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(54) IMAGE FORMING APPARATUS.

(57) A novel transmission gear mechanism for driving a developing device in an image forming apparatus of such a type that the developing device is brought close to or apart from a photosensitive drum while being interlocked with opening/closing action of a cover. This mechanism is composed of a first bevel gear (71) fitted on a revolving shaft (624) on the side of the photosensitive drum unit connected to the driving motor, a second bevel (72) to constantly mesh with the first bevel gear, a third bevel gear (81) fitted on the revolving shaft (635) on the side of the developing device unit, a fourth bevel gear (82) to constantly mesh with the third bevel gear, and rotative connecting means (91) for connecting the second and fourth bevel gears to each other. The rotative connecting means is provided with a connecting structure to transmit the rotation of the second bevel gear (72) to the fourth bevel gear (82) when the developing device approaches the photosensitive drum and to permit displacement of the fourth bevel gear (82) when the developing device performs the approaching/departing action.

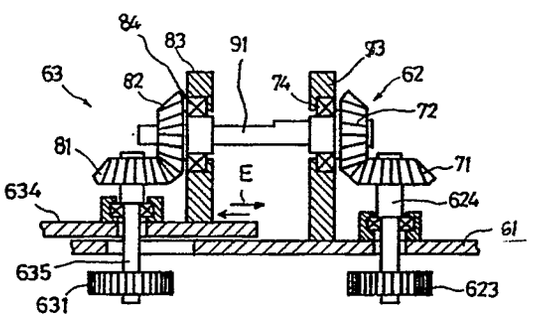


Fig.4

EP 0 429 657 A1

IMAGE FORMING APPARATUS

FIELD OF THE INVENTION

The present invention relates to an electrophotographic image forming apparatus which causes a developing unit to come close to or to be separated from a photoconductive drum in conjugation with the opening or closing operation of the upper frame and particularly to a gear power transfer mechanism for transmitting a rotating force of a drive motor to the developing unit side from the photoconductive drum unit side when the developing unit is caused to come close to the photoconductive drum unit.

BACKGROUND OF THE INVENTION

An image forming apparatus such as laser printer or electronic copying machine is now widely used and these machines always require simplified operation procedures and stabilized printing quality.

This image forming apparatus is so structured that the upper frame can be opened or closed for the lower frame forming the boundary at the paper transfer path in order to reset the paper jam and replacement of the developing unit and photoconductive drum unit. Moreover with such opening or closing operation, the photoconductive drum provided within the upper frame is caused to come close to or to be separated from the developing unit and the power in the photoconductive drum unit side is transferred to the developing unit side with the power transmitting mechanism when the developing unit and photoconductive drum are caused to become close with each other.

Fig. 10A and Fig. 10B are structural diagrams schematically showing typical example (Japanese unexamined patent sublication HEI 1-92776) of the image forming apparatus explained above.

This image forming apparatus divides the frame into the upper and lower frame The lower frame (hereinafter called base) 1 is provided with a paper cassette setting part 11, a paper transfer path 12, a fixing unit 13 and a pick roller, transfer roller not illustrated. Meanwhile, the upper frame (hereinafter called cover) 2 is provided with a photoconductive drum unit 3, a deveoping unit 4 and a link mechanism 5 and is rotatable around the rotating axis 14 for the base 1. At the dividing section of the base 1 and cover 2, the paper transfer path is formed.

Therefore, as shown in Fig. 10B, the cover 2 can be opened for the base 1 at the boundary of paper transfer path by rotating it around the rotating axis 14.

The photoconductive drum unit 3 is fixed to the cover 2 and the developing unit 4 is swayably provided to the cover 2. A mag roller (not illustrated) within the developing unit 41 can be moved closely to or separated from the photoconductive drum 31 through such swaying operation.

The link mechanism 5 sways the developing unit 4 in accordance with the closing and opening operation of cover 2, namely causes the developing unit 41 to come close to or separate from the photoconductive drum 31. For this purpose, the link mechanism 5 is composed of an L type rotatable arm 51, an L type transmitting arm 52 and a rotatable arm 53. The L type rotatable arm 51 has a guide hole 512 which engages with an engaging pin 511 provided on the base 1 at the one end thereof and rotates around the center axis 513 in accordance with the closing and opening operation of cover 2. The L type transmitting arem 52 couples the other end of the L type rotatable arm 51 and the one end of rotatable arm 53 to realize integrated operation of these arms. The rotatable arm 53 rotates around the rotating axis 531 and is provided, at the one end thereof, with a pushing mechanism 54 consisting of a plate spring to push the devloping unit 4 toward the photoconductive drum unit 3.

Here, operations of link mechanism 5 will be explained.

First, the cover 2 shown in Fig. 10A is closed to the base 1. In this case, the L type rotatable arm 51 of the link mechanism is rotated around the rotating axis 513 simultaneously with depression in the direction of arrow mark A, thereby the transmitting arm 52 is pulled in the direction of arrow mark B and the rotatable arm 53 is driven to rotate counterclockwise around the rotating axis 531. Simultaneously, the pushing mechanism 54 integrated with the rotatable arm 53 is moved to the right side, pushing the developing unit 4 toward the photoconductive drum unit 3. As a result, the developing unit 41 and the photoconductive drum 31 are set in the closing condition. Since the developing unit 41 is provided with a pair of gap rollers 42 which are in contact with both end portions of external circumference of the photoconductive drum 31, the mag roller and photosensitive drum in the developing unit are provided opposed with each other with a constant interval between them under such closed condition.

Next, the cover 2 shown in Fig. 10B is opened. Under this condition, the transmitting arm 52 of the link mechanism is moved in the direction of arrow mark C and thereby a pushing force of the pushing mechanism 54 toward the developing unit 4 is

eased. As a result, the developing unit 4 is separated from the phtoconductive drum unit 3 with a recovery force of spring not illustrated and the photoconductive drum 31 is so far separated from the gap roller 42.

Therefore, a large gap is generated, under this condition, between the developing unit 41 and the phtoconductive drum 31 and thereby paper jam can be reset and replacement of developing unit and photoconductive drum can be realized easily. Moreover, the photoconductive drum surface can be protected from damage during the operations explained above.

