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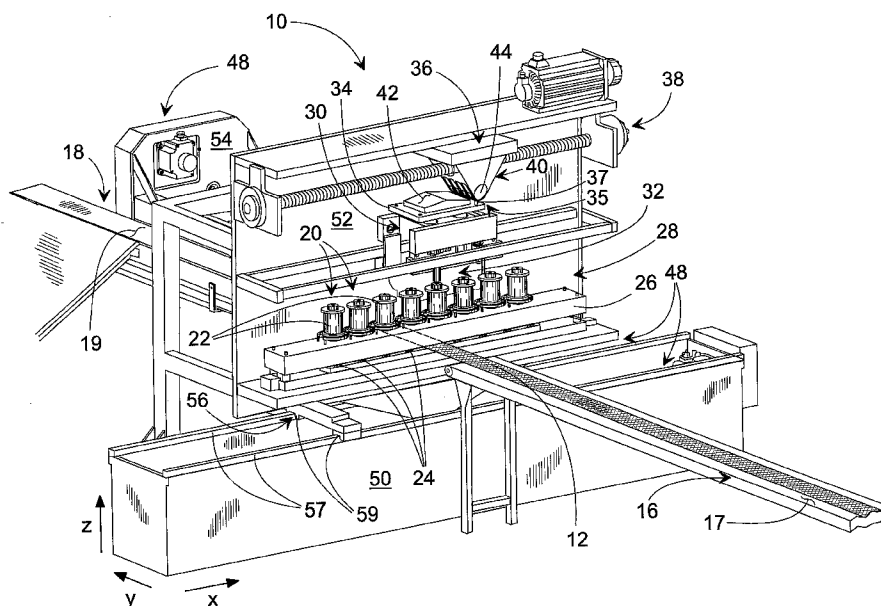
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(54) **Title:** PUNCH PRESS



(57) **Abstract:** The invention relates to a punch press (10), in which compressive machining is performed on a blank. The punch press (10) includes tools (20), a ram (30), a drive element (36) of the ram (30), and a precise-positioning operating device (38) for moving the drive element (36) of the ram (30), as well as a precise-positioning moving element (40) for moving the ram (30) in the direction of the tool row to the location of the desired toll (20). According to the invention the said moving element (40) of the ram (30) is arranged to operate using the same said moving operating device (38) of the ram (30).

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PUNCH PRESS

The present invention relates to a punch press, in which compressive machining is performed on a blank, which punch press
5 is of a type according to the preamble to Claim 1,

Very many types of punch presses, for example sheet-material machining centres, are known while patent publication FI 68545 discloses a basic method for determining and moving the positions of a blank and a machining head. Patents US 5199293 and
10 US 5092151 disclose a mechanism, in which a force is directed to a ram moving a tool, through a control head of the ram using two or more sloping surfaces. When the sloping surfaces move relative to each other, the movement produced by the drive
15 element of the operating device of the ram is directed as desired to the blank being machined. In patent FI 108924 is a ram drive head and control element with a construction as a roller-sloping-surface pair. In the constructions described above, a rotating revolver type of tool holder is generally
20 used, even though a linear tool holder would be more economical in terms of manufacturing costs. Publications US 2458160 and DE 3339340 disclose sheet-material machining centres.

The invention is intended to create a punch press that can be
25 manufactured more economically than before, in which a linear tool holder is used. The characteristic features of the punch press according to the present invention are stated in the accompanying Claim 1. If the same precise positioning operating device is used to position the ram relative to the tools and to
30 drive the tools by means of the ram, a considerably cheaper implementation of a punch press will be achieved. The term driving the tools by means of the ram refers to creating the necessary compressive movement.

35 In a punch press, compressive machining directed to a blank is performed. The blank can be, for example, of plate, profiled,

or sheet material. The punch press includes a blank-feeding line and exit line, which can be implemented in many different ways. The lines can be based on rollers, which are on a plane, permitting the blanks to move along the feed lines in the punch
5 press. The lines can also be of a robot type, in which case a robot places the blank for machining. The same or another robot removes the machined blank after machining. Such lines are widely known in the art, making it unnecessary to describe them in greater detail in this connection.

10

The punch press also includes tools. The blanks are machined by means of several different types of tool, by means of which the desired holes and impressions are created in the blanks. The tools comprise a plunger and a stop, by means of the joint
15 action of which the desired machining result is obtained. In the present application, the plunger is used as a synonym for the word punch and stop is used as a synonym for the word die. However the essential feature is the corresponding operation achieved using these. The tools are placed in a tool holder, so
20 that a series of tools is formed. The tools can include tools for very many different types of operation, such as piercing, forming, edging, chasing, or bending. The blanks are fed between the plunger and the stop, where they are machined. The plane, on which the machining takes place, is referred to as
25 the work plane. The machining of the blanks takes place in practice by pressing the plunger part of the tool towards the stop, thus shaping the blank between them.

The plunger is moved using a ram. The ram has at least two
30 operating positions, which are the rest position and the work position. In the rest position, the ram does not touch the plunger. In the work position, the ram is in contact with the plunger. The ram has two ends, the first of which is in contact with the plunger in the work position. The other end of the ram
35 is the drive head, from which force is directed on the ram to perform the machining event of the plunger.

The movement of the ram and indirectly of the plunger is performed using the drive element of the ram. The drive element moves perpendicularly to the direction of movement of the ram. By means of this drive element, the force necessary to operate
5 the ram is directed to the drive head of the ram.

The drive element of the ram is moved by an operating device. The operating device can be, for example, a servo motor. The positioning of the drive element of the ram should be very
10 precise, so that the desired movement is transmitted by the ram to the plunger, so that the plunger will perform the desired movement relative to the blank. For this reason, the positioning should be precise. The drive element of the ram and the drive head of the ram can be implemented in many ways. They can
15 be, for example, bevelled surfaces, which are coated with some substance with a low sliding friction, such as Teflon. The drive element and the drive head can also be a pair formed by a nose roller and a ridged stop. The nose roller can be either the drive element or the drive head, and correspondingly the
20 ridged stop can be either the drive element or the drive head.

