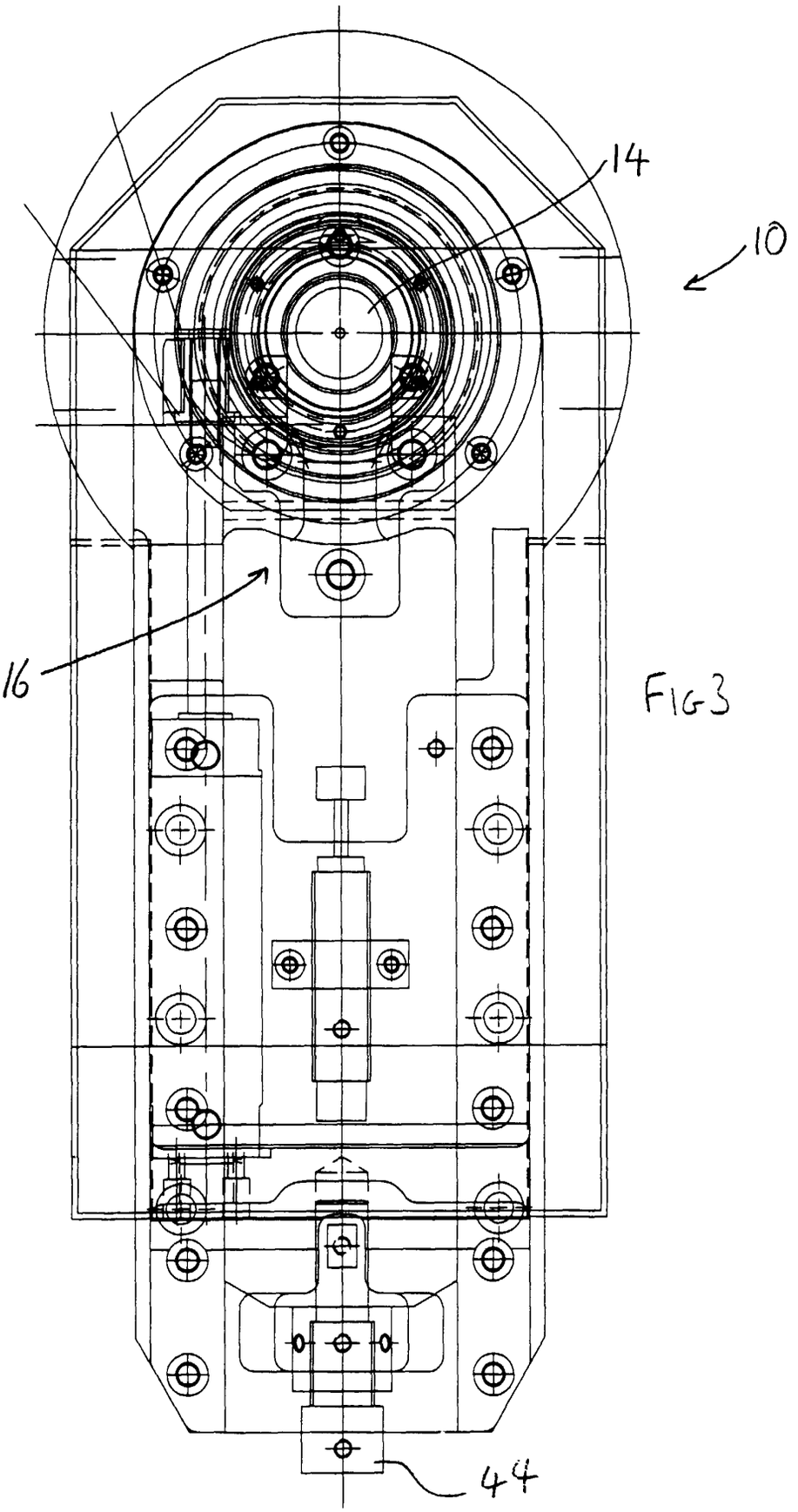


FIG 3

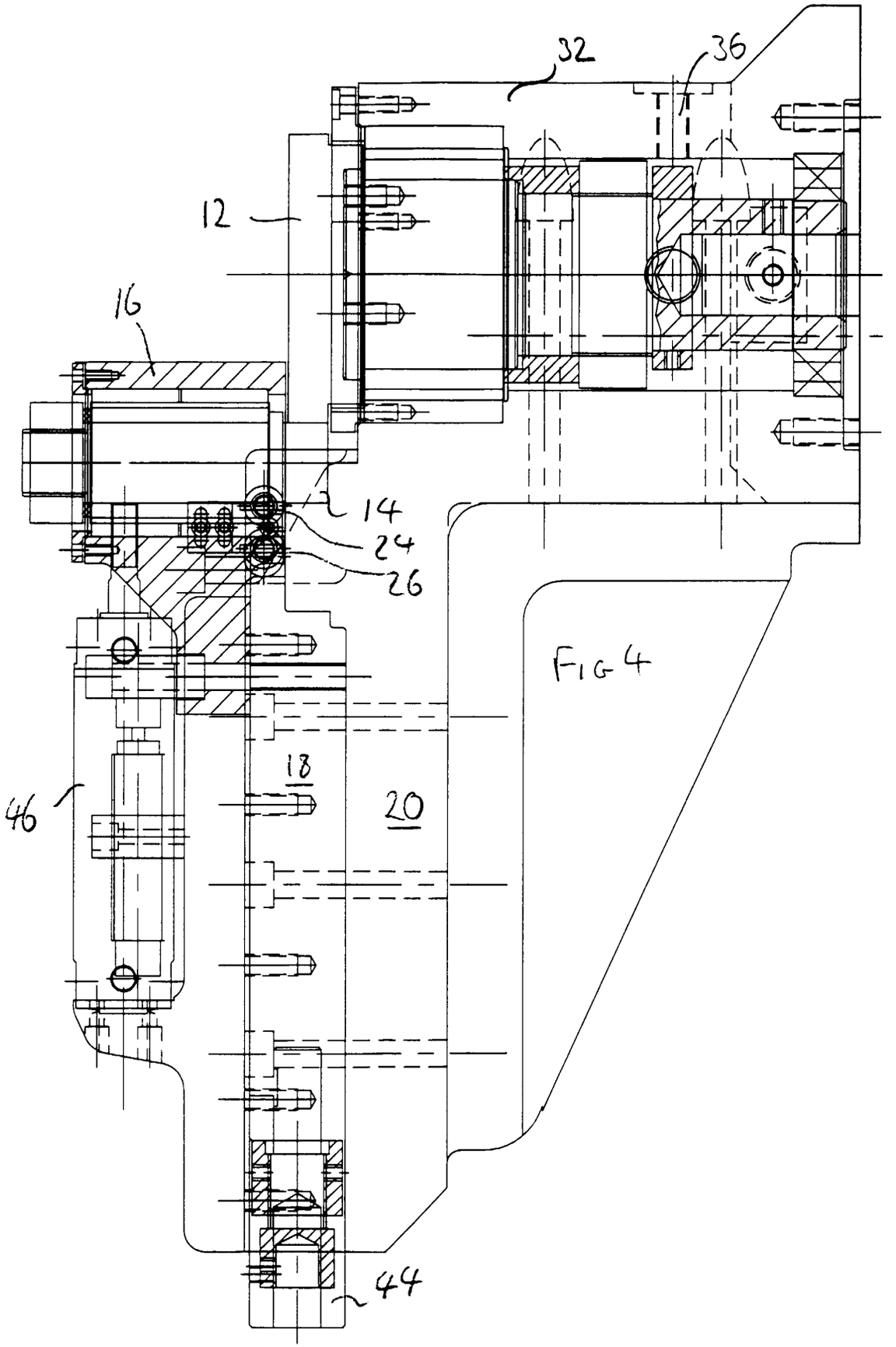


