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(54) **Sheet cutting apparatus**

(57) A sheet cutting apparatus is composed of a guide rail (21c) extending in a predetermined direction, a fixed blade (22) arranged in parallel with the guide rail (21c), a rotary blade (27) for rotating in contact with the fixed blade (22), a blade carriage (24) for rotatably supporting the rotary blade (27) and moving along the guide rail (21c), together with the rotary blade (27), and a driving mechanism (25, 30, 31) for driving the blade carriage (24) and the rotary blade (27) to cut a sheet supplied to the fixed blade (22). Particularly, the driving mechanism includes a single spherical rolling element (30) for rotating in contact with the guide rail (21c) and the rotary blade (27), and a rolling element supporting member (31) for supporting the spherical rolling element (30) within a space where the spherical rolling element (30) pushes a point of a rotary blade (27) plane except for a first straight line which extends in the predetermined direction through a center of the rotary blade (27) and a second straight line which extends in a direction perpendicular to the first straight line through the center of the rotary blade (27).

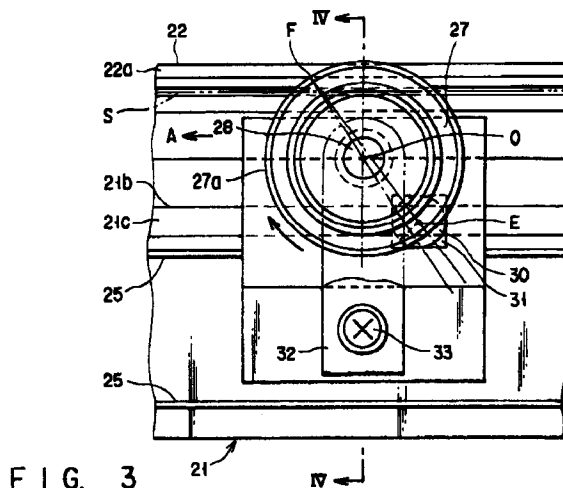


FIG. 3

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Description

The present invention relates to a sheet cutting apparatus for cutting a printed sheet in a facsimile apparatus, and more particularly, to a sheet cutting apparatus in which a rotary blade and a fixed blade are used for cutting a sheet.

For example, in a facsimile apparatus which performs a thermal transfer printing on a rolled sheet of recording paper, there is provided a sheet cutting apparatus for cutting the recording paper. A conventional sheet cutting apparatus of this kind is disclosed in Japanese Patent Application KOKAI Publication No. 5-200694.

FIGS. 6 and 7 show the conventional sheet cutting apparatus. In these figures, a reference 1 denotes a support member provided on a frame 2. The support member 1 is engaged with a feed screw 3 and movable in the sheet cutting direction. A reference 4 denotes a rotary blade of a disc shape which has a shaft 5 rotatably supported by the support member 1. A reference 6 denotes a long fixed blade which extends in the sheet cutting direction and is brought into contact with the rotary blade 4 to cut a sheet S. The rotary blade 4 is supported under the pressure externally applied from a spring plate 11 mounted on the support member 1.

A reference 7 denotes a roller-type rolling element having a shaft 8 which serves as the center axis of the element 7 and projects from both ends of the element 7. The rolling element 7 is placed in a groove 9 formed in the support member 1 and extending to both sides of the shaft 5 of the rotary blade 4 in the sheet cutting direction. The bottom portion of the groove 9 is opened to expose a flat guide rail 10 provided on the frame 2. Shaft bearings 9a are formed to support the shaft 8 of the rolling element 7 on both sides of the bottom portion of the groove 9. The roller-type rolling element 7 is movably and rotatably supported by shaft bearings 9a of the groove 9 via the shaft 8. Further, the rolling element 7 is maintained to be in contact with the guide rail 10 exposed at the bottom portion of the groove 9, and the back surface of the rotary blade 4.

Specifically, when the roller-type rolling element 7 is moved along with the support member 1, the rolling element 7 is rotated by the guide rail 10 being in contact therewith and simultaneously rotates the rotary blade 4 being in contact therewith. At this time, the shaft 8 of the rolling element rotates on the shaft bearings 9a of the groove 9. In addition, when the roller-type rolling element moves in the groove 9, the shaft 8 moves on the shaft bearings 9a by rotation. Note that a contact point Q between the rotary blade 4 and the rolling element 7 is positioned behind a line extending to connect the rotation center of the rotary blade 4 and a contact point P between the rotary blade 4 and the fixed blade 6, in the moving direction of the support member 1.

Further, the feed screw 3 is rotated by an electric motor not shown, to move the support member 1 in a direction A or B. For example, when the support mem-

ber 1 moves in the direction A, the roller-type rolling element 7 is moved to an end portion of the groove 9 in the direction B, and then pushed by the support member 1. At this position, the rolling element 7 is continuously rotated around the shaft 8 on the shaft bearings by the guide rail 10 being in contact therewith. As the rolling element 7 rotates, the rotary blade 5 is rotated in contact with the fixed blade 6 to cut a sheet S passing through a position between the rotary blade 4 and the fixed blade 6.

In the conventional sheet cutting apparatus constructed as described above, there is a problem as will be described below.

This apparatus uses a roller-type rolling element 7 having a shaft 8 which projects from both ends of the element 7 as means for allowing a rotary blade 4 to rotate in accordance with a movement of the support member 1. Therefore, the shaft bearings 9a for supporting the shaft 8 must be formed in a groove 9 of the support member 1. That is, the structure of the groove 9 becomes complicated to support the roller-type rolling elements 7, and requires a high manufacturing cost.