As explained above, the image forming apparatus causes the developing unit 4 to come close to or to be separated from the photoconductive drum unit 3 in accordance with the opening and closing operations of the cover 2 and is also provided with the gear power transfer mechanism for transmitting the rotating force of drive motor to the rotating part of developing unit from the photoconductive drum unit under the closed condition of these units explained above.

This gear power transfer mechanism 6 is composed, as shown in Figs. 11A, 11B and Fig. 12, of a drive gear unit 62 coupled with the drive motor (not illustrated) in the side of photoconductive drum unit 3 and a driven gear unit 63 coupled with the rotating part of developing unit 41 (mag roller, developer agitating screw, etc.). The drive gear unit 62 is provided with three gears rotatably provided on a fixed substrate 61, namely a first intermediate gear 621 engaged with the drive motor, a second intermediate gear 622 always engaged with the first intermediate gear and a drive gear 623 always engaged with the second intermediate gear. The axis of first intermediate gear 621 is coupled with the drive mechanism of the photoconductive drum 31 and the second intermediate gear 622 is coupled with the rotating aixs of paper transfer roller not illustrated.

On the other hand, the driven gear unit 63 is composed of a movable bracket 634 (hatched area in Fig. 12) provided movably in the direction of arrow mark to the fixed substrate 61 and the three gears rotatably provided to this bracket. Three gears include a driven gear 631 engaging with the drive gear 623 in the side of photoconductive drum when the developing unit 4 comes close to the photoconductive drum unit 3, a third intermediate gear 632 always engaging with the driven gear and a fourth intermediate gear 633 always engaging with the third intermediate gear. The fourth intermedaite gear 633 is provided with four pawls coupled with a coupling pawl gear in the side of developing unit 41 as shown in the figure. When these pawls couple, the mag roller and the developer agitating screw in the developing unit 41 are rotated. The gears explained above, although not limited thereto, may be manufactured through the molding of synthetic resin material.

Here, operations of this gear power transfer mechanism 6 will be explained.

First, the cover 2 shown in Fig. 11A is closed for the base 1 and the developing unit 4 is moved toward the photoconductive drum unit 8. In this case, the driven gear 631 of the gear power transfer mechanism engages with the drive gear 623 becaise both units are in the closed condition. As a result, a rotating force of the drive motor transmitted to the grive gear 623 through the first intermediate gear 621 and second intermediate gear 622 is further transferred sequentially to the driven gear 631, third intermediate gear 632 and fourth intermediate gear 633 from such drive gear to rotate the mag roller within the developing unit 41. Therefore, the photoconductive drum 31 and developing unit 41 are driven by the single drive motor.

Next, the cover 2 shown in Fig. 11B is opened and thereby the developing unit 4 is separated from the photoconductive drum unit 3. In this case, the driven gear 631 of the gear powre transfer mechanism 6 is separated from the drive gear 623 releasing the engagement and thereby the rotating force of drive motor is not transferred to the developing unit 41. Accordingly, the mag roller in the developing unit 41 is no longer rotated.

Meanwhile, in the image forming apparatus of the prior art explained above, gap between the photoconductive drum 31 and developing unit 41 changes depending on a little deviation of supporting axis of the gap roller 42 and rotating axis of photoconductive drum 31 specifying such gap. Such change of gap gives large influence on the engagement between the drive gear 623 of the drive gear unit 62 and the driven gear 631 of driven gear unit 63. Namely, since positional relation between the drive gear unit 62 and driven gear unit 63 is determined with reference to the axis center of the gap roller 42 of developing unit and rotating center of the photoconductive drum 31, even if the center positions are little deviated, adequate engagement between the drive gear 623 and driven gear 631 can no longer be attained.

Accordingly, here rises a problem that creak is generated between gears, for example, when engagement between the drive gear and driven gear becomes deep or gear missing and gear skipping are generated when engagement becomes shallow, due to relative eccentricity of the rotating axes in the side of photoconductive drum unit (rotating axes of the photoconductive drum and drive gear) and the driven axis axis in the side of developing unit (supporting axis of gap roller and rotating axis of driven gear).

From such conditions, high level technique and

longer processing time have been required for adjustment of gap in order to attain adequate engagement between the drive gear and driven gear. Thereby, the prior art has a disadvantage that provision of gear power transfer mechanism at the time of manufacturing the image forming apparatus and replacement of developing unit and photoconductive drum after manufacture of apparatus have been made uneffectively. Therefore, it has also been difficult to prepare the gear power transfer mechanism as a unit for maintenance work.

DISCLOSURE OF THE INVENTION

It is therefore principal object of the present invention to provide a novel image forming apparatus which has solved disadvantages of the image forming apparatus of the prior art.

It is another object of the present invention to provide an improved gear power transfer mechanism which is capable of always transferring adequate rotating force to the rotating part of the developing unit.

It is further object of the present invention to provide a gear power transfer mechanism which has eliminated gap adjustment between gears, ensures easy assembling and maintenance and can easily be provided as the unit for maintenance work.

In summary, the present invention proposes an image forming apparatus in which the developing unit is provided movably so that it can be moved closely to or separated from the photoconductive drum and the gear power transfer mechanism is provided so that the rotating axis in the side of photoconductive drum unit coupled with the drive motor is coupled with the rotating axis in the side of developing unit under condition that the photoconductive drum and the developing unit are provided closely and paritucularly has structured such gear power transfer mechanism as explained hereunder.

The gear power transfer mechanism characterizing the present invention comprises, as shown in Fig. 1, a first bevel gear 71 fixed to the rotating axis 624 in the side of photoconductive drum unit, a second bevel gear 72 provided to always engage with the first bevel gear, a third bevel gear fixed to the rotating axis 635 in the side of developing unit, a fourth bevel gear 82 provided to always engage with the third bevel gear, and a gear coupling means 91 to engage the second bevel gear 72 and the fourth bevel gear 82 in order to transfer the rotation of second bevel gear 72 to the fourth bevel gear 82 in the axis of the direction orthogonally crossing each rotating axis and allow the movement of fourth bevel gear 82 in the axial direction in conjunction with the movement of developing unit 41

In short, the present invention has eliminated direct coupling between the drive gear and driven gear which has been conducted in the prior art. Therefore, gap adjustment between the drive gear and driven gear can be eliminated. Moreover, gear missing and gear skipping of gears can be prevented and adequate motor power can always be transferred to the rotating part of the developing unit.