The selection of the correct tool from the tools is based on moving the ram to the location of the desired tool. Thus, a moving element that can be precisely positioned is required to
25 move the ram in the direction of the tool row. The moving element is driven by an operating device, which can be, for example, a servomotor. The motion of this too should be precise. The term precise referred to in the two connections above means that positioning should be possible with an accuracy of
30 0.01 - 0.5 mm, preferably 0.15 - 0.2 mm. Operating devices capable of such precise positioning are expensive, so that they form a significant part of the manufacturing costs of the machine.

35 After the work stage, the ram and the plunger should be returned to the rest position, to allow the blank to be realigned

relative to the tool. At the same time, a change may be made to the use of another tool. The return of the ram to the rest position takes place using return means. The return means can be, for example, springs or cylinders.

5

The plunger of the tool is used to make a linear movement against the stop perpendicular to it. The blank is machined in the work plane between these, which is at right angles to the direction of movement of the ram. In other words, the direction
10 of movement of the plunger is normal to the work plane. In the work plane, the blank is directed to the correct location by the moving means. The moving means are thus used to move the blank relative to the tools, i.e. to move the moving means relative to the blank.

15

In the solution according to the invention, the moving elements act surprisingly simultaneously as the operating device moving the drive element of the ram. As stated above, the moving element and the operating device must both operate with precise
20 positioning. Manufacturing costs can be reduced considerably, if the operating device moving the drive element is at the same time also the moving element of the ram. The solution according to the invention requires one component less performing precise positioning than the solutions according to the prior art.

25

In terms of constructional simplicity and operation, the tool holder is linear and parallel to the movement of the drive element of the ram. In addition, a linear tool holder is cheaper to manufacture. If the tool holder is parallel to the
30 drive element of the ram, a construction is achieved, in which the same operating device can be used as the drive element of the ram and as the moving element of the ram when selecting a tool. In other words, the same operating device, which moves the drive element of the ram, is used as the moving element of
35 the ram. Thus only a single operating device is required to perform the two positionings. The direction, in which the drive

element moves, is preferably the same direction as the direction of movement of the body of the operating device.

In one embodiment, the precisely positioning operating device
5 is a rolling screw. The use of a rolling screw in the embodiment in question is justified, despite its high price, by its high precision. In addition, the use of a rolling screw achieves a suitable speed, because high rotation speeds can be used in a rolling screw. In addition, the construction in
10 question has low friction, so that wear and heating are small. In the punch press according to the invention, the rolling screw used is preferably a ball-race screw. A ball-race screw has the advantage over roller screws belonging to the group rolling screws of having a simpler construction. In addition,
15 ball-race screws are cheaper. Because a great load-bearing capacity is not required without increasing the diameter of the screw, the use of a ball-race screw is advantageous.

In a second embodiment, the punch press includes a machine body
20 and an operating-device body. The blank-positioning devices comprise the linear moving means of the operating-device body, and linear feed devices, which are at right angles to each other. The linear movement can be implemented very precisely, for example, with the aid of rail structures. It is therefore
25 advantageous to implement the positioning means with the aid of separate linearly movable structures. If the movement is examined relative to the machine body, it can be seen that the positioning means comprise two parts. The first part is an operating-device body and the second part is transfer means.
30 The transfer means are in connection with the totality formed by the feed line and the exit line. These two totalities move at right angles relative to each other. In addition, both move relative to the machine body in only one direction linearly, in the direction permitted by the rail structure. The tool holder
35 can be attached permanently to the operating-device body, in which case the tools move along with the operating-device body.

The blank is, for its part, attached to the transfer means and is moved using the transfer means.

In a third embodiment, the operating element and the drive head of the ram are formed of a rolling element and a sloping surface. The conversion of sliding friction into rolling friction reduces wear in the components. There is no need to use lubricants between the planes, so that the apparatus remains clean. In a preferred embodiment, the operating element of the ram is a rolling element. Such a construction is simpler to construct and more reliable in operation. The rolling element is very advantageously a roller nose, which is previously known in the technology sector in question.

In a fourth embodiment, the moving element of the ram comprises the said operating device and grip means belonging to it. This achieves an embodiment, in which the drive element and the operating device use entirely the same precise-positioning components. In addition to this, the operating element includes grip means. When using entirely the same precision-positioning components an embodiment is achieved, in which the very expensive component is fully exploited for carrying out two functions. The ram has preferably at least three operating positions, which are a rest position, a work position, and a transfer position. Thus the grip means can be all the time below the nose of the operating device, but they touch the ram only when the ram is in the transfer position. No moving grip means are required in connection with the operating device, so that the construction associated with the operating device becomes simple and easily manufactured.

In a fifth embodiment, the grip means include a cylinder in connection with the ram, by means of which the ram is raised to the transfer position. This allows the components permitting movement, which permit the ram's third transfer position, to be implemented using well-tried technology. There are preferably

two cylinders on top of each other, in which case the first cylinder is used for returning to the work position and the second cylinder for moving to the ram's transfer position. It is advantageous to use two cylinders on top of each other, as they can be located in the centre of the ram and its vertical support guides. Thus the force of the cylinders directed to the ram is in the desired direction and raises the ram upwards, without causing lateral forces that twist the ram and strain the vertical support guides. Pneumatic or hydraulic cylinders can be used as the return cylinders. It is self-evident that many other types of cylinder and springs, which can be operated, for example, using nitrogen, are suitable as the return means. The cylinders are preferably pneumatic, because great forces are not required in the application. In addition, a pneumatic embodiment is cleaner in use.

In the following, the invention is examined in greater detail with reference to the accompanying drawings, depicting some applications of the invention, in which

20

Figure 1 shows a punch press according to the invention,

Figure 2 shows the plunger mechanism of the punch press according to the invention, in the rest position,

Figure 3 shows the plunger mechanism of the punch press according to the invention, in the work position,

Figure 4 shows the plunger mechanism of the punch press according to the invention, in the transfer position,

Figure 5 shows a second embodiment of the plunger mechanism according to the invention, in the transfer position,

and

Figure 6 shows a third embodiment of the plunger mechanism according to the invention, in the transfer position.