When the support member 1 moves, the roller-type rolling element receives a frictional resistance caused by a contact between the shaft bearings 9a of the groove 9 and the shaft 8, in addition to a frictional resistance which is caused by a contact of the roller-type rolling element 7 with other parts such as a guide rail 10, so that the frictional resistance applied to the roller-type rolling element 7 is increased. As a result, the roller-type rolling element 7 with the shaft cannot be smoothly rotated when the support member 1 moves, resulting in that the rotary blade 4 is rotated at a low efficiency by moving the support member 1 so as to rotate the roller-type rolling element 7.

Further, the roller-type rolling element 7 can not be rotated in a direction other than that defined by the orientation of the rolling element due to the shaft 8. In FIG. 6, the roller-type rolling element 7 is provided such that the shaft 8 is oriented in the direction perpendicular to the moving direction of the support member 1. However, the rotary blade 4 is provided such that the shaft 5 projects at right angles with respect to the shaft 8. Since the rotation direction of the roller-type rolling element 7 depends on the moving direction of the support member 1, the rotary blade 4 cannot be efficiently rotated by means of the rotation torque of the roller-type rolling element 7.

Note that a rolling element for rotating a rotary blade is also disclosed in Japanese Utility Model Application KOKAI Publication No. 5-53890 and Japanese Utility Model Application KOKAI Publication No. 6-15595. The rolling element has a shaft, like in Japanese Patent Application KOKAI Publication No. 5-200694. Therefore, similar problems arise in the same manner as described above.

An object of the present invention is to provide a sheet cutting apparatus which is capable of smoothly rotating a rotary blade without requiring a complicated

structure.

According to the present invention, there is provided a sheet cutting apparatus which comprises a guide rail extending in a predetermined direction; a fixed blade arranged in parallel with the guide rail; a rotary blade for rotating in contact with the fixed blade; a blade carriage for rotatably supporting the rotary blade and moving along the guide rail, together with the rotary blade; and a driving mechanism for driving the blade carriage and the rotary blade to cut a sheet supplied to the fixed blade; wherein the driving mechanism includes a single spherical rolling element for rotating in contact with the guide rail and the rotary blade, and a rolling element supporting member for supporting the spherical rolling element within a space where the spherical rolling element pushes a point of a rotary blade plane except for a first straight line which extends in the predetermined direction through a center of the rotary blade and a second straight line which extends in a direction perpendicular to the first straight line through the center of the rotary blade.

In the sheet cutting apparatus, the driving mechanism includes a single spherical rolling element and a rolling element supporting member. The spherical rolling element rotates in contact with the guide rail and the rotary blade. The rolling element supporting member supports the spherical rolling element within a space where the spherical rolling element pushes a point of a rotary blade plane except for a first straight line which extends in the predetermined direction through a center of the rotary blade and a second straight line which extends in a direction perpendicular to the first straight line through the center of the rotary blade. As the blade carriage moves, the spherical rolling element is rotated by the guide rail being in contact therewith to rotate the rotary blade being in contact therewith and moving together with the blade carriage. Since the spherical rolling element has no shaft, the rotation direction thereof is not restricted. Therefore, no shaft bearing is required to be formed in the rolling element supporting member. This simplifies the structure of the rolling element supporting member and reduces the manufacturing cost.

In addition, when the spherical rolling element moves together with the blade carriage, rotation of the rolling element is not influenced due to a friction between a shaft and other components. Since the frictional resistance produced when the rolling element is rotated is small, the spherical rolling element can rotate smoothly, thereby efficiently transmitting its rotation torque to the rotary blade.

Moreover, since the spherical rolling element is rotatable in various directions, when the blade carriage moves, the spherical rolling element can be rotated in a direction inclined along the rotation direction of the rotary blade determined by the moving direction of the blade carriage. As a result of this, the rotation torque of the spherical rolling element can be transmitted to the rotary blade with high efficiency.

This invention can be more fully understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a front view showing a sheet cutting apparatus according to a first embodiment of the present invention;

FIG. 2 is a plan view showing the sheet cutting apparatus of FIG. 1;

FIG. 3 is a front view showing a blade carriage shown in FIG. 1, in detail;

FIG. 4 is a cross-section of the blade carriage cut along a line IV-IV in FIG. 3;

FIG. 5 is a front view showing the blade carriage of a sheet cutting apparatus according to a second embodiment of the present invention;

FIG. 6 is a front view showing the blade carriage of a conventional sheet blade apparatus; and

FIG. 7 is a cross-section of the blade carriage shown in FIG. 6.

A sheet cutting apparatus according to a first embodiment of the present invention will now be explained with reference to the accompanying drawings.

FIGS. 1 and 2 show an overall structure of the sheet cutting apparatus, and FIGS. 3 and 4 more specifically show a blade carriage. The sheet cutting apparatus according to the present embodiment is, for example, used to cut a rolled sheet of recording paper in its widthwise direction in a facsimile apparatus which performs a thermal printing on the recording paper sheet. In addition, the sheet cutting apparatus according to the present embodiment performs cutting when the blade carriage moves in a direction A.

In FIG. 1 or 4, the reference 21 denotes a frame which has a span corresponding to the width of a paper sheet S to be cut and is provided horizontally in the widthwise direction of the sheet S. A sheet receive section 21a is formed in one side edge portion of the frame 21 and extends in the lengthwise direction of the frame 21 to receive the sheet S. A blade carriage receive section 21b and a rolling element guide rail 21c are formed below the sheet receive section 21a and extend in the lengthwise direction of the frame 21. Each of these components 21a to 21c has at least a span equivalent to the width of the sheet S to be cut.