BRIEF EXPLANATION OF DRAWINGS

Fig. 1 is a diagram indicating principal structure of the gear power transfer mechanism in the image forming apparatus of the present invention;

Fig. 2 is a rear view of the gear power transfer mechanism of an enbodiment of the present invention;

Fig. 3 is a front view of the gear power transfer mechanism of an embodiment of the present invention;

Fig. 4 is a sectional view indicating coupling structure between tow pairs of bevel gears and rotation transfer axis;

Fig. 5 is a perspective view of the essential portion of Fig. 4;

Fig. 6 is a perspective view of the essential portion indicating an example of modification of the coupling structure between two pairs of bevel gears and rotation transfer axis;

Fig. 7 is an outline diagram of another example of modification of the coupling structure of between two pairs of bevel gears and rotation transfer axis;

Fig. 8 is a rear view of gear power mechanism comprising a gear coupling structure of Fig. 7;

Fig. 9 is a sectional view of essential portion of a gear coupling structure of Fig. 8;

Fig. 10A is an outline of structure indicating the condition where the cover of image forming apparatus of the prior art is closed;

Fig. 10B is an outline of structure indicating the codition where the cover of image forming apparatus of the prior art is opened;

Fig. 11A is a front view of a gear power transfer mechanism of the prior art under the condition that the developing unit and photoconductive drum unit are in the closed condition;

Fig. 11B is a front view of a gear power transfer mechansim of the prior art under the condition that the developing unit and photoconductive drum unit are separated from each other; and

Fig. 12 a rear view of a gear power transfer mechanism of the prior art under the condition that the developing unit and photosensitive drum unit are located closely.

PREFERRED EMBODIMENTS OF THE INVENTION

Embodiment 1:

An embodiment of the gear power transfer mechanism of the present invention will be explained with reference to Fig. 2 to Fig. 5. The elements like those of the prior art shown in Fig. 11 and Fig. 12 are designated by the like reference numerals.

Only difference between the embodiment and the prior art is that two pairs of bevel gears 71, 72 and 81, 82 and single rotation transfer axis 91 are added. With addition of such elements, the structure is partly modified. Namely, as shown in Fig. 4, the gap between the drive gear 623 in the side of photoconductive drum unit and the driven gear 631 in the side of developing unit is set wider than that of prior art and the rotating axis 624 of the drive gear 623 is provided through the rear side of the fixed substrate 61, while the rotating axis 635 of the drive gear 623 through the rear side of the driven gear 631. Each bevel gear is not limited thereto but is manufactured by the molding of synthetic resin materials.

The rotating axis 624 of drive gear 623 is coupled with the first bevel gear 71, which is always coupled with the second bevel gear 72. The second bevel gear 72 has a boss at the single side surface. This boss is rotatably supported through a bearing 74 for the L type supporting member 73 provided on the fixed substrate 61. Moreover, the one end of rotation transfer axis 91 is fixed to the axis hole of the secong bevel gear 72. The other end of rotation transfer axis 91 has a flat area 911 formed by cutting out a part of the external circumference and this flat area is inserted into the axis hole of the fourth bevel gear 82 which will be explained later.

Accordingly, when the drive gear 623 is rotated by a drive motor, the rotating force thereof is sequentially transferred to the first bevel gear 71 and the second bevel gear 72 through the rotation axis 624 to rotate the rotation transfer axis 91.

On the other hand, the rotation axis 635 of driven gear 631 is coupled with the third bevel gear 81, which is always coupled with the fourth bevel gear 82. This fourth bevel gear 82 has a boss at the single side surface and this boss is rotatably supported through a bearing 84 by the L type supporting member 83 provided on the movable bracket 634. Moreover, the other end of the rotation transfer axis 91 is inserted into the axis hole of the fourth bevel gear 82. Under this insertion condition, the fourth bevel gear 82 is slidable for the rotation transfer axis 91 and it rotates together with the rotation transfer axis 91. The fourth bevel gear 82 can be rotated because this gear and rotation transfer axis 91 are tentatively coupled with each other by a contact force at the edge portion of flat area 911 provided at the other end of the rotation transfer axis 91.

Therefore, when the cover 2 is opened and the movable bracket 634 is thereby moved in the direction of arrow mark E together with the developing unit 4, the fourth bevel gear 82 slides on the rotation transfer axis 91 together with the bracket. Moreover when the photoconductive drum 3 and the developing unit 4 are ordinarily located closely, the rotating force of the drive motor transferred to the rotation transfer axis 91 is then transmitted to the third bevel gear 81 through the fourth bevel gear 82 and is then tranferred to the driven gear 631. As a result, the rotating part of the developing unit 4 is driven, like a prior art, by the drive motor in the side of photoconductive drum unit 3.

According to an embodiment of the present invention explained above, the drive gear in the side of photoconductive drum unit is not coupled in direct with the driven gear in the side of developing unit. Therefore, gap adjustment between such gears is unnecessary. Accordingly, the gear powr transfer mechanism as a whole can be prepared as a unit element for maintenance work.

The coupling structure of two pairs of bevel gears allows following two types of modifications in addition to the embodiment explained above.

Embodiment 2:

As a first modification, two rotation transfer axes 92, 93 are used as shown in Fig. 6, and one of them is fixed to the second bevel gear 72 while the other to the fourth bevel gear 82. The free end of the first rotation transfer axis 92 fixed to the second bevel gear is provided with a split groove 921, while the free end of the second rotation transfer axis 93 fixed to the fourth bevel gear is provided with an engaging part 931 which may be fitted to the splig groove 921. According to the coupling structure consisting of this split groove 921 and engaging part 931, the second rotation transfer axis 93 may be freely moved in the axial direction and rotates together with the first rotation transfer axis 92.