In the punch press 10 according to the invention shown in Figure 1, blanks 12 are fed for machining on a blank 12 feed line 16 and are removed after machining on an exit line 18. The

blanks shown in Figure 1 are of plate material and are fed continuously for machining. In the lines there can be rotating rollers, which guide the blanks forward (not shown). The feed line 16 can also be based on a belt solution, in which an
5 endless belt 17 runs around the feed line 16. Tools 20 are used to machine the blanks 12. The tools 20 comprise a plunger 22 and a stop 24, by means of the joint action of which the necessary holes and impressions are made in the blanks 12. Machining takes place by pressing the plunger 22 against the stop 24. The
10 tools 20 are situated in a tool holder 26, thus forming a tool series 28. The blanks 12 are fed between the plunger 22 and the stop 24, where their machining takes place. The plane, in which the blanks are machined, i.e. the plane in which the blank is during machining, is referred to as the work plane. The moving
15 of the plunger 22 takes place using a ram 30. The first end of the ram is connected to the plunger when a plunger is used (not shown). In the rest position, the ram 30 does not touch the plunger 22. The ram 30 directs a force through the drive head 34 to perform the machining event of the plunger.

20

The ram 30 shown in Figure 1 has a drive element 36. This drive element 36 moves perpendicularly to the direction of movement of the ram 30. The drive of the drive element of the ram takes place by directing the desired force to the ram using the drive
25 element, when the ram moves, moving the plunger at the same time. The punch press 10 includes an operating device 38 for moving the drive element 36. The moving of the drive element using the operating device should be very precise, so that the drive element will move the ram as desired. The drive element
30 36 and drive head 34 of the ram can be implemented in many ways. The drive element and drive head of the ram can be bevelled surfaces (not shown). In Figure 1, they are formed of a rolling element and a sloping surface 42. In Figure 1, the rolling element is a roller nose 44 while the sloping surface
35 42 is two-sided.

In the punch press of Figure 1, the correct tool is selected by moving the ram to the location of the desired tool. The ram 30 is moved accurately to the location of the correct tool 20 in the longitudinal direction of the tool holder 26 using a moving
5 element 40, which in the case of Figure 1 is also the drive element 36 and thus moves using the same operating device 38. When using the drive element 36 as the moving element 40, there should be grip means 35 in connection with the drive element 36. The grip means include a grip pin 37. In the solution
10 according to the invention, moving can also be implemented using a moving element, which is separate from the drive element, but which nevertheless operates using the same operating device as the moving element (not shown). By using the same operating device 38 as both the precise positioning means
15 required by the drive element 36 and as the precise positioning device required by the ram's moving element 40, an economical solution is achieved, as only one expensive precise positioning element is required.

20 Figure 1 shows that the punch press 10 includes the drive element 36, by means of which the ram is pressed as desired. There are return means in connection with the ram 30 for moving the ram upwards. Springs or cylinders can act as the return means. Figures 2 - 4 show the construction and operation of
25 some return means are shown in greater detail.

According to Figure 1, the shaping forces are directed to the blank 12 by means of tools 20, which comprise a plunger 22 and a stop 24. The work plane is between the plunger 22 and the
30 stop 24. The shaping of the blank is based on the movement made by the plunger against the blank. The plunger makes a movement perpendicular to the blank. For the machining to take place at the correct location in the blank, the tools should be at the correct location relative to the blank at the moment of machin-
35 ing the blank. To align the blank 12 and tools 20 as desired, the punch press 10 includes positioning means 48. The punch

press 10 includes a machine body 50 and an operating-device body 52. The machine body is permanently mounted on the factory floor, so that the movement of the components are referred to relative to it. A set of co-ordinates x-, y-, and z- are marked
5 in the figure. In many cases, the x- and y-axes are the other way round (not shown), but references in the present text to movements in the set of co-ordinates are to the co-ordinates shown. The axes of the co-ordinates are, in the case of the figure, at an angle of 90° to each other. The feed line 16 and
10 the exit line 18 are permanently attached to the machine body 50. The feed belt 17 of the feed line 16 of course moves relative to the machine body, as does the exit belt 19 of the exit line 18. The feed line 16 and the exit line 18 are thus fixed in the direction of the x-axis relative to the machine body 50.
15 The alignment of the blank 12 and the tool 20 as desired in the direction of the y-axis takes place by moving the blank 12 relative to the machine body 50 and thus to the operating-device body 52. The operating-device body 52 remains stationary in the y-direction relative to the machine body. The movement
20 of the blank 12 in the y-direction takes place using the feed means, i.e. in the base of Figure 1 using a carriage 54. The carriage 54 moves in the direction of the y-axis. The carriage 54, which moves only in the direction of the y-axis, positions its location, and at the same time the location of the blank 12
25 very precisely in the y-direction. Aligning the blank 12 and the tool 20 as desired in the x-direction takes place by moving the operating-device body 52 relative to the machine body 50 and thus to the blank 12. The blank remains stationary in the x-direction relative to the machine body 50. The operating-
30 device body 52 moves in the direction of the x-axis. The operating-device body 52, which moves only in the direction of the x-axis, positions its location and at the same time that of the blank 12 very precisely. The movement of the operating-
device body 52 in the x-direction takes place by using the
35 moving means 56 of the operating-device body 52. These moving means 56 of the operating-device body 52 comprise rails 57 and

roller elements 59 supported on them. In other words, the carriage and the operating device align the blank and the tool in a direction at right angles to each other. The linear movement is implemented in both directions with the aid of a rail structure. By implementing the alignment of the blank and the tool in this manner by means of two positioning means moving linearly perpendicularly to the machine body, a construction is achieved, which can be used to implement very precise positioning of the blank and the tools.

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The operation of the return means is described in greater detail in connection with Figures 2 - 4. The return means are central to the implementation of the invention. The solution according to the invention could be implemented in many other ways, for instance, with several opposed cylinders. The implementation of the solution according to the invention preferably utilizes a construction similar to the cylinder construction shown in connection with Figures 2 - 4, allowing the ram to be brought as desired to three main positions. The three main positions of the ram are the work position, the rest position, and the transfer position. In this embodiment, the moving element of the ram comprise a ram drive device operated by an operating device and of grip means in connection with it. When the ram is in the rest position, the roller of the drive device does not touch the ram. In the work position, the roller is, in turn, on top of the sloping surface of the ram. In the transfer position, the drive device is located in such a way that the grip means belonging to the drive device are closed on the drive head of the ram.