A reference 22 denotes a fixed blade which extends to have a span equivalent to the width of the sheet S to be cut. A longitudinal side edge portion of the blade 22 is formed to serve as a cutting section 22a. The fixed blade 22 is oriented such that the cutting section 22a is positioned to face one side edge portion of the frame 21, and is arranged horizontally above the sheet receive section 21a of the frame 21, with a predetermined distance inserted therefrom. The fixed blade 22 is fixed to the frame 21 by bolts 23 provided at both end portions of the blade 22. The sheet S is fed in a direction C perpendicular to the lengthwise direction of the frame 21,

as shown in FIGS. 2 and 3, and passes a position between the fixed blade 22 and the sheet receive section 21a. A reference 24 is a blade carriage which has a projecting portion 24a, as shown in FIG. 4. The blade carriage 24 is positioned on one side of the frame 21, and supported by fitting such that the projecting portion 24a can freely slide on the blade carriage receive section 21b of the frame. As a result of this, the blade carriage 24 is brought into movable in directions A and B corresponding to the sheet cutting direction.

As shown in FIGS. 1 to 4, the frame 21 is provided with a device for driving the blade carriage 24. For example, a reference 25 denotes a belt which is connected to the blade carriage 24 and wound around pulleys 26A and 26B rotatably mounted on both end portions of the frame 21 in the lengthwise direction of the frame 21. The pulley 26A is rotated by an electric motor (not shown) which is mounted on the frame 21. Therefore, when the pulley 26A is rotated by the electric motor, the belt 25 is applied with a rotation torque so that the other pulley 26B is rotated together with the belt 25. As the belt 25 rotates, the blade carriage 24 moves in the lengthwise direction of the frame 21 (or in the horizontal direction). A reference 27 denotes a rotary blade of a disc shape. The entire circumferential portion of the rotary blade 27 serves as a cutting section 27a. The rotary blade 27 has a cylindrical shaft 28 projecting from the center thereof as shown in FIG. 4. This rotary blade 27 is arranged on one side of the blade carriage 24, and the shaft 28 is horizontally inserted in a support hole 29 which is formed in the blade carriage 24 to rotatably support the shaft 28. The support hole 29 is a circular hole which is set perpendicular to the surface of the frame 21, and has a diameter slightly greater than the diameter of the shaft 28 so that the rotary blade 27 is can be inclined to have a contact with the fixed blade 22. Specifically, the shaft 28 can be inclined toward all the circumferential direction around the center axis of the support hole 29.

As shown in FIGS. 3 and 4, a reference 30 denotes a spherical rolling element formed of a ball which is truly spherical and has no shaft. The spherical rolling element 30 is rotatably engaged and supported by a rolling element support section 31 formed in the blade carriage 24. As the blade carriage 24 moves, the spherical rolling element 30 moves together and is rotated to be freely slid in contact with a rolling element guide rail 21c of the frame 21 and also kept in contact with a back surface of the rotary blade 27, to rotate the rotary blade 27.

The spherical rolling element 30 is supported within a space where the rolling element 30 pushes the back surface of the rotary blade 27 at a point E. Specifically, the space is located below the shaft 28 of the rotary blade 27 and on the downstream side of the shaft 28 in the direction A, in which the blade carriage 24 is moved.

The rotary blade 27 is universally movable around a semi-spherical center projection thereof, and inclined by the rolling element 30 such that the cutting section 27a is brought into contact with the cutting section 22a of the

fixed blade 22 at a point F. Specifically, a portion of the cutting section 27a which is located above the shaft 28 and on the upstream side of the shaft 28 in the direction A is lifted down to the cutting section 22a of the fixed blade 22. The rolling element support section 31 is formed at a position where the spherical rolling element 30 is moved and rotated in the above condition.

The rolling element support section 31 is a concave portion which has four side walls defining a square opening in one surface of the blade carriage 24. The spherical rolling element 20 is accommodated in the space surrounded by the four side walls. Each of the four side walls is formed to be flat so that only a point thereof can be brought into contact with the spherical rolling element 20. In addition, the bottom of the concave portion is opened to expose the rolling element guide rail 21c of the frame 21. That is, a point of the rolling element guide rail 21c is brought into contact with the spherical rolling element 30 supported by the rolling element support section 31. In this manner, the rolling element 30 is made rotatable without suffering any limitation to its rotating direction. The diameter of the spherical rolling element 30 is determined such that the rolling element 30 is slightly spaced from the four side walls and projects from the opening to have a contact with the back surface of the rotary blade 27.

A reference 32 is a rotary blade press member made of a metal spring plate. As shown in FIGS. 3 and 4, the rotary blade press member 32 is positioned outside the rotary blade 27, and an end of this member 32 is in contact with the semi-spherical center projection of the rotary blade 27 while the other end of the rotary blade press member 32 is fixed to the blade carriage 24 by means of a bolt 33. Thus, the rotary blade press member 32 presses, at one end, the rotary blade 27 from outside against the blade carriage 24.

As shown in FIG. 3, the rotary blade 27 thus pressed by the rotary blade press member 32 is inclined with kept in contact at a point E with the spherical rolling element 30 engaged and supported in the rolling element support section 31, so that the cutting section 27a has a contact with the cutting section 22a of the fixed blade 22 at a point F. Specifically, a portion of the cutting section 27a which is located above the shaft 28 and on the upstream side of the shaft 28 in the direction A is lifted down to the cutting section 22a of the fixed blade 22. In this case, the shaft 28 of the rotary blade 27 together with the rotary blade 27 is inclined within the hole 29 of the blade carriage 24, thereby allowing the rotary blade 27 to be inclined.

Now will be explained the operation of the sheet cutting apparatus constructed in the structure described above.

