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(54) **Swaging Machine.**

(57) A swaging machine comprises a machining head (1), a plurality of swaging dies (5) respectively so placed in a hollow interior of a spindle (2) as to slide along grooves formed in the machining head (1), a plurality of swaging hammers (7), each arranged on the outer circumference of the dies, a plurality of wedges (4) inserted between the swaging a hammers and the die so as to move longitudinally of the spindle (2). The machining head (1) further has a set of rollers (82) and an outer ring (8). The rollers (82) are rotatably arranged between the spindle (2) and the outer ring (8). The diameter of the rollers (82) is slightly larger than the distance between the spindle (2) and the outer ring (8), so the dies (5) intermittently strike or swage the work placed in the center space of the set of dies (5) through the swaging hammers (7) when the outer ends of the hammers (7) are pressed innerward through the rotating rollers (82).

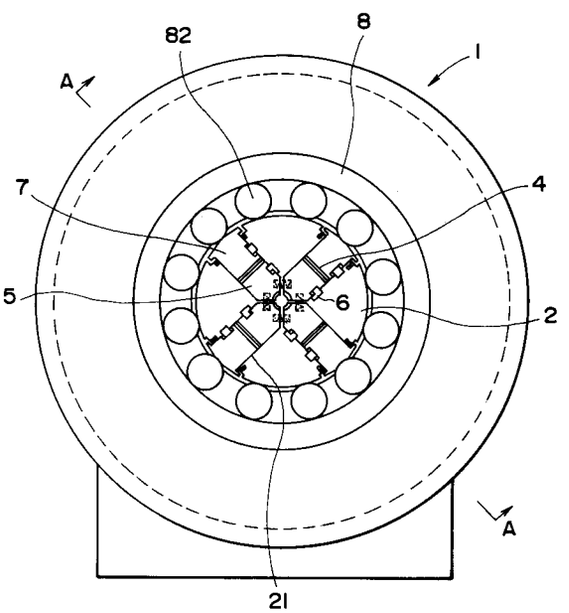

FIG. 1

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Technical Field

The present invention relates to a swaging machine, in particular, to a swaging machine enabling to improve its accuracy of finishing and machining works.

Background Art

The swaging machine has been used in which small bars and round rods are put into (set in) a machining portion constructed by several dies which strike the works so as to form them of desired shapes.

Fig. 10 is a front view showing an example of the machining head 1 of the conventional swaging machine. According to the conventional swaging machine shown in Fig. 10, it comprises a spindle 2, a machining portion 11 for machining the work placed on the spindle 2, a plurality of dies 5 slidably placed around the machining portin 11, swaging hammers 7 slidably arrange around the dies 5 so as to press them functioning their operations, wedges 4 inserted between the dies 5 and the swaging hammer 7 so as to control the size of the machining portion 11, limit plates 73 restricting the strokes of the swaging hammers 7, and a plurality of rollers 82 and an outer ring 8. Also, the conventional swaging machine above has a die driving arranged on the outer periphery of the swaging hammer 7, and springs 54 and 74 for urging outside the dies 5 and the swaging hammer 7.

In operation of the conventional swaging machine, when the outer ring 8 rotates at a high speed, the rollers 82 come in contact with the swaging hammer 7, thereby the motions of the up-and-down swaging hammer 7 are transferred to the dies 5 through the wedges 4. As a result, the dies 5 respectively move toward the center of the machining head 1 striking at a high speed the work machining and forming the work of a desired size.

Meanwhile, when another work having a diameter of different size is machined, the wedges 4 are moved along the axial direction to control the positions of the dies 5 and accordingly the size of the machining portion 11 is set at a suitable one to the diameter of the work.

Next, the technical problems and their solutions will be explained with reference to the background art above.