Accordingly, while the movable bracket 634 moves, the fourth bevel gear 82 can be moved together with the bracket and rotation of the second bevel gear 72 can be transferred to the fourth bevel gear 82 under the condition that the developing unit 4 and photoconductive drum 3 are located adjacently. In above structure, the coupling can further be stabilized by fixing a cylindrical portion surrounding the coupling portion of the first rotation transfer axis 92 and the second rotation transfer axis 93 to the side of any one of these axes.

Embodiment 3:

In another embodiment, as shown in Fig. 7 to Fig. 9, two pairs of bevel gears are coupled with two rotation transfer axes 94, 95. However, this embodiment is different from the previous one in such points that the axis center of second bevel gear 72 is deviated in the upper and horizontal directions for the axis center of fourth bevel gear 82 and the two rotation transfer axes 94, 95 to be fixed to respective axis holes are allocated in different positions and the free end of each rotation transfer axis is provided with a pair of flat gears 96, 97 which are always engaged with each other.

As shown in Fig. 7, the first flat gear 96 is fixed to the first rotation transfer axis 94 being fixed to the second bevel gear 72, while the second flat gear 97 to the second rotation transfer axis 95 being fixed to the fourth bevel gear 82. These two flat gears 96, 97 are provided in such a manner that these are always engaged with each other for transmission of rotation, and the second flat gear 97 is slidable for the first flat gear 96 in order to realize movement of the fourth bevel gear 82. Therefore, each flat gear employs the gear structure where height of tooth is high and number of teeth is considerably small and moreover the number of teeth of bevel gears forming a pair is different. In more practical, as shown in Fig. 8 and Fig. 9, the number of teeth of the first bevel gear 71 and third bevel gear 81 is set larger than the number of teeth of the second bevel gear 72 and fourth bevel gear 82. Thereby, a contact force (surface pressure) between tooth surfaces of a pair flat gears becomes small the second flat gear 97 slides smoothly for the first flat gear 96 and transfer of driving force to the second flat gear from the first flat gear becomes more stable.

Moreover, in this modification, as shown in Fig. 8 and Fig. 9, the rotating axis 635 of the driven gear 631 is longer than the rotating axis 624 of the drive gear 623. Therefore, the third bevel gear 81 is located higher than the first bevel gear 71. The center area of the longer rotating axis 624 is supported by a bearing 637 for stabilizing rotation thereof. The movable bracket 634 is provided with a pair of supporting members 98, 99 in order to movably support two rotation transfer axes 94, 95. The second bevel gear 72 and first flat gear 96 are fixed to the first rotation transfer axis 94, while the fourth bevel gear 82 and second flat gear 97 to the second rotaton tranfer axis 95.

In this structure, when the movable bracket 634 is moved in the direction of arrow mark, the second flat gear 97 slides on the firt flat gear 96 together with the second rotation transfer axis 95 and moves in the same direction. Moreover, in case the photoconductive drum unit 3 and the developing unit 4 are located closely with each other, rotation of the first rotation transfer axis 94 is sequentially transmitted to the first flat gear 96 and second flat gear 97, to rotate the second rotation transfer axis 95.

Even in such embodiment, the rotating power can be transferred to the developing unit from the side of photoconductive drum like the above two embodiments. This embodiment has the following peculiar effect that high accuracy is not required for positioning of opposed second bevel gear 72 and fourth bevel gear 82.

While the preferred embodiments of the present invention have been described, the present invention also allows various other modifications within the scope of the claims.

Claims

1. An image forming apparatus comprising a movable developing unit (41) which can be moved closely to and separated from the photoconductive drum (31) and a gear power transfer mechanism (6) which couples the rotating axis (624) in the side of photoconductive drum unit coupled with the drive motor and the rotating axis (635) in the side of developing unit under the condition that the photoconductive drum and developing unit are located closely, whereby said gear power transfer mechanism further comprising a first bevel gear (71) fixed to the rotating axis (624) in the side of said photoconductive drum unit, a second bevel gear (72) provided to always engage with said first bevel gear, a third bevel gear (81) fixed to the rotating axis (635) in the side of said developing unit, a fourth bevel gear (82) provided to always engage with said third bevel gear, and a rotation coupling means (91) for coupling said second bevel gear (72) and the fourth bevel gear (82) so that rotation of said second bevel gear (72) is transferred to said fourth bevel gear (82) with the axis orthogonally crossing the rotating axis and movement in the axial direction of the fourth bevel gear (82) is allowed in conjunction with movement of said developing unit (41).

2. An image forming apparatus according to claim 1, wherein said second bevel gear (72) and said fourth bevel gear (82) are allocated on the same axis and said rotation coupling means (91) is formed by single rotation transfer axis, the one end thereof is fixed to the axis of said second bevel gear while the other end is provided with an engaging member (911) which allows sliding but rotation thereof for the axis hole of said fourth bevel gear.

3. An image forming apparatus according to claim 1, wherein the second bevel gear (72) and the fourth bevel gear (82) are allocated on the same axis and the rotation coupling means (91) is composed of the first rotation transfer axis (92) being fixed at the one end to the axis of said second bevel gear and the second rotation transfer axis (93) being fixed at the one end to the axis of said fourth bevel gear and comprises a pair of engaging members (921, 931) which allow relative aliding of these axes but rotation thereof at the other end portions opposed with each other of these rotation transfer axes.

4. An image forming apparatus according to claim 1, wherein said second bevel gear (72) and fourth bevel gear (82) are allocated with deviation of axes and said rotation coupling means (91) is composed of a first rotation transfer axis (94) the one end thereof is fixed to the axis of said second bevel gear, a first flat gear (96) fixed to the other end of said first rotation transfer axis, a second rotation transfer axis (95) the one end thereof is fixed to the axis of said fourth bevel gear, and a second flat gear (97) fixed to the other end of said second rotation transfer axis and slidabley engaged with the teeth of said first flat gear.