At first, the blade carriage 24 is positioned at the right end of the frame 21 in FIGS. 1 and 2. A sheet S is fed in the direction C shown in FIGS. 2 and 4, and passes a position between the sheet receive section 21a and the fixed blade 22. Then, the pulley 26A is rotated by the electric motor to travel the belt 25 in the

manner described above, thereby horizontally moving the blade carriage 24 in the direction A, which is identical to the lengthwise direction of the blade carriage receive section 21b in FIGS. 1 to 3.

As the blade carriage 24 is moved, the spherical rolling element 30 is moved together with the carriage 24, in contact with the rolling element guide rail 21c of the frame 21. Therefore, the spherical rolling element 30 is rotated due to a friction against the rolling element guide rail 21c. Further, the rotary blade 27 is applied with a rotation torque by a friction against the spherical rolling element 30 thus being rotated, and is thereby rotated around the shaft 28 in the direction indicated by an arrow in FIG. 3. The rotary blade 27 is moved along the cutting section 22b of the fixed blade 22 in the lengthwise direction. The cutting section 22b is kept in contact with an upper end of the rotary blade 17 rotated while moving. The rotary blade 27 is inclined such that a portion of the cutting section 27a which is located above the shaft 28 and on the upstream side of the shaft 28 in the direction A is lifted down to the cutting section 22a or the fixed blade 22 at a point F. Due to this inclination of the rotary blade 27, the sheet S is cut with a less shearing force. Further, cutting of the sheet S is continued while the blade carriage 24 moves a distance corresponding to the entire width of the sheet S.

According to the embodiment, the sheet cutting apparatus described above uses a spherical rolling element 30 rotatably supported by the support section 31 as means for rotating the rotary blade 28 in accordance with a movement of the blade carriage 24. Since there is no shaft in the spherical rolling element 30, the rotation direction of the spherical rolling element 30 can be prevented from being specified. In this case, shaft bearings for the rolling member are not required to be formed in the support section 31. This simplifies the structure of the rolling element support section 31 and reduces the manufacturing cost.

In addition, when the spherical rolling element 30 moves together with the blade carriage 24, the spherical rolling element 30 is not applied with such a frictional resistance as would have been caused if the spherical rolling element 30 had a shaft and had a contact with any other components. This reduces the frictional resistance produced when the spherical rolling member 30 rotates according to the movement thereof.

Therefore the spherical rolling element 30 can rotate smoothly, thereby efficiently transmitting its rotation torque to the rotary blade 27.

Further, the rotation direction of the spherical rolling element 30 is not restricted since the element does not have a shaft. As a result of this, the spherical rolling element 30 is rotated in a direction inclined toward the rotating direction (indicated by an arrow in FIG. 3) of the rotary blade 27 with respect to the moving direction of the blade carriage 24. Therefore, the spherical rolling element 30 can efficiently transmit its rotation torque to the rotary blade 27 with a high efficiency.

In particular, the spherical rolling element 30 is

freely supported in the support section 31 by contact on points, and hence, the spherical rolling element 30 is supported with the smallest frictional resistance applied by such contact on points. Since the spherical rolling element 30 rotates very smoothly, efficient transmission of the rotation torque to the rotary blade 27 can be maintained.

Note that the shape of the rolling element support section 31 of the blade carriage 24 is not limited to a shape shown in the figure, but may be modified into various shapes such as a cross or like.

The following explanation will be made to a sheet cutting apparatus according to a second embodiment. This sheet cutting apparatus will be constructed in the same structure as that of the first embodiment, except for the following respect. FIG. 5 shows a blade carriage 24 for the sheet cutting apparatus. In FIG. 5, the same portions as those in FIG. 3 are denoted by the same references.

In the sheet cutting apparatus of the present embodiment, the rotary blade 27 cuts a sheet S not only when the blade carriage 24 moves in the direction A but also when the blade carriage 24 moves in the direction B in FIG. 5.

The blade carriage 24 has a rolling element support section 41 of a groove shape which is located below the shaft 28 of the rotary blade 28 and extends in directions A and B, that is, on the both sides of the shaft 28. The rolling element support section 41 is formed such that a spherical rolling element 30 is movably and rotatably engaged therein. The longitudinal side walls of the rolling element support section 41 have flat surfaces to be in contact with the spherical rolling element 30 on points. The bottom portion of the rolling element support section 41 is opened like in the first embodiment, and the spherical rolling element 30 is in contact with the rolling element guide rail 21c of the frame 21.

The rolling element support member 41 of a groove shape has an end space 41a located below the shaft 28 of the rotary blade 24 and on one side of the shaft 28 in the direction B, in which the blade carriage moves. The spherical rolling element 30 is placed in the end space 41a to push the back surface of the rotary blade 27 at a point E. The other end space 41b of the rolling element support section 41 is located below the shaft 28 and on the side of the shaft 28 in the direction A. The spherical rolling element 30 is placed in the end space 41b to push the back surface of the rotary blade 27 at a point Ea. when the blade carriage 24 moves in the direction A shown in FIG. 5, the spherical rolling element 30 is placed at the end space 41a of the rolling element support section 41, as indicated by a continuous line in FIG. 5. Therefore, the rotary blade 27 pushed by the spherical rolling element 30 is inclined such that a portion of the cutting section 27a which is located above the shaft 28 and on the upstream side of the shaft 28 in the direction A is lifted down to the cutting section 22a of the fixed blade 22 at a point F. In this case, the sheet S is cut in the same manner as that of the first embodiment.

When the blade carriage 24 moves in the direction B shown in FIG. 5., the spherical rolling element 30 is placed at the end space 41b of the rolling element support section 41, as indicated by a dotted dash line in FIG. 5. Therefore, the rotary blade 27 pushed by the spherical rolling element 30 is inclined such that a portion of the cutting section 27a which is located above the shaft 28 and on the upstream side of the shaft 28 in the direction B is lifted down to the cutting section 22a of the fixed blade 22 at a point G. In this case, the sheet S is cut in the same manner as that of the first embodiment.