According to the conventional swaging machine, movement strokes of the dies 5 are restricted by a number of limit plates 73 inserted between the spindle 2 and the swaging hammer 7. In other words, outside movement of the dies 5 is restricted or controlled by a clearance g_1 formed between the swaging hammer 7 and the limit plate 73, and centralizing movement of the dies 5 is by a gap g_2 between the swaging hammer 7 and the limit plate 73. It is noted that the movement of dies 5 along their outside direction is no problem.

Concerning the centralizing movement above, because the swaging hammer 7 and the die 5 are different in structure from each other and placed independently through the wedge 4, it is difficult to make the movement distances of the dies 5 along the central direction equal to each other or uniform due to change of machining reaction and rebounding force of the spring 54, even the strokes of the swaging hammers 7 are restricted.

In addition, when the dies 5 are placed as shown in Fig. 10, the gravity functions on the dies (I) and (II), respectively placed at their upper positions along the direction toward the center of the machining head 1. On the contrary, as for the dies (III) and(IV) placed the lower positions, the gravity functions as an outside directed force to them. Consequently, an imbalance is created between these two sets of dies (I),(II) and other dies (III), (IV).

Such difference between effects of the gravity to the two sets of the dies influences on the accuracy of finishing and machining work, curveness, circularity, and size, making the machining of the works with a high precision difficult.

Accordingly, it is the purpose of the present invention to provide a swaging machine for directly restricting the movement stroke of the dies in order to solve the technical problem of the prior art and attaining a swaging machining with a high machining precision.

Summary of the Invention

It is noted that the swaging machine according to the present invention has limit plates restricting the strokes of dies and functions cooperatively with the wedges, which plates are arranged between a spindle of the machining head of the swaging machine and the dies.

When the swaging hammers are driven a drive mechanism and move toward the center of the machining head, the wedges and dies are driven and move toward the center. The distance of movement of the dies is limited to a fixed one without being effected of changes of machining reaction and spring reaction.

When the machining opening formed by dies is controlled by moving the wedges along the front-and-behind direction, the limit plates as well as the wedges cooperatively move in order to keep always the gap distance between the dies and the limit plates at a fixed one.

Brief Description of the Drawings

Fig. 1 is a front view of the important portion of the swaging machine according to the present invention; Fig. 2 is a section taken along a line A-A of Fig. 1; Fig. 3 is a partly enlarged view of Fig. 1; Fig. 4 is a section taken along a line B-B of Fig. 3; Fig. 5 is a section taken along a C-C of Fig. 4; Fig. 6 is a perspective view of an example of a wedge holding member; Fig. 7 is a perspective view of an example of the wedge; Fig. 8 is a perspective view of an example of the die; Fig. 9 is a perspective view of an example of the limit plate for the die; and Fig. 10 is a front view of an example of the machining head of the conventional swaging machine.

Detailed Explanation of the Invention

One way of carrying out the present invention will be described using examples of the swaging machine according to the present invention referring to the drawings.

As shown clearly in Figs.1 to Fig. 5, a cylindrical or hollow spindle 2 in the machining head 1 has a cross groove 21 formed on its surface. A sliding shaft 22 is contained in the hollow of the cylindrical spindle 2 through bearings. A wedge supporting member 3 fixed on a front end portion of the sliding shaft 22 has a cross groove 31 of a section: T as shown in Fig. 6 formed thereon. The wedge 4 as shown in Fig. 7 of a shape of T in plane and consists of a head portion 41 and an operative portion 42. The operative portion 42 has a side tapered at a slant α head 41 of the wedge 4 is slidably installed in the groove 31 of the wedge supporting member 3.

The die 5 has a cut-out portion 51 of a section of an arc formed at its front end and has a shape of a block slidably installed in the groove 21 of the hollow spindle 2. The cut-out portions 51 of respective dies function as an element of a machining portion 11 of a circular shape. As shown in Fig. 8, the die 5 has a surface 52 opposing to the cut-out portion 51, which surface is slanted at an angle α of the slanted face 43 of the wedge 4. The die 5 has a side face provided with a groove 53 extending in parallel with the slanted face 52. Springs 54 are inserted between two adjacent dies 4 in order to press always the dies 4 toward the wedges 4.