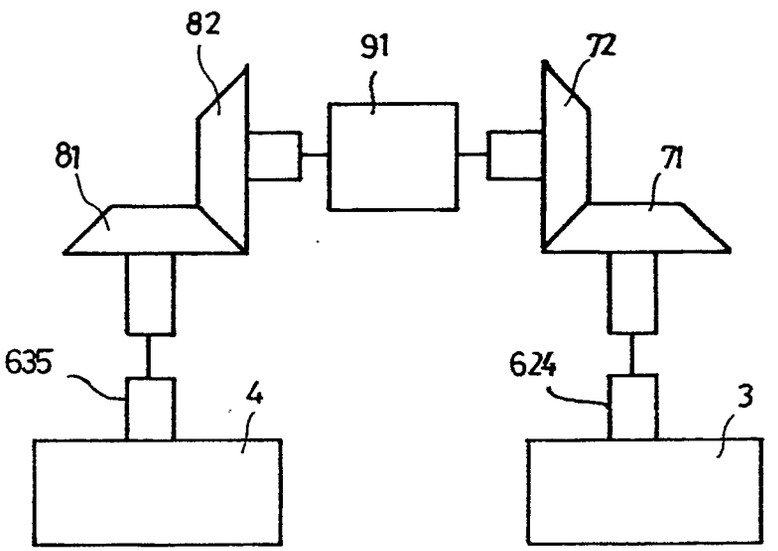
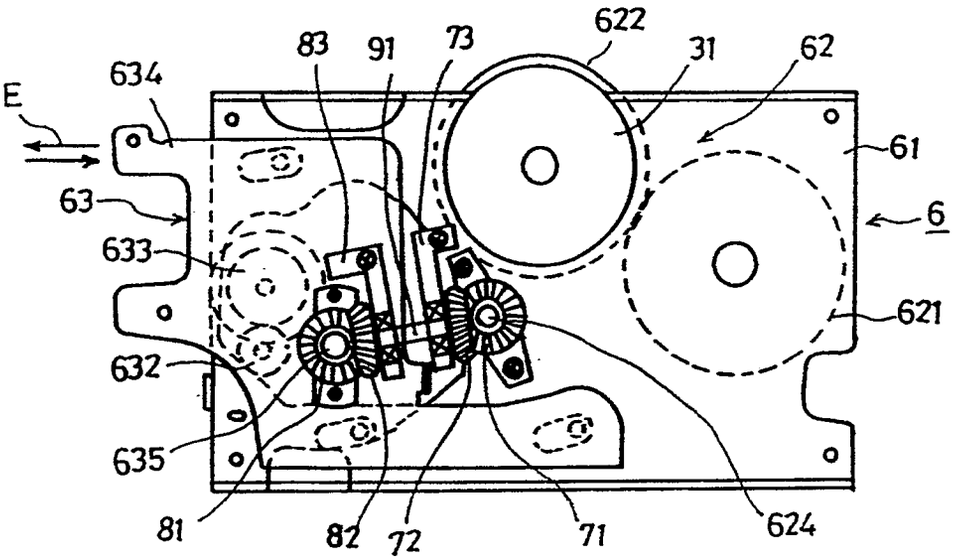


Fig.1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624

Fig. 2

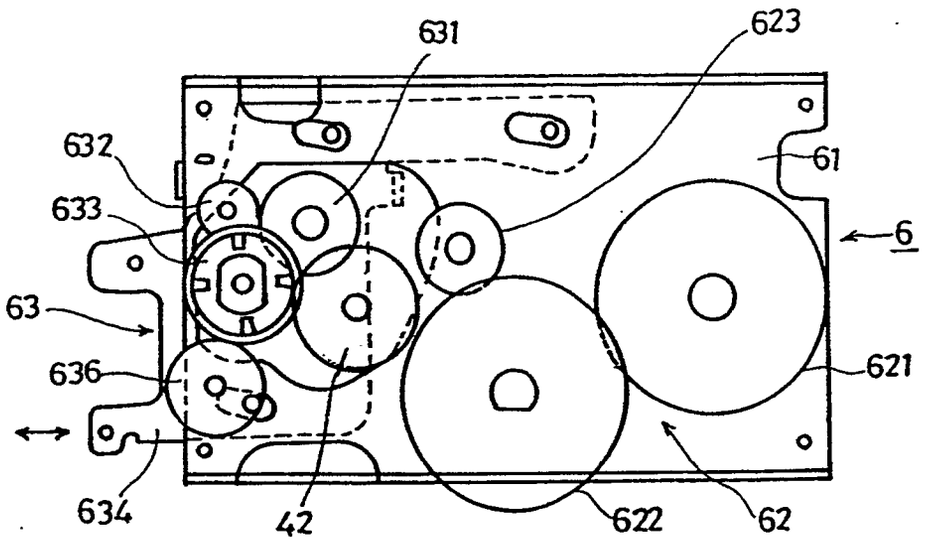
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Fig. 3

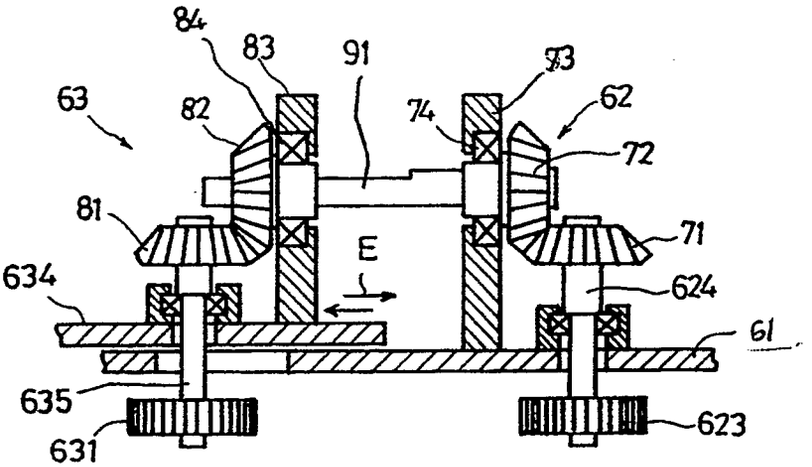
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Fig.4