According to the structure as described above, when the blade carriage 24 moves in one of the directions A and B, the spherical rolling element 30 moves in the direction opposite to the moving direction of the blade carriage 24, within the rolling element support section 41 of the blade carriage 24. The spherical rolling element 30 pushes the rotary blade 27 and causes the rotary blade 27 to be inclined such that the rotary blade 27 is kept in contact with the fixed blade 22 at a point depending on the moving direction of the blade 27. Therefore, the present embodiment has an advantage that the sheet S can be cut when the blade carriage 24 is moved in either direction, in addition to advantages obtained in the first embodiment described above.

Note that the present invention is not limited to the embodiments as described above, but can be variously modified in practice. In the embodiments described above, the fixed blade 22 have a length not less than the width of the sheet to be cut. However, such a long blade is not required to be mounted on the frame 21 if a short fixed blade is mounted on the blade carriage 24 to have a contact with the rotary blade 27 and the blade carriage 24 is moved together with the rotary blade 27 and the short fixed blade, for example. In the above embodiments, although the fixed blade 22 is disposed at an upper portion of the frame 21 while the spherical rolling element 30 is provided below the shaft 28 of the rotary blade 27. However, the fixed blade may be provided below the frame 21, while the spherical rolling element 30 may be provided above the shaft 28 of the rotary blade 27.

As described above, in the sheet cutting apparatus of the present invention, the driving mechanism includes a single spherical rolling element and a rolling element supporting member. The spherical rolling element rotates in contact with the guide rail and the rotary blade. The rolling element supporting member supports the spherical rolling element within a space where the spherical rolling element pushes a point of a rotary blade plane except for a first straight line which extends in the predetermined direction through a center of the rotary blade and a second straight line which extends in a direction perpendicular to the first straight line through the center of the rotary blade. As the blade carriage moves, the spherical rolling element is rotated by the guide rail being in contact therewith to rotate the rotary blade being in contact therewith and moving together

with the blade carriage. Since the spherical rolling element has no shaft, the rotation direction thereof is not restricted. Therefore, no shaft bearing is required to be formed in the rolling element supporting member. This simplifies the structure of the rolling element supporting member and reduces the manufacturing cost.

In addition, when the spherical rolling element moves together with the blade carriage, rotation of the rolling element is not influenced due to a friction between a shaft and other components. Since the frictional resistance produced when the rolling element is rotated is small, the spherical rolling element can rotate smoothly, thereby efficiently transmitting its rotation torque to the rotary blade.

Moreover, since the spherical rolling element is rotatable in various directions, when the blade carriage moves, the spherical rolling element can be rotated in a direction inclined along the rotation direction of the rotary blade determined by the moving direction of the blade carriage. As a result of this, the rotation torque of the spherical rolling element can be transmitted to the rotary blade with high efficiency.

The spherical rolling element is freely supported in the supporting section by contact on points, and hence, the spherical rolling element is supported with the smallest frictional resistance applied by such contact on points. Since the spherical rolling element rotates very smoothly, efficient transmission of the rotation torque to the rotary blade can be maintained.

When the blade carriage moves in one of two opposite directions, the spherical rolling element moves in the direction opposite to the moving direction of the blade carriage. The spherical rolling element pushes the rotary blade and causes the rotary blade to be inclined such that the rotary blade is kept in contact with the fixed blade at a point depending on the moving direction of the rotary blade. Therefore, the sheet S can be cut when the blade carriage is moved in either direction.

Claims

1. A sheet cutting apparatus comprising:

- a guide rail (21c) extending in a predetermined direction;
- a fixed blade (22) arranged in parallel with the guide rail (21c);
- a rotary blade (27) for rotating in contact with the fixed blade (22);
- a blade carriage (24) for rotatably supporting the rotary blade (27) and moving along the guide rail (21c), together with the rotary blade (27); and
- a driving mechanism (25, 30, 31, 41) for driving the blade carriage (24) and the rotary blade (27) to cut a sheet supplied to the fixed blade (22);

characterized in that the driving mecha-

nism includes a single spherical rolling element (30) for rotating in contact with the guide rail (21c) and the rotary blade (27) to drive the rotary blade (27) according to a movement of the blade carriage (24), and a rolling element supporting member (31, 41) for supporting the spherical rolling element (30) within a space where the spherical rolling element (30) pushes a point of a rotary blade (27) plane except for a first straight line which extends in the predetermined direction through a center of the rotary blade (27) and a second straight line which extends in a direction perpendicular to the first straight line through the center of the rotary blade (27).

2. A sheet cutting apparatus according to claim 1, characterized in that said rolling element supporting member includes an opening (31, 41), formed in the blade carriage (24), for accommodating the spherical rolling element (30) set to be in contact with the guide rail (21c) and the rotary blade (27).
3. A sheet cutting apparatus according to claim 2, characterized in that said opening is an opening (31) which is accommodating the spherical rolling element (30) in a space where the spherical rolling element (30) pushes a point located on a third straight line which extends through the center of the rotary blade (27) and forms substantially a same angle with respect to each of the first and second straight lines.
4. A sheet cutting apparatus according to claim 2, characterized in that said opening has a flat surface which is brought into contact with a point of the spherical rolling element (30) as the blade carriage (24) moves.
5. A sheet cutting apparatus according to claim 2, characterized in that said opening is an opening (41) of a groove shape which extending on both sides of the second straight line in the predetermined direction to change a position of the spherical rolling element (30) when movement of the blade carrier is reversed in the predetermined direction.