The limit plate 6 for the dies 5 is slidably inserted between the groove 53 of the dies 5 and a groove 23 so formed in the spindle 2 as to oppose the groove 53. As shown in Fig.9, the limit plate 6 consists of a die fitting portion 61 fitted into the groove 53 of the die 5, a spindle fitting portion 62 fitted into the groove 23 of the spindle 2, and an engagement 63 slidably fitted in the groove 31 of the wedge supporting member 3 together with the wedge 4. The die fitting portion 61 has an upper face 64 having an angle α identical with that of the slanted face 41 of the wedge 4.

A width of the groove 53 of the die 5 is determined so as to leave when the die fitting portion 61 of the die limit plate 6 is fitted into the groove 53, a gap g_3 between the slanted face and a side (upper face) of the groove 53, which gap g_3 is substantially identical with the gap g_1 formed between the hammer limit plate 73 and the swaging hammer 7, and another gap g_4 between the lower face of the die limit plate 6 and another side (lower face) of the groove 53, which gap g_4 is substantially equal to the gap g_2.

The swaging hammer 7 is slidably installed in the groove 21 of the hollow spindle 2 through the wedge 4 has a flat shape of substantial T and a front end portion 71 of a convex shape. The hammer limit plate 73 is slidably inserted between the groove 72 formed at the side face of the swaging hammer 7 and another groove 24 formed in the hollow spindle 2. Springs 74 are installed between the spindle 2 and the swaging hammer 7 so as to urge constantly the swaging hammer 7 outward.

An outer ring 8 is made of wear resistance material. A number of rollers 82 contained and arranged at a regular interval in the roller cage 81 are placed between the outer ring 8 and the hollow spindle 2. Respective rollers 82 come in contact in line with an outer periphery face of the spindle 2 and an inner periphery face of the outer ring 8. A flywheel 83 is integrally installed on the outer periphery of the outer ring 8.

Next, an operation of the swaging machine according to the present invention will be explained.

When the hollow spindle 2 is stable and the outer ring 8 rotates, for example, along a direction of an arrow (a), the rollers 82 slidingly coming into contact with the outer ring 8 rolls along a direction of an arrow (b) and moves along the direction equal to that of the outer ring 8. While, the convex portion 71 of the swaging hammer 7 slides on alternately the roller cage 81 and the roller 82, together with the rotation of the outer ring 8. Because the roller 82 extrudes a little from the inner face of the roller cage 81, the swaging hammer 7 displaces toward the center of the machining head 1 against a force of the spring 74 when the roller 82 rides on the convex 71 of the swaging hammer 7. thus the wedge 4 and the dies 5 are driven to move toward the center striking and machining the work set in the machining portion 11. When the rollers 82 is disengaged from the convex 71 of the swaging hammer 7, these rollers immediately return to their original positions by force of the springs 54 and 74. The size of the machining portion 11 can be controlled by advancing or backing the wedge 4.

Meanwhile, because in the conventional swaging machine the strokes of the dies 5 are restricted by only the hammer limit plate 73 placed between the spindle 2 and the swaging hammer 7, it is difficult to make the movement distances toward the center of the dies 5 equal each other.

According to the present invention, in addition of the hammer limit plate 73, dies limit plates 6 are placed between the spindle 2 and the dies 5 in order to make a gap g_3 between the dies 5 and the dies limit plate 6. The gap g_3 is used to control the strokes of the dies 5 moving toward the center portion of the dies 5, so that it is possible to keep the movement distance of the dies 5 constantly at an uniform one.

When the wedge 4 is moved along front-and-back direction to control the opening of the machining portion 11, the dies limit plate 6 attached to the wedge supporting member 3 moves together with the wedge 4, as a result it is possible to always keep the gap g_3 between the slanted face 64 of the dies limit plate 6 and the die 5 at a predetermined distance.