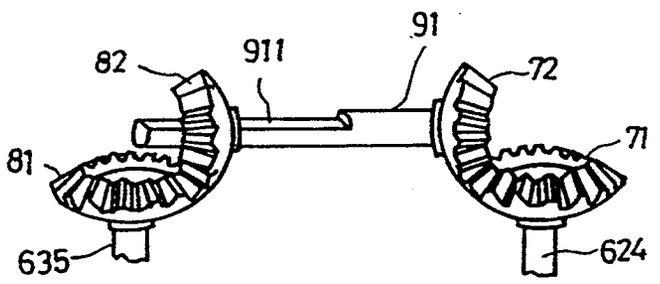
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Fig.5

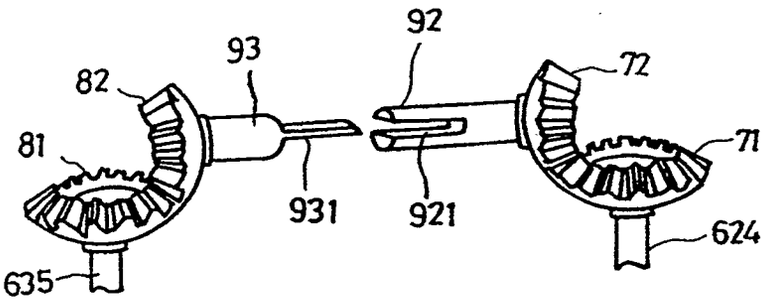
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Fig.6

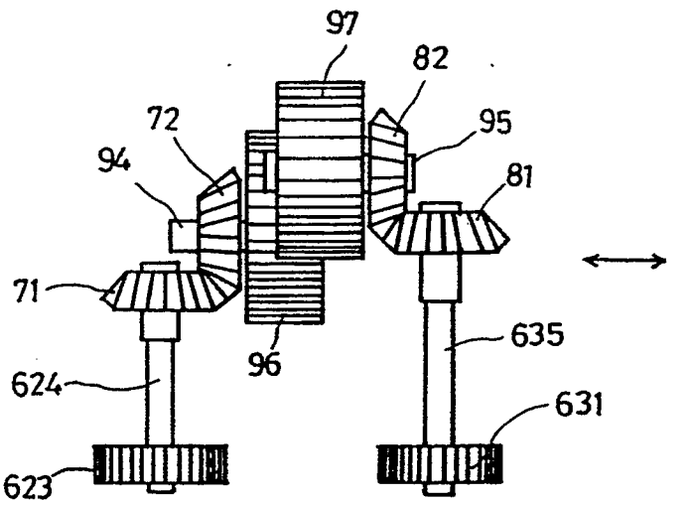
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Fig.7

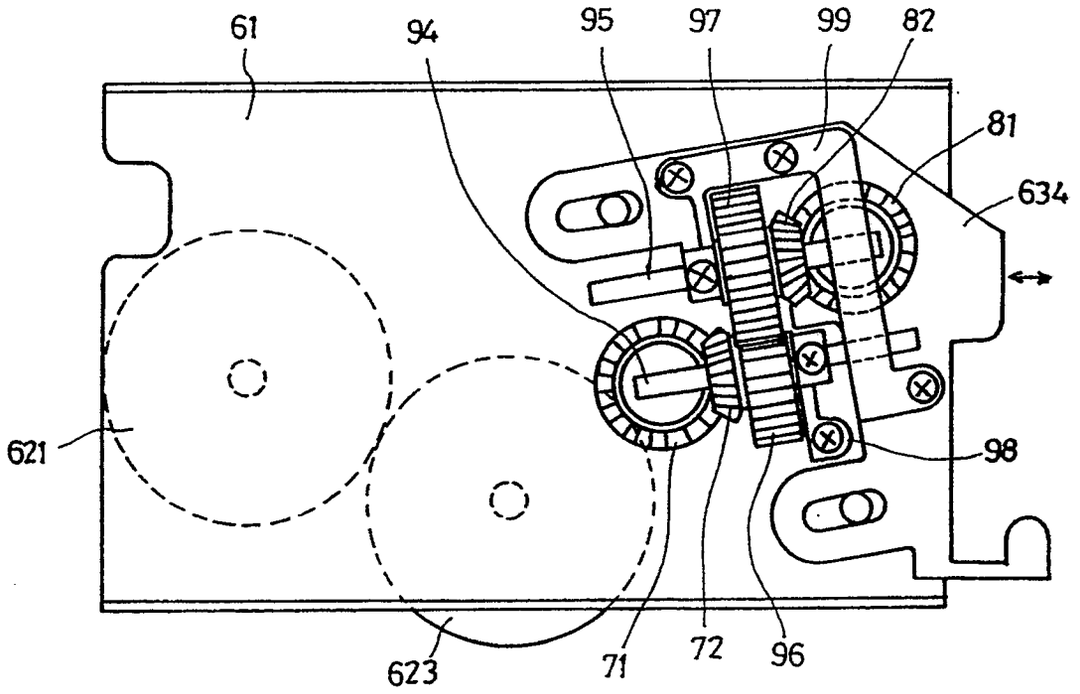
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Fig. 8