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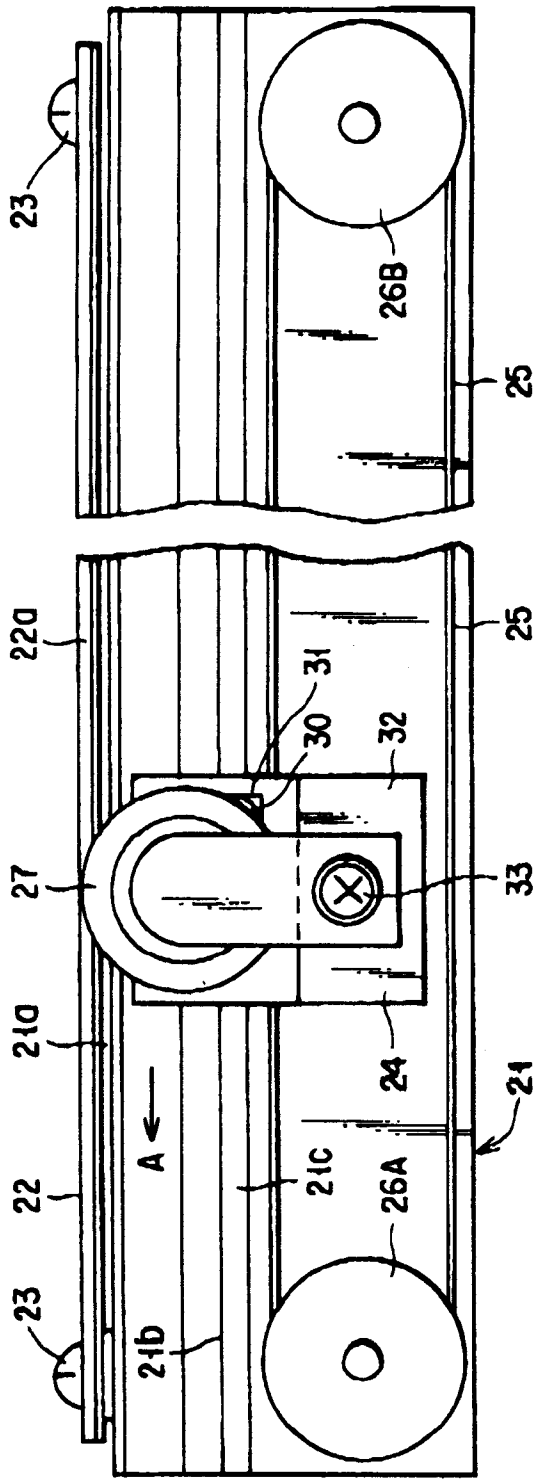