According to the embodiment above of the swaging machine of the present invention, the spindle 2 is stable and the outer ring 8 rotates. It is apparent, however, that the present invention can carry out in another aspect in which the outer ring 8 is stable and the spindle 2 is rotary.

In the statement above, the swaging machine of the present invention has four dies 5 arranged around the hollow spindle 2, however, it is possible to select the number of the die to two and three, and to suitably and slightly change the structure of respective parts of the swaging machine.

Because that the limit plate is placed between the spindle and the die so as to control the stroke of the die and cooperate with the wedge, it is possible to always sustain the movement volumes of the dies. Consequently, a swaging machine having a high precision of machining is firmly attained.

Claims

1. A swaging machine comprising a plurality of dies (5) placed in a spindle (2) so as to slide toward a center of the machine, a plurality of swaging hammers (7) respectively arranged on the outer periphery of the dies, a plurality of wedges (4) installed between said swaging hammers and said dies so as to move along a longitudinal direction, and a drive mechanism provided with a plurality of rollers (82) in order to intermittently drive the swaging hammers (7), wherein the work is striken when the drive mechanism makes said swaging hammer (7), the wedge (4), and the dies (5) move toward the central portion of a machining head of the swaging machine so as to machine said work, Characterized in that further comprising a limit plate (6) arranged between said spindle (2) and the die (5) so as to restrict the stroke of the die (5) and cooperate with said wedge (4).