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In Figure 2, the punch press 30 according to the invention is in the rest position. The first end 32 of the ram is in the rest position under the plunger 22, but does not touch the plunger 22. The other end of the ram is the drive head 34. The ram 3 is attached to a ram frame 66 through guides 60. The guides 60 in the ram frame 88 permit the ram 30 to move in the

z-direction. The ram 30 is moved downwards by the drive element 36, i.e. the roller nose 44. The movement of the ram 30 upwards takes place, in turn, by means of a cylinder group 70. The cylinders 62 and 64 are on top of each other in the cylinder group 70. In the cylinder group 70, the lower cylinder is the return cylinder 62 and the upper cylinder is the transfer cylinder 64. The cylinders comprise a cylinder chamber and a piston. The rest position of the ram 30 is dimensioned in such a way that the first end 32 of the ram 30 does not touch the plunger 22 nor does the grip pin 37 touch the drive head 34 of the ram 30. The piston of the transfer cylinder 64, i.e. the upper piston 74 is attached to the upper surface 67 of the ram frame 66. Thus, when leading air into the upper cylinder chamber 84 on top of the upper piston 74, the cylinder bodies 80 and 82, which are joined together, i.e. the cylinder group 70, rise upwards. In the rest position, the air is below the upper piston 74 in the upper cylinder chamber 84, in which case the cylinder bodies 80 and 82 are in the lower position. The piston of the return cylinder 62, i.e. the lower piston 76 is attached in connection with the first end 32 of the ram 30. Thus when leading air under the lower piston 76 of the lower cylinder chamber 86, the ram 30 rises. In the case in Figure 2, the ram 30 is in the rest position, when there is air in the upper cylinder chamber 84 under the upper piston 74 and there is air in the lower cylinder chamber 86 under the lower piston 76. By leading air to the upper cylinder chamber 84 above the upper piston 74, the ram 30 is made to rise. The ram is then in the transfer position, which is seen in Figure 4. In turn, by leading air to the lower cylinder chamber 86 above the lower piston 76, the ram is made to move downwards. In the application, moving the ram downwards does not take place with the aid of air, but instead by moving the roller nose in connection with the drive head of the ram. When the ram moves downwards, air is allowed to flow into the lower cylinder chamber on top of the lower piston. The ram then moves to the work position, which is seen in Figure 3.

In Figure 3, the ram 30 of the punch press according to the invention is in the work position. In the work position, the ram is lower than in the rest position. The ram 30 has moved downwards, i.e. in the negative direction in the z-axis compared to Figure 2, in which the ram is in the rest position. The ram has moved downwards, because the roller nose 44 has moved in the x-direction on top of the sloping drive head 34 of the ram. The movement of the roller nose has only taken place in the x-direction. Thus, the ram 30 has been moved down by the effect of the weight produced by the roller nose 44 on the drive head 34 of the ram 30, and not by the lower piston 76. At the same time however, sufficient air has been allowed to flow into the lower cylinder chamber 86 on top of the lower piston 76 for the lower piston 76 to be allowed to move significantly downwards without affecting the movement of the ram 30. The first end 32 of the ram is in contact with the plunger in the work position.

In Figure 4, the ram 30 of the punch press according to the invention is in the transfer position. In the transfer position, the ram is higher than in the rest position and thus also higher than in the work position. The ram has moved upwards, i.e. in the positive direction in the z-axis compared to Figure 2, in which the ram is in the rest position. The ram 30 has moved upwards, when the roller nose 44 has guided the ram 30 to the side from on top of the drive head 34 and after this air has been led both to the lower cylinder chamber 86 below the lower piston 76 and to the upper cylinder chamber 84 above the upper piston 74. The roller nose 44 is aligned relative to the ram 30, in such a way that when the ram 30 rises to the transfer position, the grip pins 37 in the roller nose 44 enter grip holes 90 intended for them. At the same time, the lateral locking of the ram frame 66 is removed, so that the ram frame 66 and at the same time the ram 30 can be moved laterally using the moving element 40, which comprises the roller nose 44 and the grip pins 37. The moving element 40 and the drive element

36, i.e. the roller nose 44, are thus moved using the same operating device 38 (Figure 1).

In other words, the ram is moved downwards by the pressing effect of the roller nose, and is moved upwards by the lifting effect of the cylinders. This is an advantageous construction, as the downwards movement must be more precise to achieve the desired machining effect. In addition, when moving the ram upwards, not much force is required, so that the upwards movement of the ram can be implemented using pneumatic cylinders.

Figure 5 shows a second embodiment of the ram mechanism of the punch press according to the invention in the transfer position. In the embodiment in question, the ram 30 of the punch press is in the transfer position. In the transfer position, the ram is higher than in the rest position and thus also higher than in the work position. The ram 30 has moved upwards, when the roller nose 44 has been guided to the side off the drive head 34 of the ram and on top of the grip shape 92. The grip shape 92 in question can be a full-width grip groove 94. In the grip groove 94 there are edges 94', which are shaped in such a way that the roller nose rises out of the groove when the ram is locked into the work position. On the other hand, when the ram is not locked, the roller nose is aligned with the ram 30 by means of the edges 94' by the moving force of the ram. At the same time, the lateral locking of the ram frame 66 is removed, so that the ram frame 66 and at the same time the ram 30 can be locked laterally using a moving element 40, which is the roller nose 44. The moving element 40 and the operating element 36, i.e. the roller nose 44 are thus moved using the same operating device 38 (Figure 1). The embodiment in question of the punch press is more advantageous, as in it there is no need for grip pins. An even more important advantage than that permits the total construction formed by the cylinder to be simplified. The simpler cylinder construction in question is

not shown, but its essential feature is that the cylinders 62, 62 (Figure 5) can be replaced with a single cylinder.