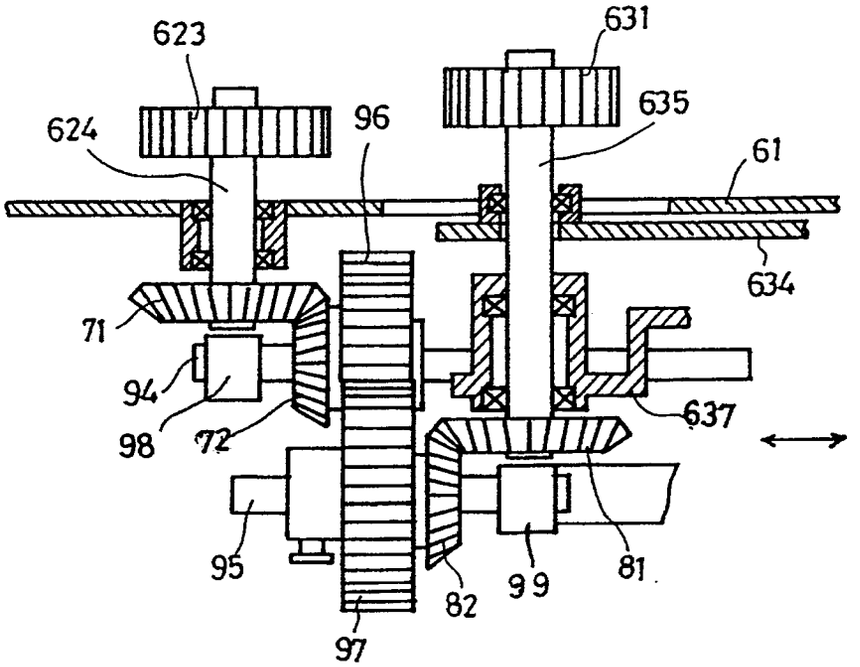
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Fig. 9