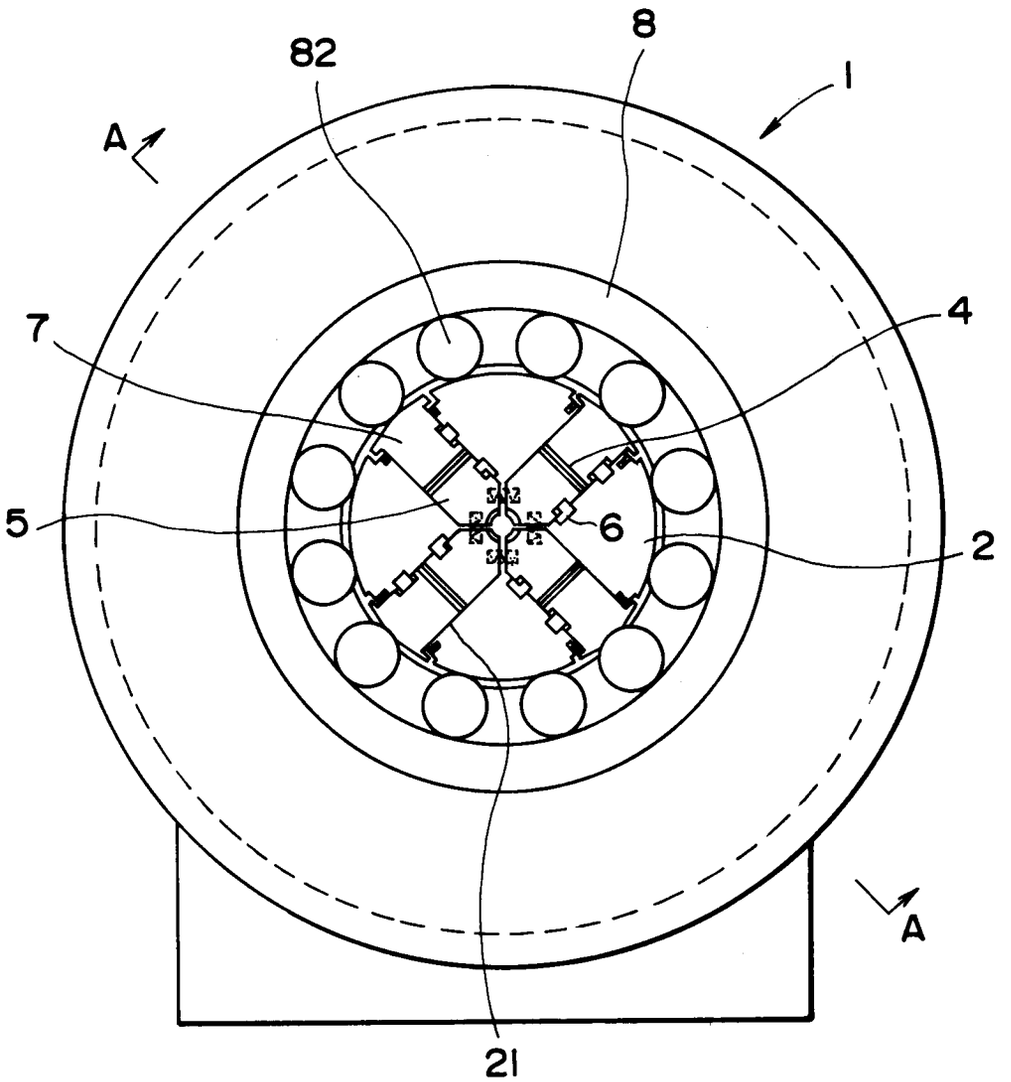

FIG. 1

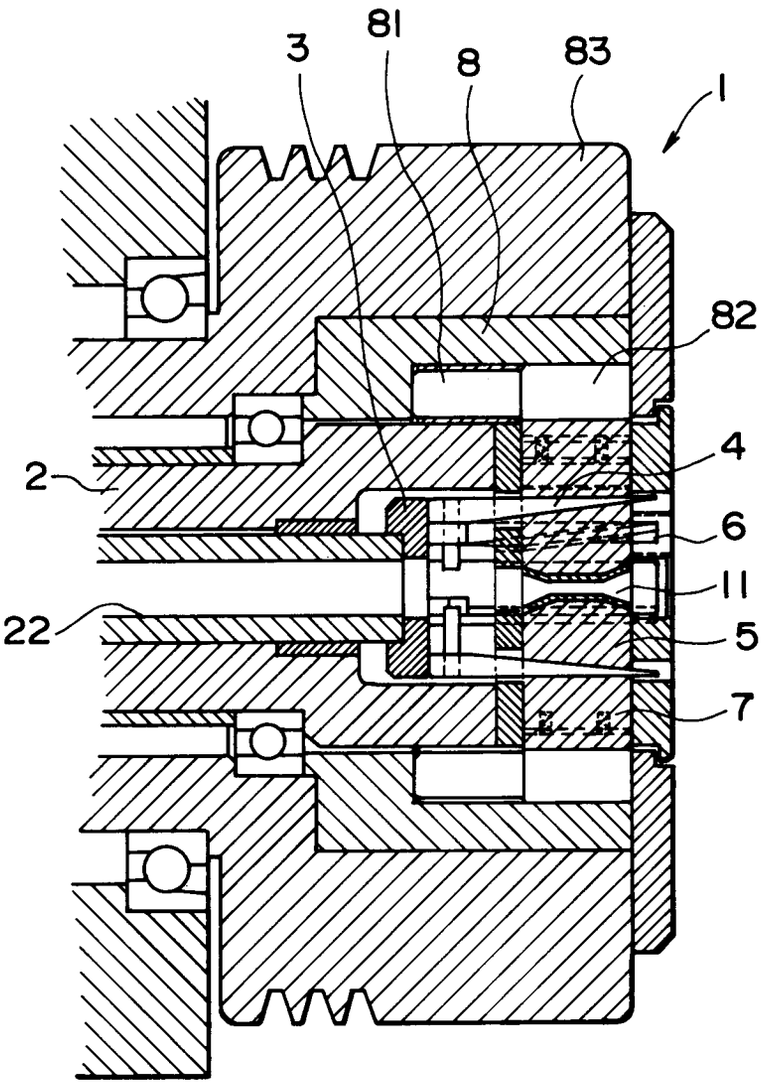

FIG. 2