Figure 6 shows a third embodiment of the ram mechanism of the 5 punch press according to the invention, in the transfer position. The shaping of the drive head 34 differs from that shown in the other figures. In Figure 5, the drive head includes drive sides 96, which are straight. An even loading and speed is directed from the straight drive sides through the ram to the 10 material being machined, by the even movement of the roller nose. In the embodiment of Figure 6, the drive sides 96 are drive sides 98 shaped to increase the speed of the roller nose during machining. Thus the force and speed are optimized. When the roller nose 44 rolls during machining on top of the drive 15 sides 98 that increase its speed, the speed rise gradually. In other words, initially the plunger 22 moves slowly, when the material being machined is thick. As the machining progresses, the speed of the plunger increases, when the remaining material is thinner. Thus force is directed to the machining at the 20 moment it is required. On the other hand, the speed is increased when the force decreases. The most important factor in the dimensioning is that force * speed is constant. The embodiment in question is the opposite of that in publication FI 971762.

CLAIMS

1. Punch press, in which compressive machining is performed on a blank, which punch press (10) includes:
- 5 - a feed line (16) and an exist line (18) for the blanks (12),
 - a tool series (28), which comprises several tools (20) and a tool holder (26), in which tools (20) are placed in a row, and in each tool (20) of the tool
10 series (28) there is a plunger (22) and a stop (24), between which the blank (12) to be machined is arranged to be fed from the feed line (16),
 - a ram (30), which has a rest position and a work
15 position, which ram (30) has a first end (32) and a second end, which first end (32) of the ram (30) is arranged in contact with the plunger (22) is the work position, and which second end of the ram (30) is arranged to be the drive head (34) of the ram (30) to move the plunger (22) in order to perform the
20 machining event,
 - a drive element (36) of the ram (30), which is arranged to move in a direction perpendicular to the direction of movement of the ram (30), by means of which the drive element (36) is arranged to direct
25 force onto the drive head (34) of the ram (30), in order to drive the ram (30),
 - a precise-positioning operating device (38) for moving the drive element (36) of the ram (30),
 - a precise-positioning moving element (40) for moving
30 the ram (30) in the direction of the tool row to the location of the desired toll (20),
 - return means for returning the ram (30) to the rest position,
 - positioning means (48) for aligning the selected tool
35 (20) and the blank (12) to be machined relative to

each other in the work plane, which is at right angles to the direction of movement of the ram (30), characterized in that the said moving element (40) of the ram (30) is arranged to operate using the same said moving operating device (38) of the ram (30).

2. Punch press according to Claim 1, characterized in that the precisely positionable operating device (38) is a rolling screw.

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3. Punch press according to Claim 1, characterized in that the rolling screw is a ball-race screw.

4. Punch press according to any of Claims 1 - 3, characterized in that the punch press (10) includes a machine body (50) and an operating-device body (52), and the positioning devices (48) comprise linear operating-device body moving devices (56) and linear feed devices, which are at right angles to each other.

20 5. Punch press according to any of Claims 1 - 4, characterized in that the drive element (36) and the drive head (34) of the ram (30) are arranged to be formed of a roller and a sloping surface (42).

25 6. Punch press according to Claims 1 - 5, characterized in that the drive element (36) of the ram (30) is a rolling element.

7. Punch press according to Claim 6, characterized in that the rolling element is a roller nose (44).

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8. Punch press according to any of Claims 1 - 7, characterized in that the said moving element (40) of the ram (30) comprises the said operating device (38) and of the grip means (35) belonging in connection with it.

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9. Punch press according to any of Claims 1 - 8, characterized in that the ram (30) has at least three operating positions, which are a rest position, a work position, and a transfer position.

5

10. Punch press according to Claim 9, characterized in that the grip elements (35) include a cylinder in connection with the ram (30), by means of which the ram (30) is raised to the transfer position.