FIG 4

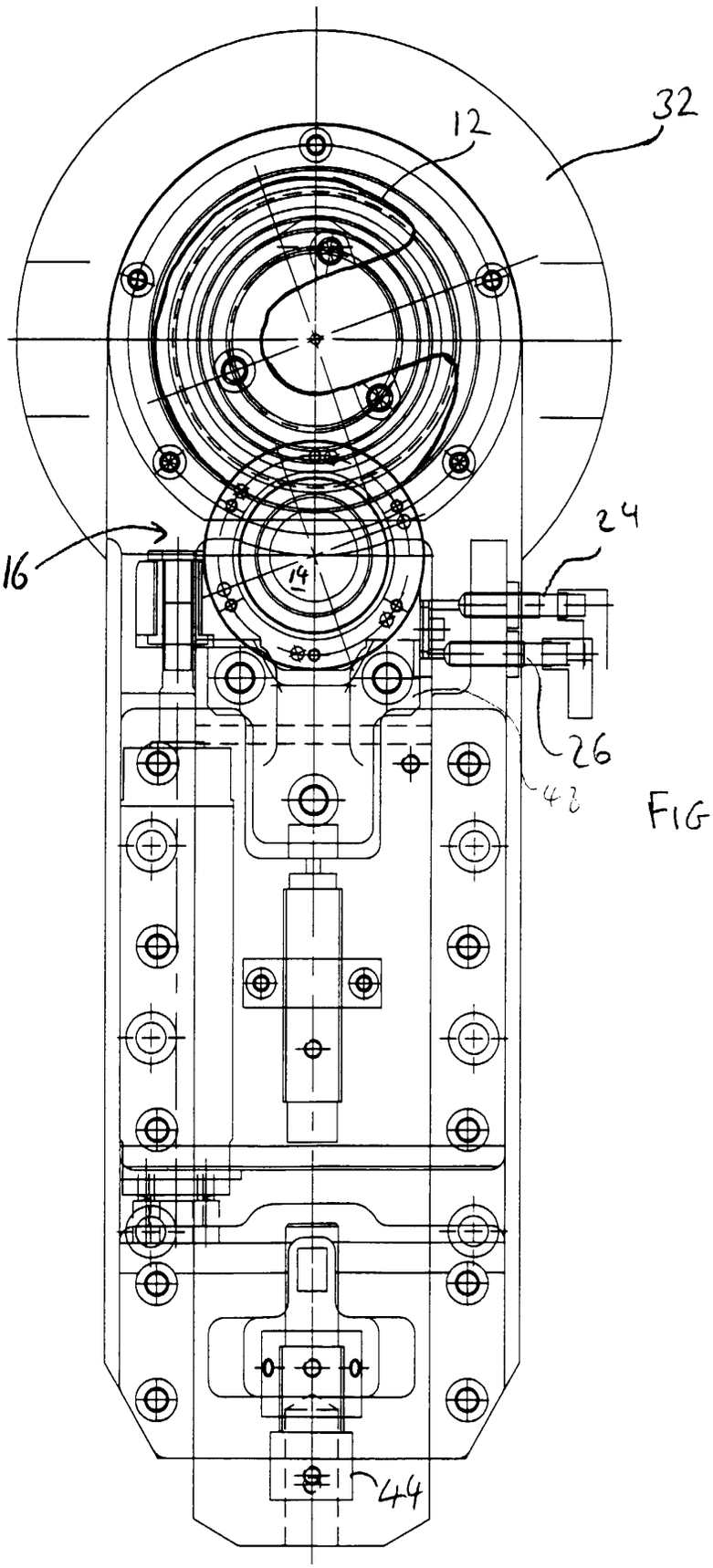


FIG 5