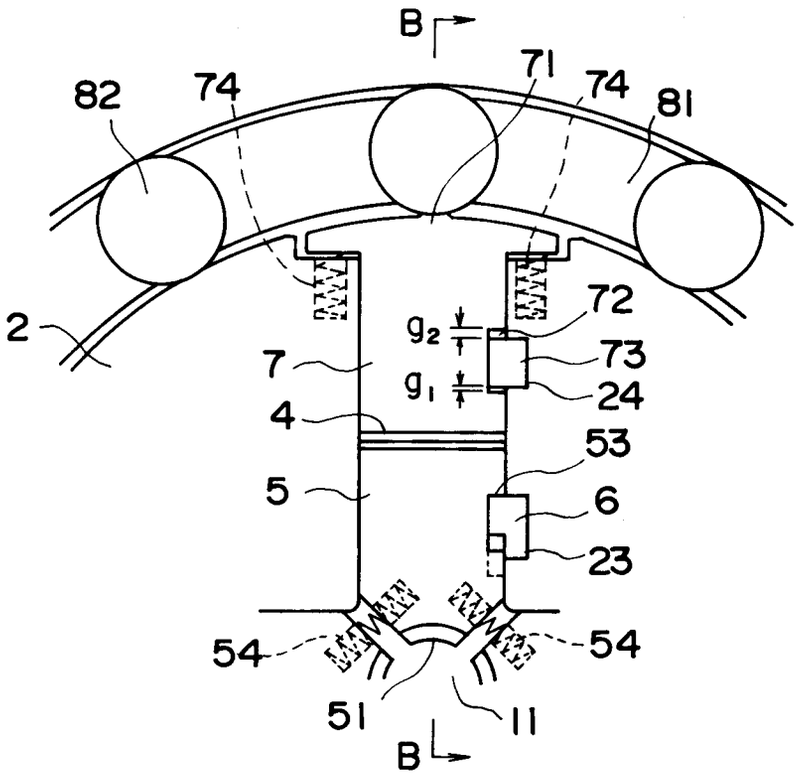
B
71
74
74
81
82
2
72
g_2
7
73
g_1
24
4
53
5
6
23
54
54
51
11