10

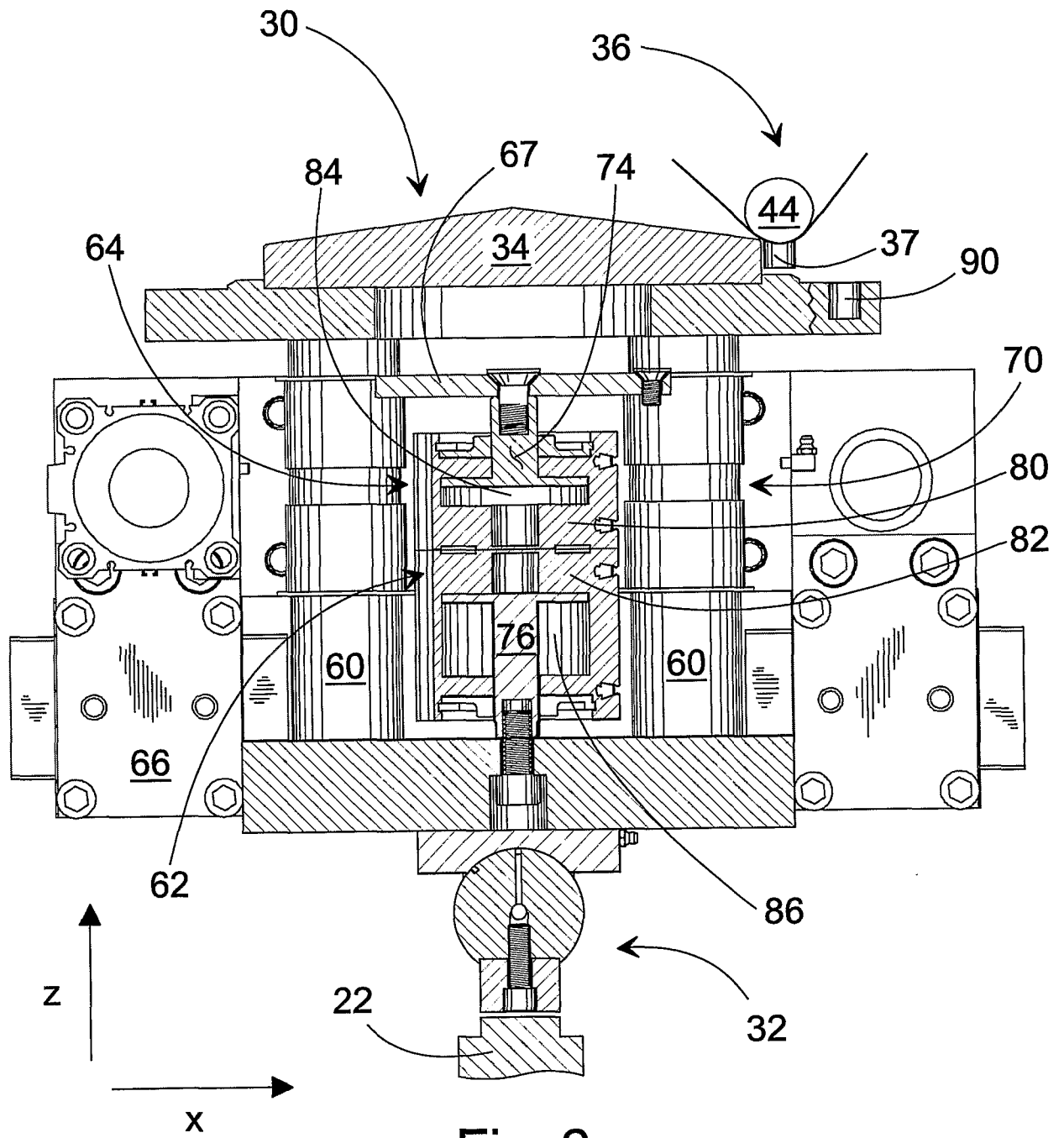


Fig. 2