FIG. 1

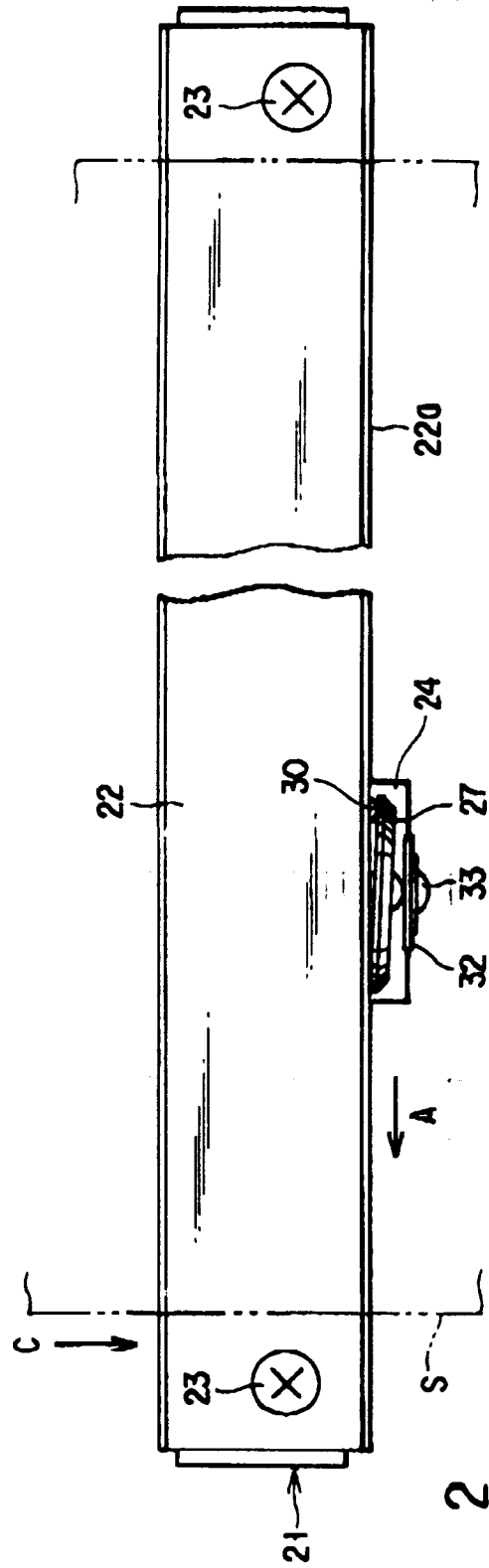
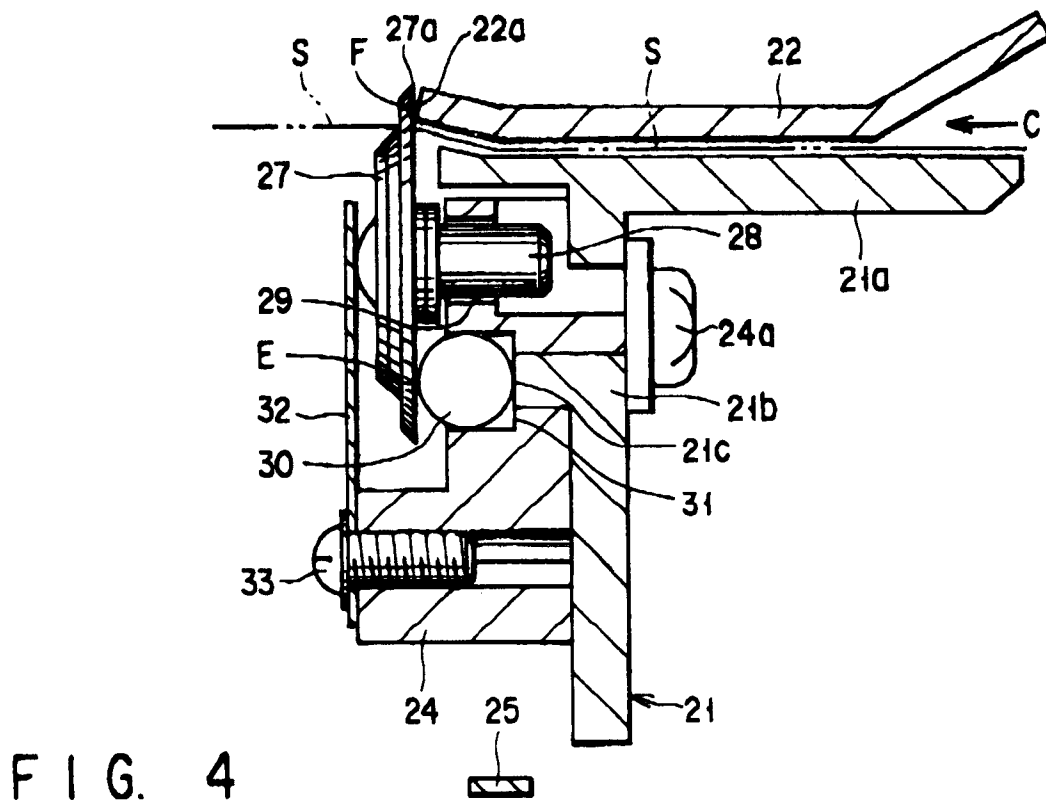
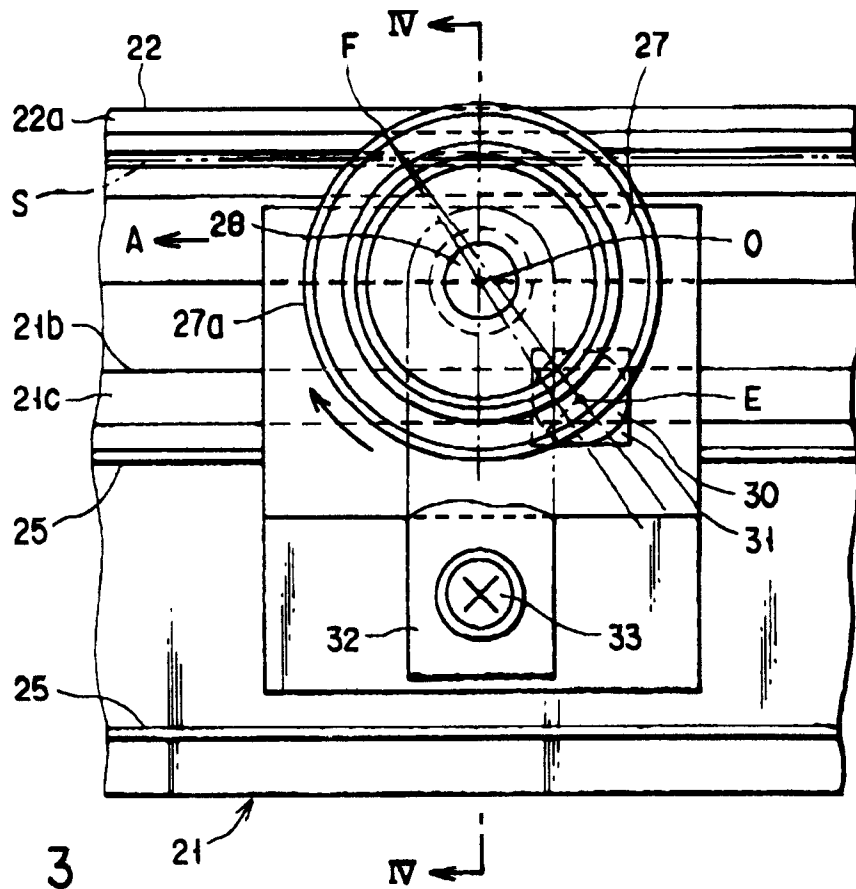