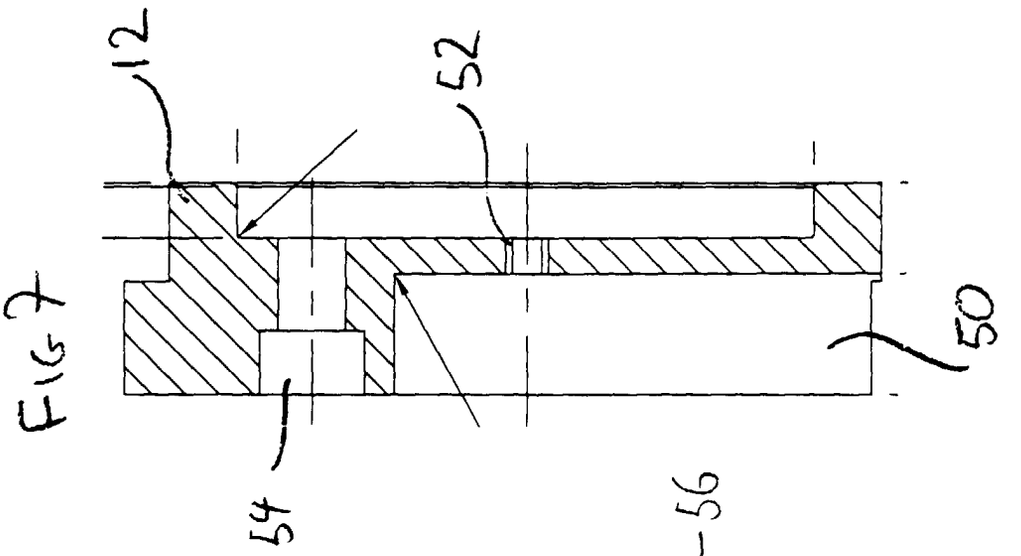


FIG 7

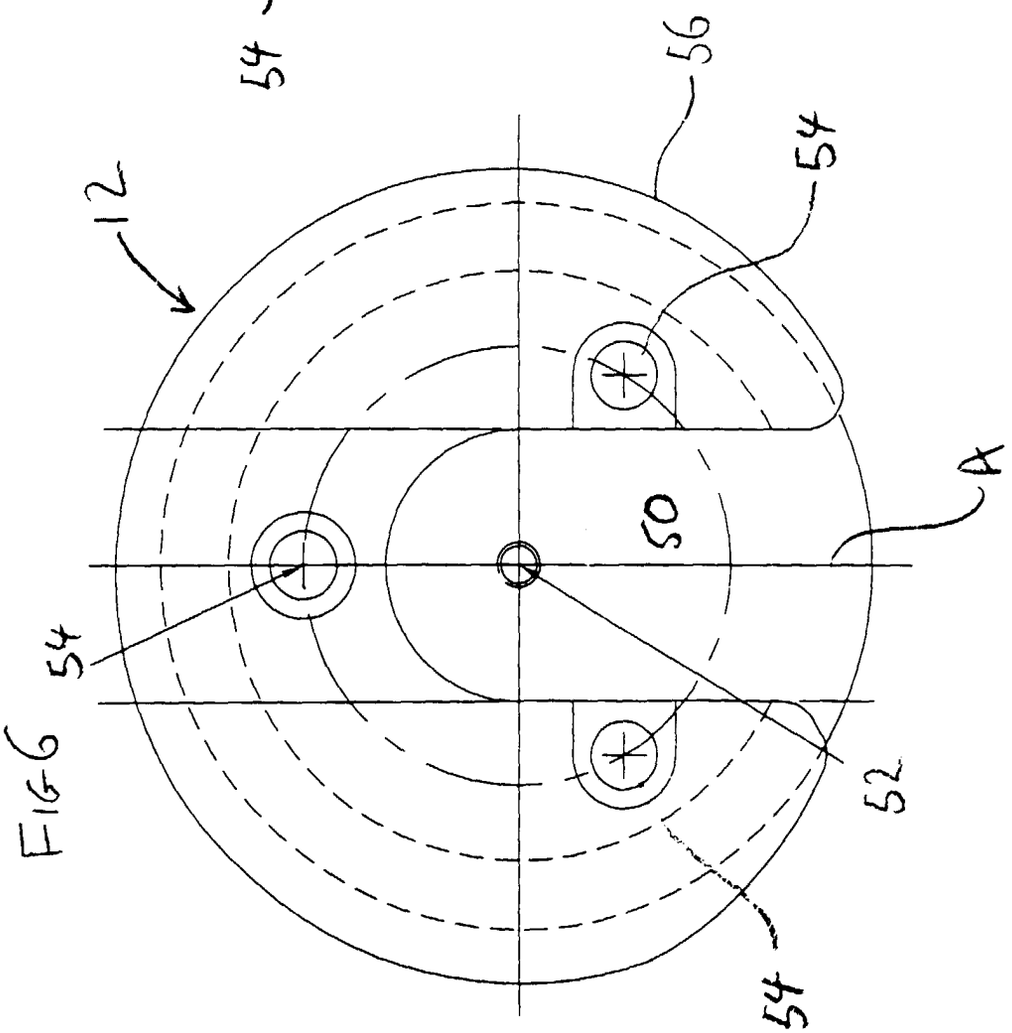