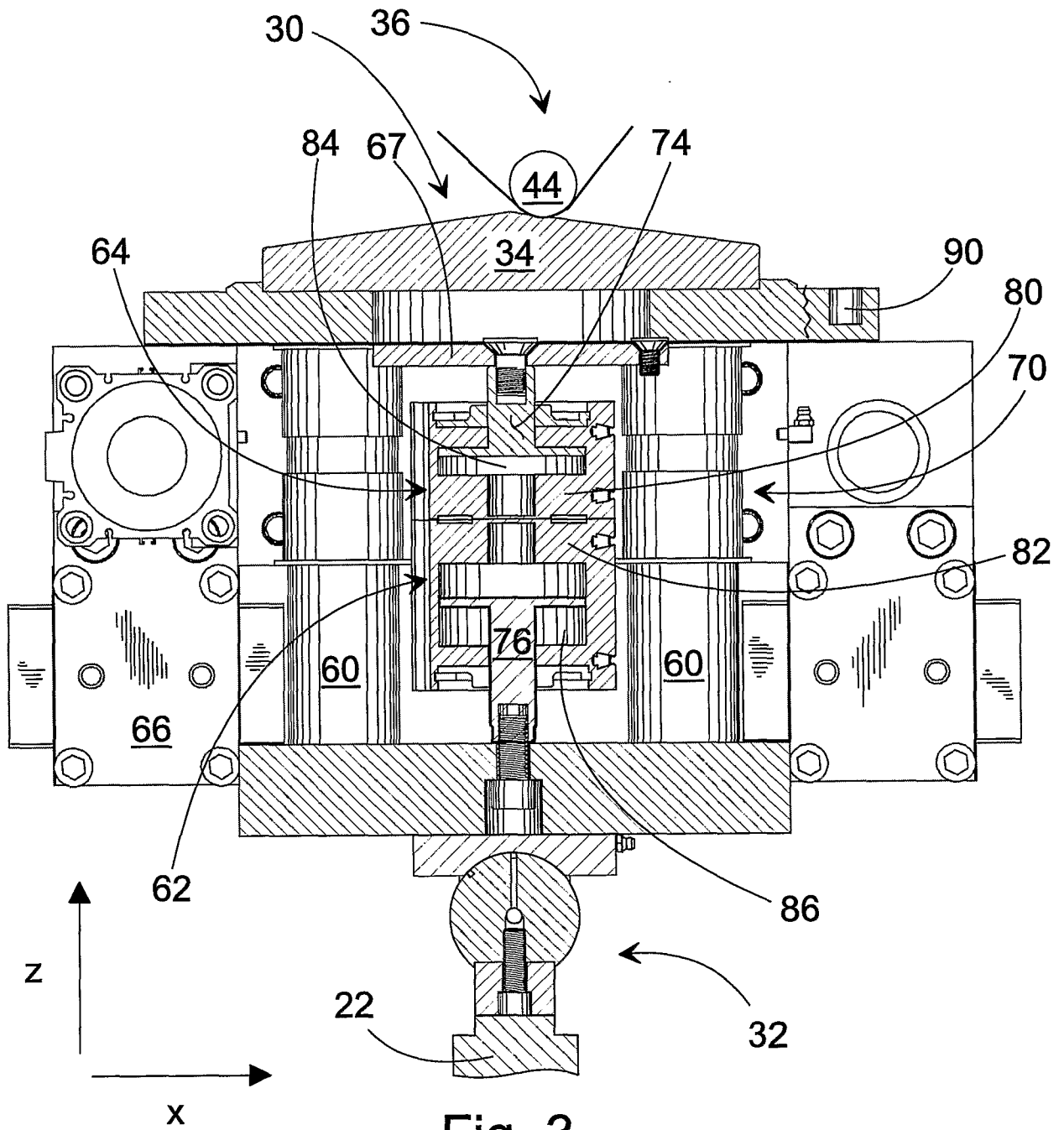
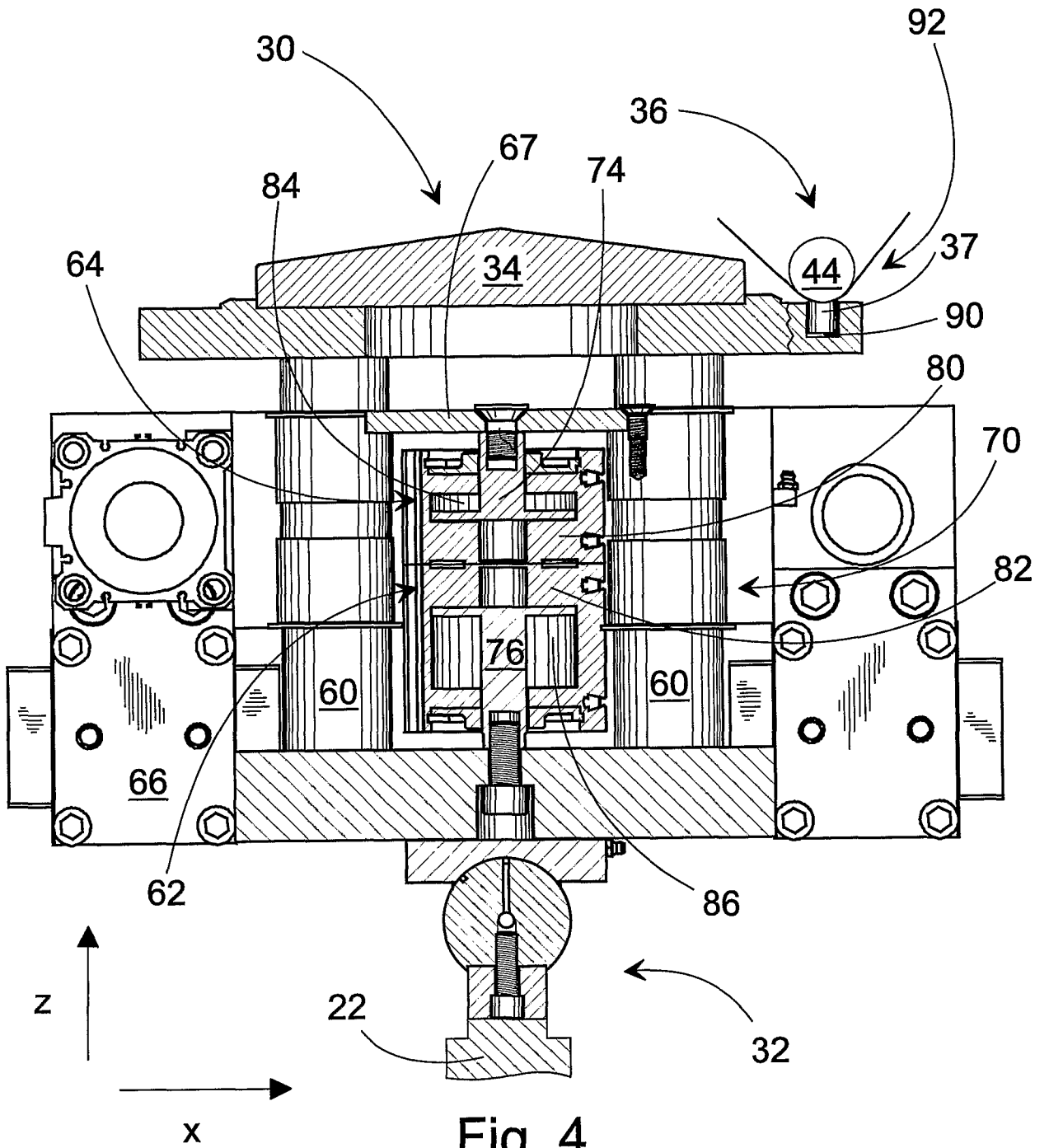