FIG. 2



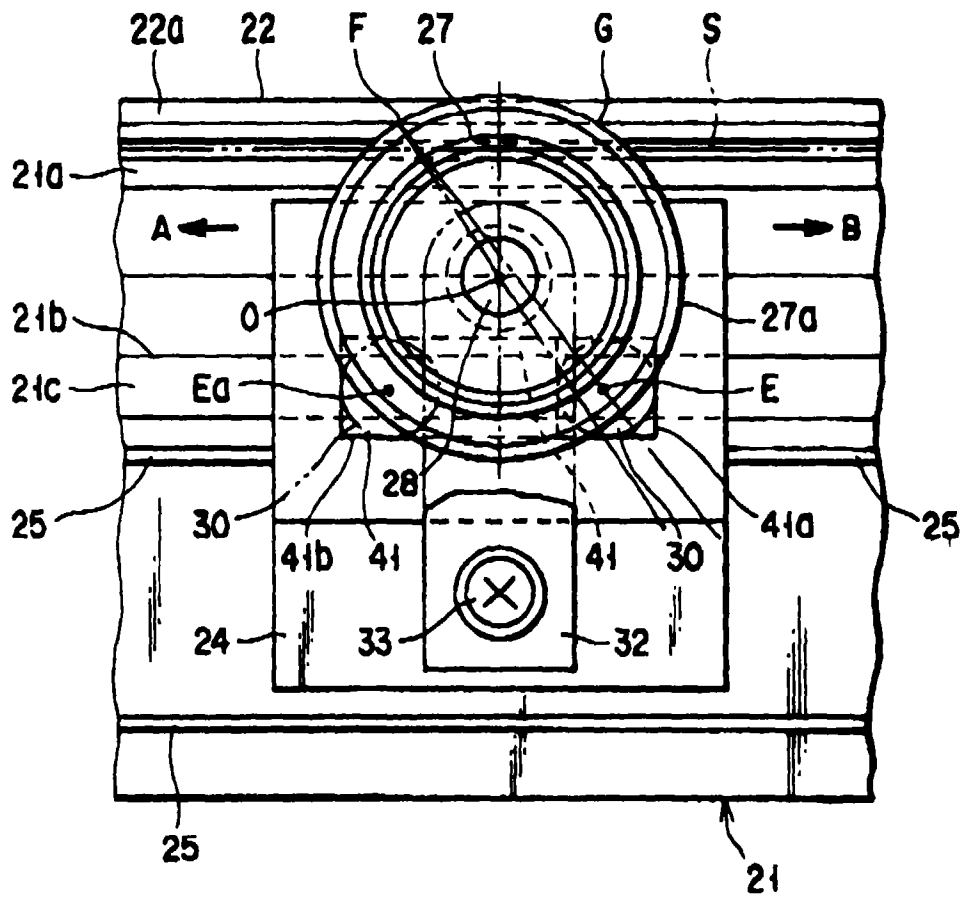


FIG. 5

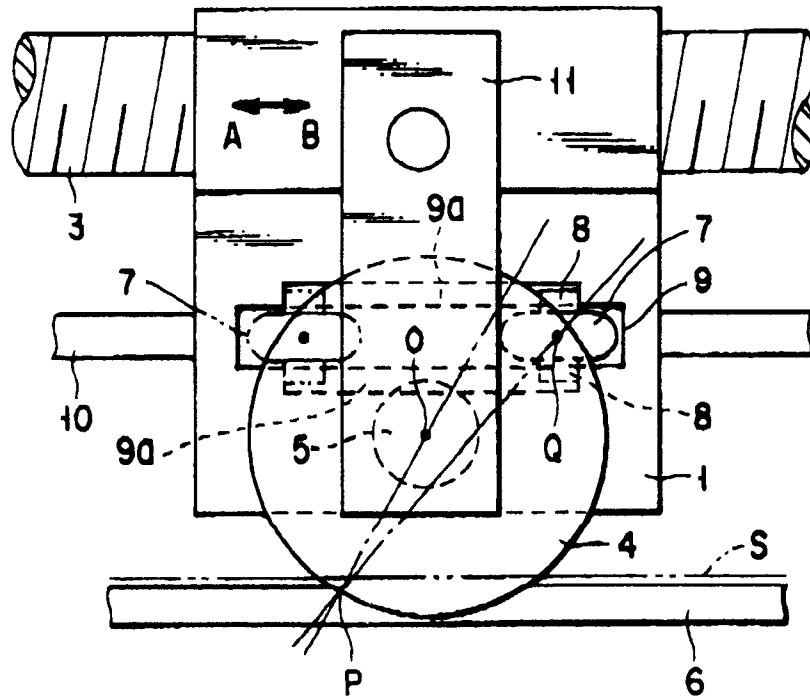


FIG. 6

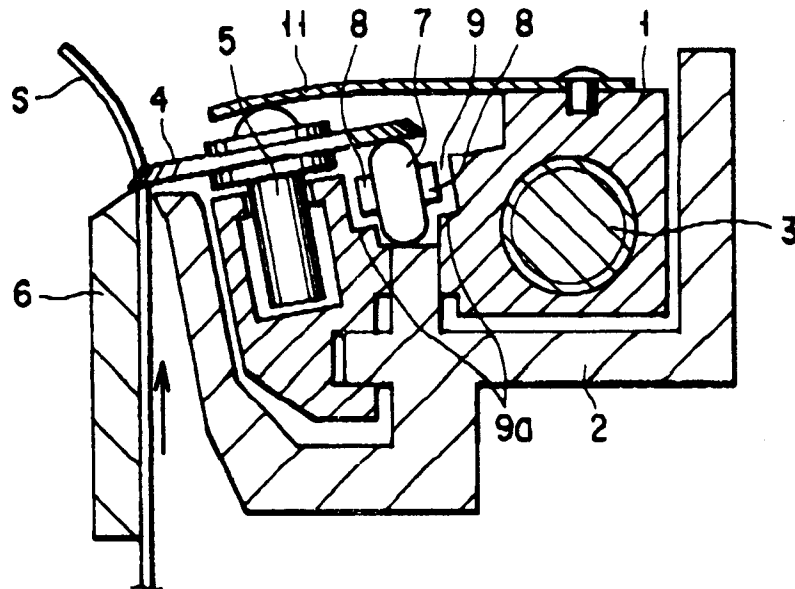


FIG. 7



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 12 0481

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.6)
D,A	JP 05 200 694 A (ONISHI) * figures *	1	B26D1/20
A	--- US 5 307 716 A (ONISHI ET AL.) -----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B26D B41J B65H
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		13 March 1997	Vaglienti, G
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