FIG 6

FIG 10

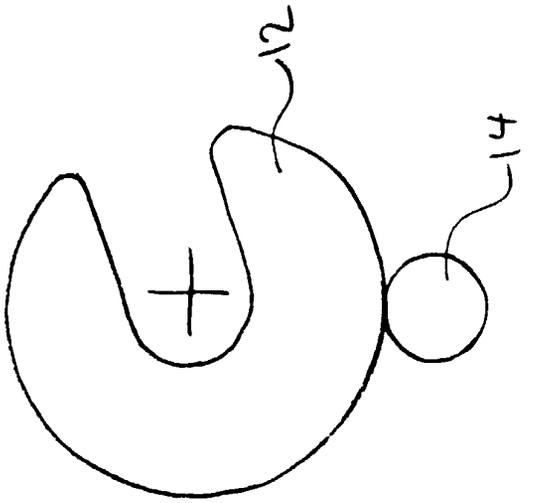


FIG 9

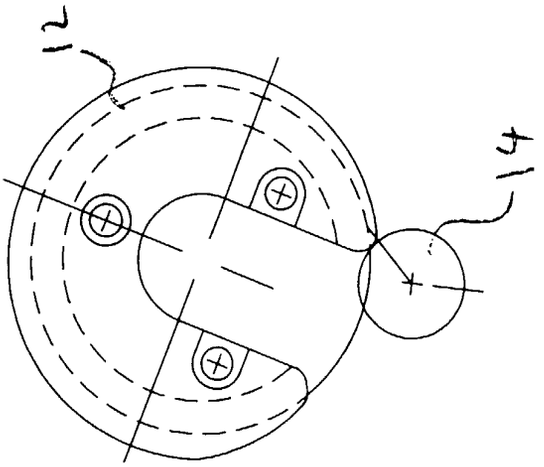
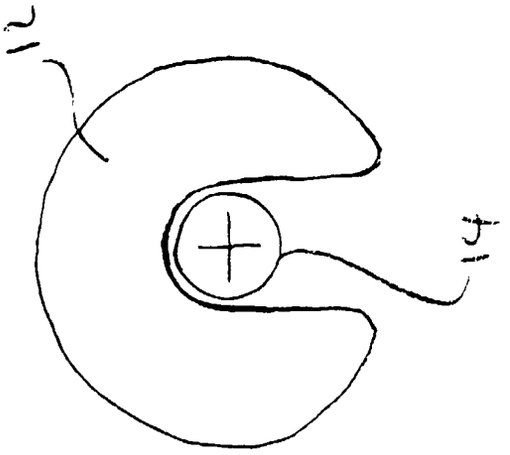