Fig. 3



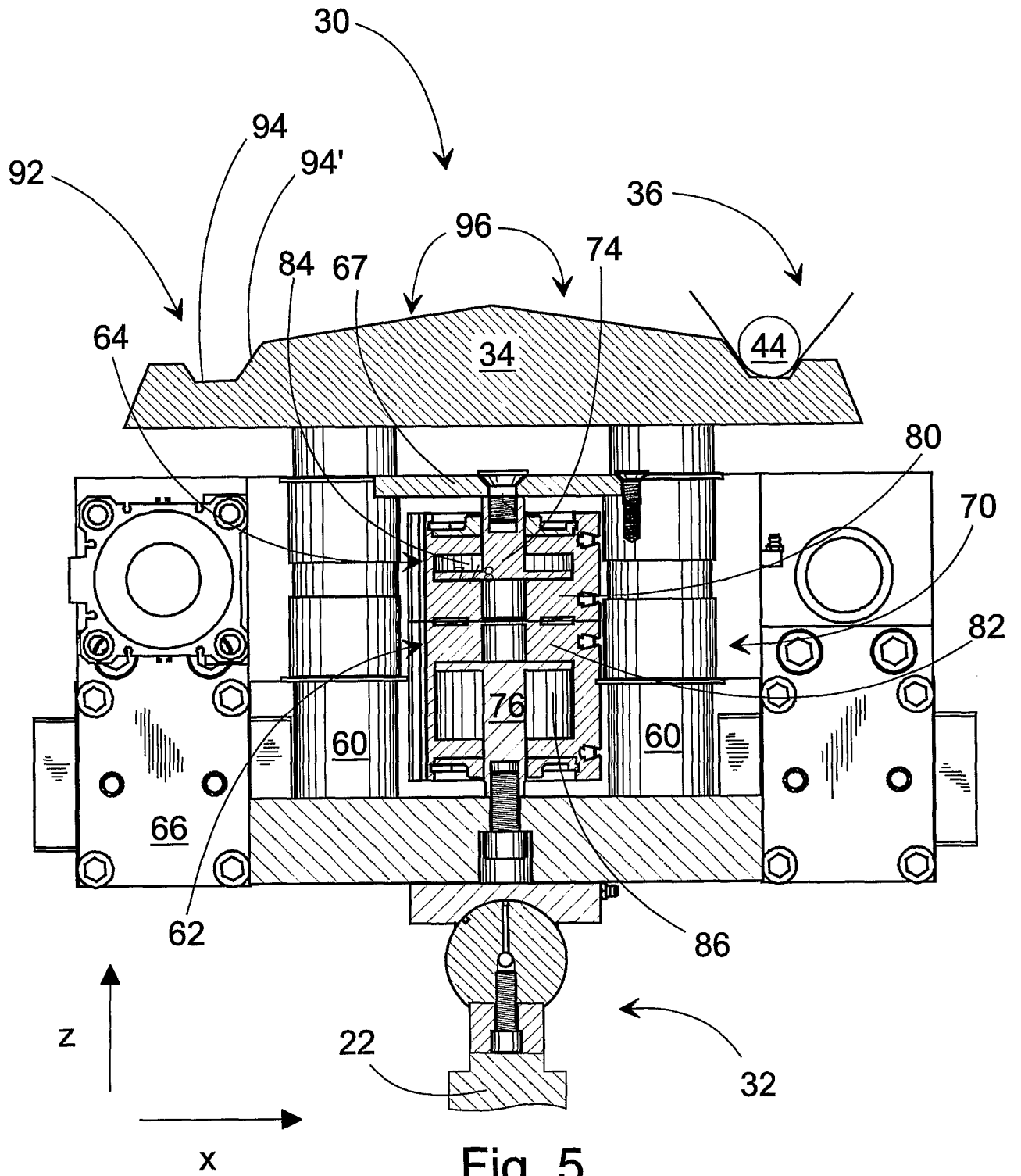
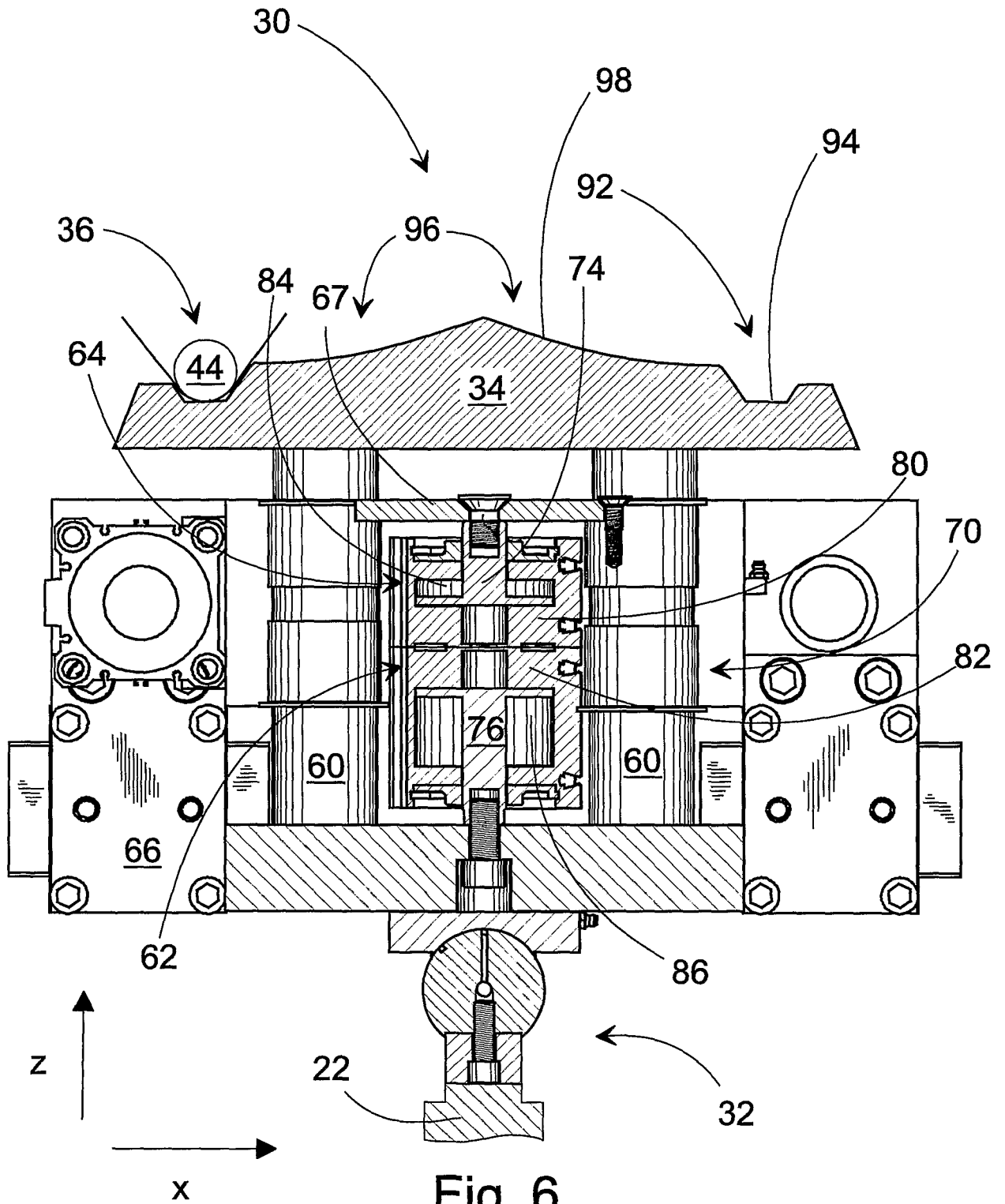


Fig. 5



INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2007/050213

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

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)

IPC: B21D

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

SE,DK,FI,NO classes as above

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

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1281452 A2 (VIRTANEN, MIKA ET AL), 5 February 2003 (05.02.2003), figures 1a, 2a, 3a, 4, 6, 7, 16, abstract --	1-10
A	WO 0023207 A2 (VIRTANEN, MIKA ET AL), 27 April 2000 (27.04.2000), figures 1a, 2a, 3a, 4, 6, 7, 16 --	1-10
A	US 5186037 A (BIHLER), 16 February 1993 (16.02.1993), abstract --	1-10
A	JP 56089337 A1 (ANRITSU CORP), 20 July 1981 (20.07.1981), abstract --	1-10

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Date of the actual completion of the international search

5 July 2007

Date of mailing of the international search report

10 -07- 2007

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2007/050213

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 20010011492 A1 (FUKUMOTO ET AL), 9 August 2001 (09.08.2001), abstract -- -----	1-10

International patent classification (IPC)**B21D 28/20** (2006.01)**B21D 28/04** (2006.01)**B21D 28/26** (2006.01)**Download your patent documents at www.prv.se**

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Paper copies can be ordered at a cost of 50 SEK per copy from PRV InterPat (telephone number 08-782 28 85).

Cited literature, if any, will be enclosed in paper form.

INTERNATIONAL SEARCH REPORT
Information on patent family members

28/05/2007

International application No.

PCT/FI2007/050213

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