B

FIG. 3

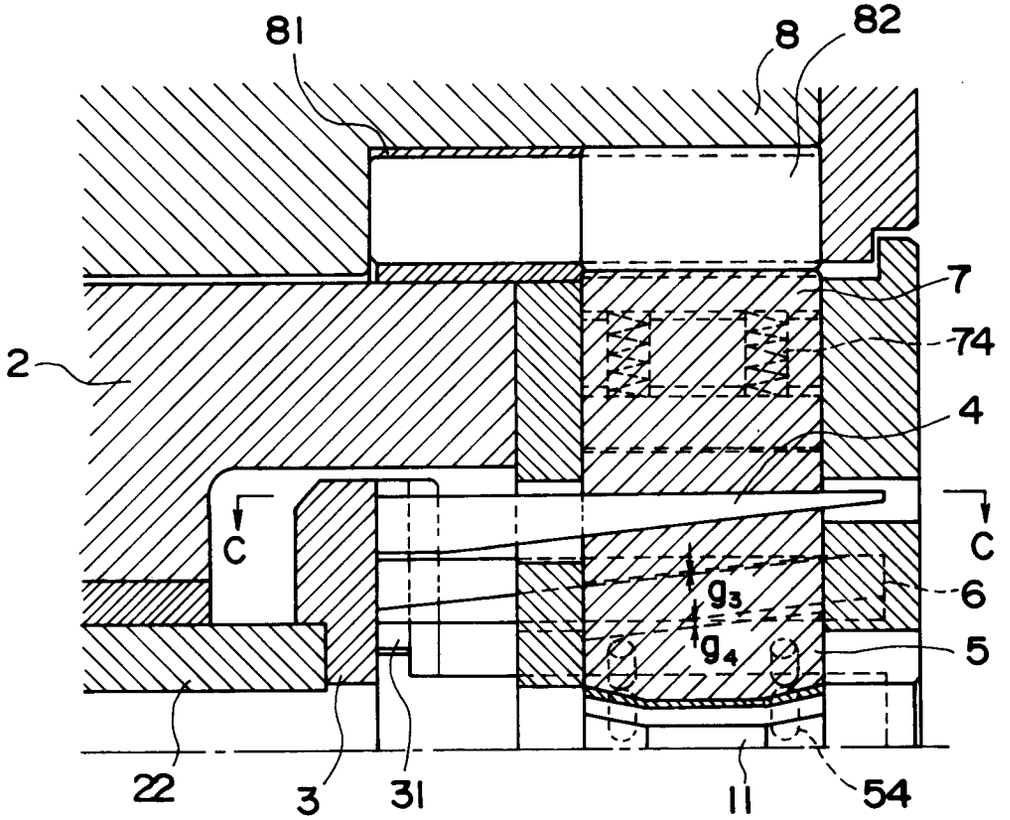
81
8
82
7
74
2
4
C
C
g_3
6
g_4
5
22
3
31
11
54