FIG 8



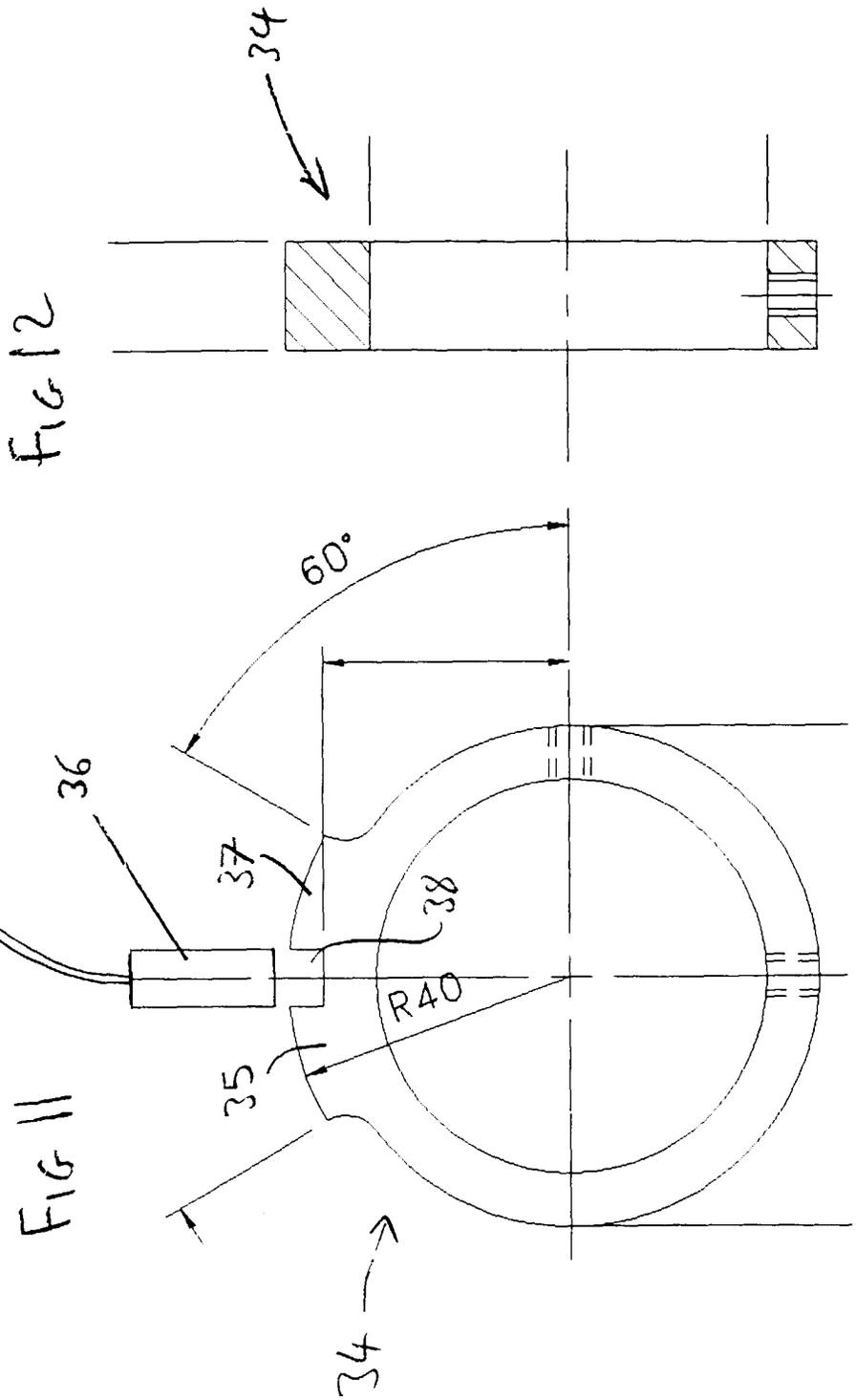


FIG 12

FIG 11

FIG 13