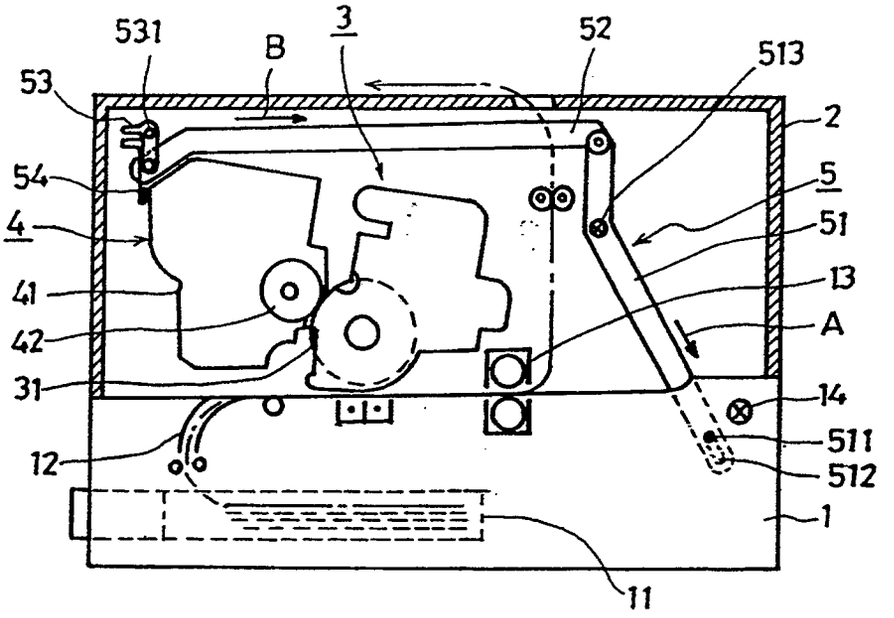

Fig.10A

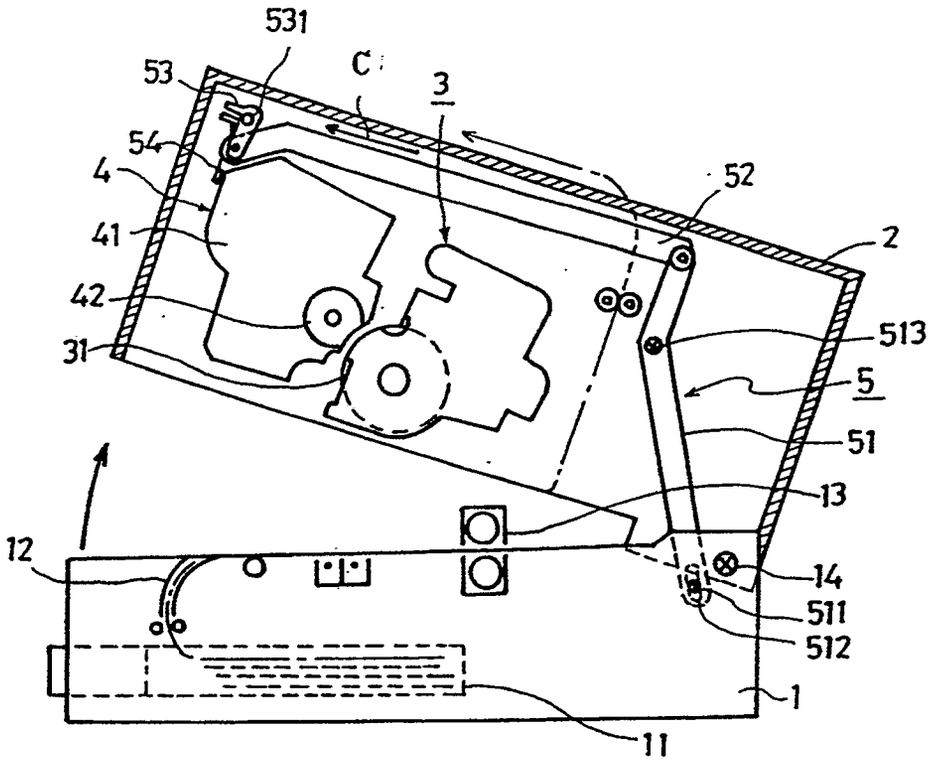

Fig 10B

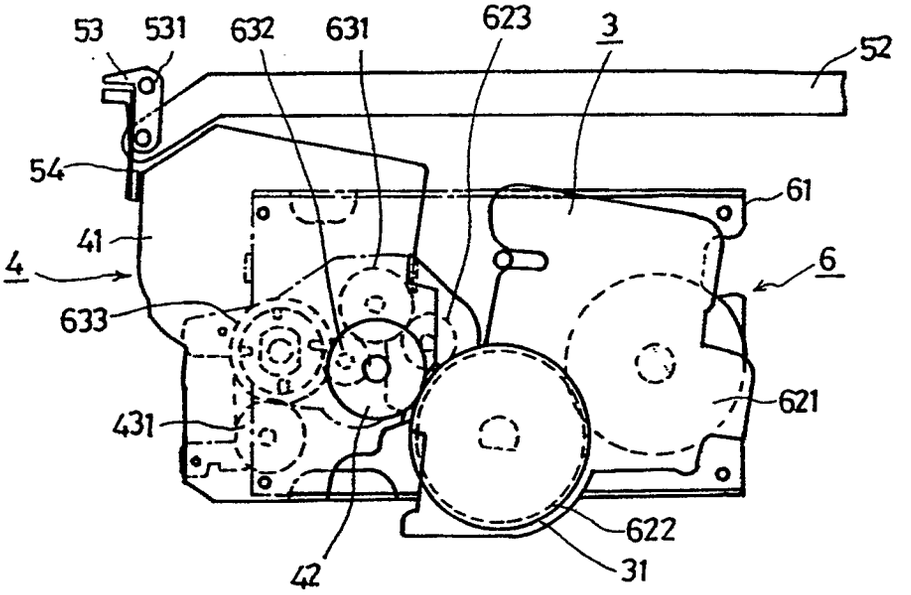

Fig.11A

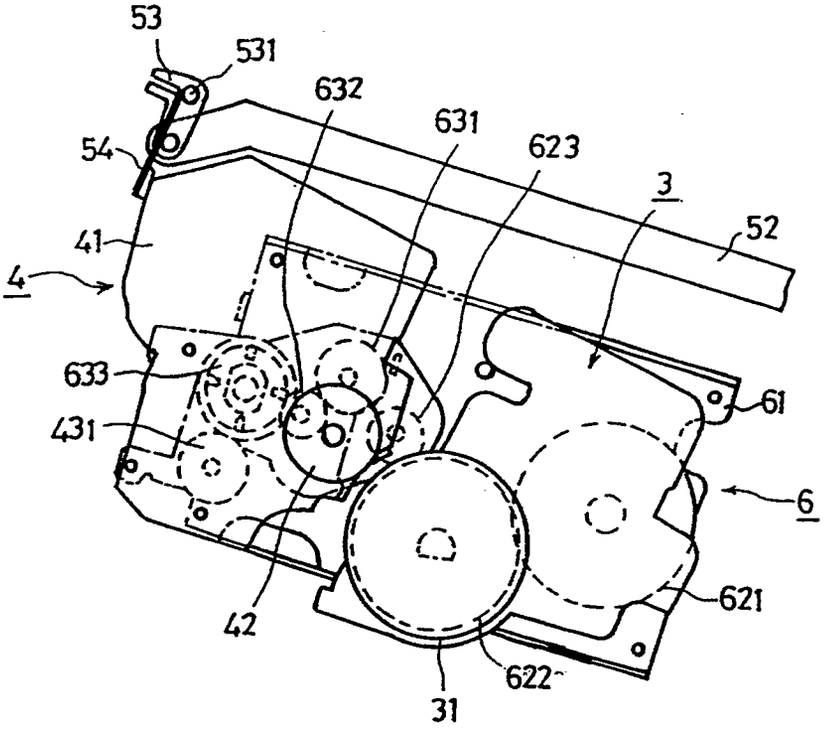

Fig.11B

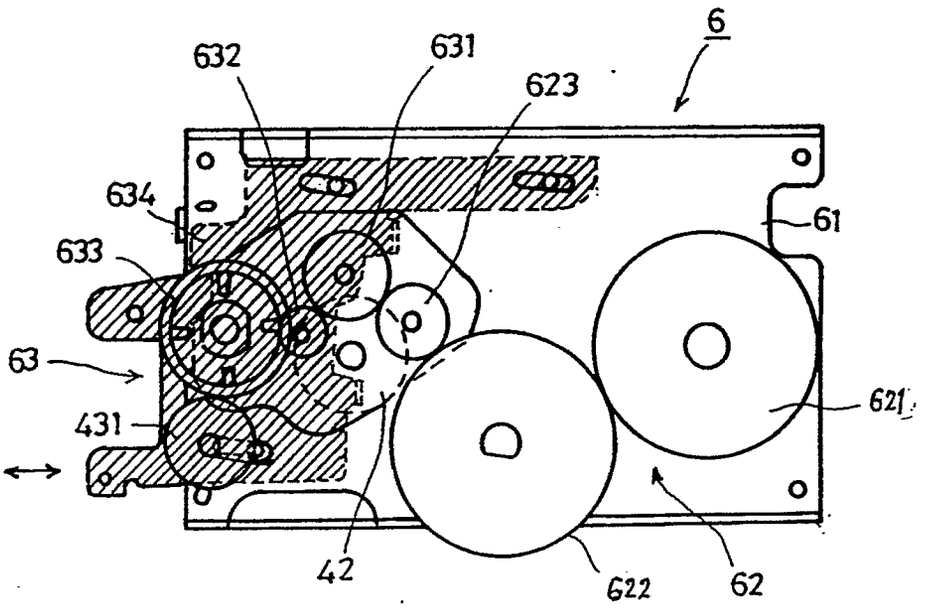

Fig. 12

INTERNATIONAL SEARCH REPORT

International Application No PCT/JP90/00619

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl[5] G03G15/00, 101, F16H1/26, F16H1/14

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System [8]	Classification Symbols
IPC	G03G15/00, 101, F16H1/26, F16H1/14

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [9]

Jitsuyo Shinan Koho	1926 - 1990
Kokai Jitsuyo Shinan Koho	1971 - 1990

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	JP, A, 62-280866 (Canon Inc.), 5 December 1987 (05. 12. 87), Lines 8 to 17, column 7, lines 9 to 17, column 8 (Family: none)	1 - 4
A	JP, A, 1-120458 (Canon Inc.), 12 May 1989 (12. 05. 89), Lines 7 to 12, column 6 (Family: none)	1 - 4

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"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)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"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

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"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

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
August 10, 1990 (10. 08. 90)	August 20, 1990 (20. 08. 90)
International Searching Authority	**Signature of Authorized Officer**
Japanese Patent Office	