FIG. 4

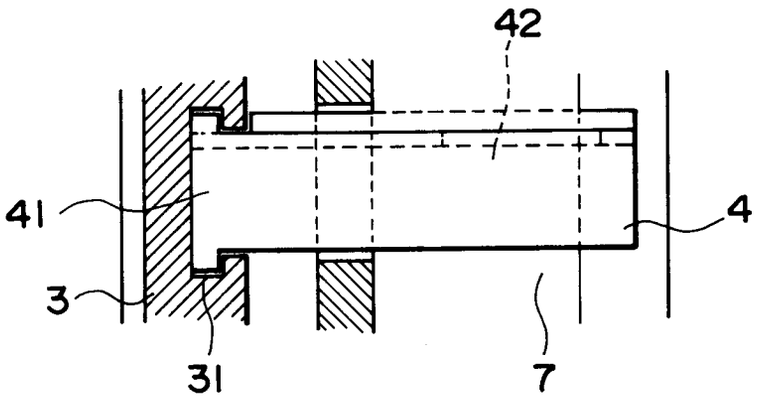

FIG. 5

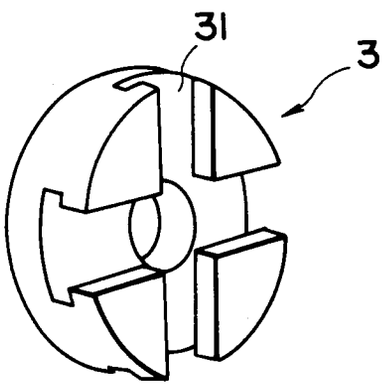

FIG. 6

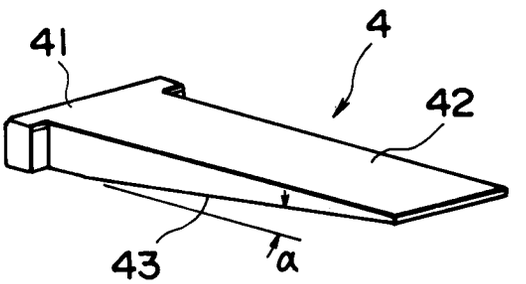

FIG. 7

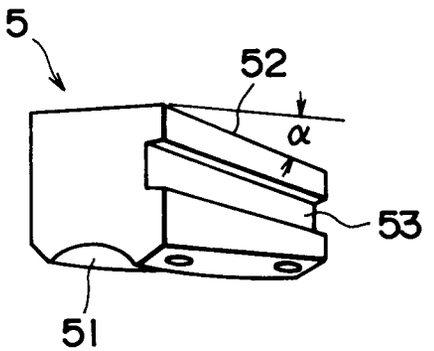

FIG. 8

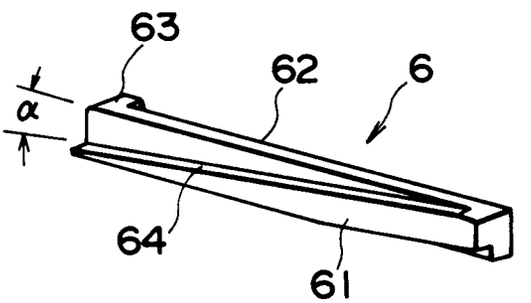

FIG. 9

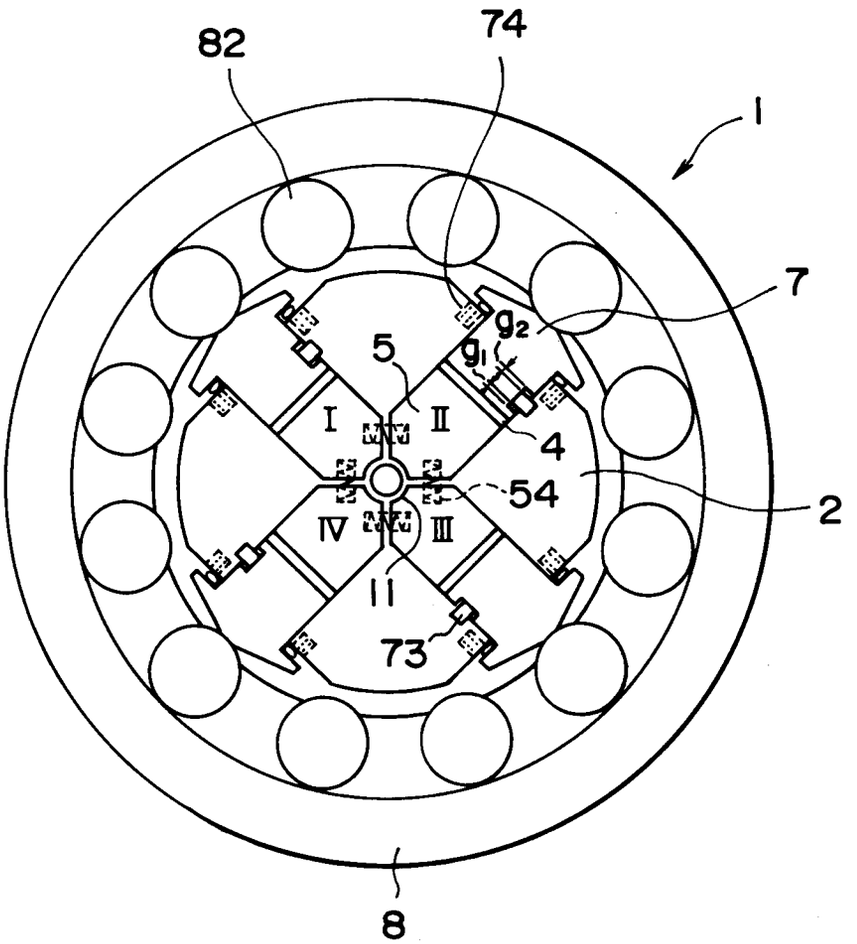

FIG. 10

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 11 4132

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US-A-2 746 321 (S. SMITH) * the whole document * *	1	B 21 J 7/16
A	US-A-2 636 405 (S. SMITH) * claim; figures 1,2 * *	1	
A	DE-A-3 202 506 (FA. HEINRICH MÜLLER) * the whole document * *	1	
A	DE-A-3 144 981 (FA. HEINRICH MÜLLER) * figures 1-3 * *	1	
A	DE-A-2 452 819 (HEINRICH MÜLLER MASCHINEN-FABRIK) * figures * *	1	
A	US-A-2 443 874 (S. SMITH) * column 1, line 34 - line 52; claims; figures 1,2 * *	1	
A	US-A-1 955 535 (E.A. CONNER)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B 21 J

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	02 January 92	THE K.H.

CATEGORY OF CITED DOCUMENTS

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