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(54) Form feeding tractor.

(57) A form feeding tractor feeds blank paper forms engaged with the pins (4) of a tractor belt (7) as it is held between the tractor chassis (9) and a cover (13) pivotably supported thereon. It has a drive sprocket (8) rotatably supported adjacent one end of the tractor chassis (9) and a belt guidance portion provided on the opposite end of the tractor chassis. The tractor belt (7) extends about the drive sprocket (8) and the belt guidance portion. A belt deflecting element is provided on the tractor chassis opposite the tractor cover and deflects the belt upwardly towards the cover to reduce the surface friction of the belt on the belt guidance portion.

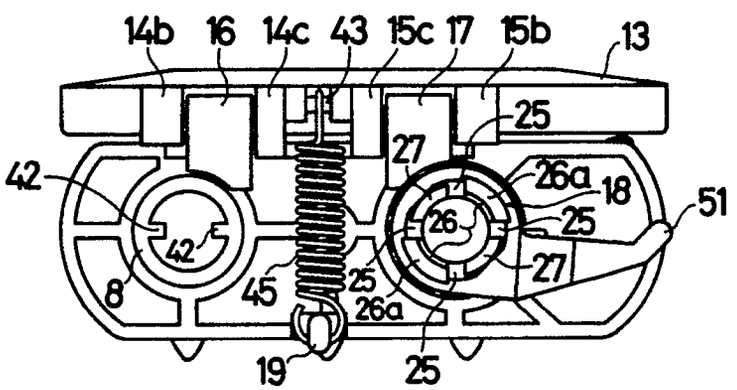

FIG. 2 1

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FORM FEEDING TRACTOR

BACKGROUND OF THE INVENTION

This invention relates to tractors for feeding continuous paper, especially for smaller printers.

Various types of printers and the like devices used as the output for computers employ tractors with a rotating endless tractor belt having pins which engage in perforations along both edges of the paper web or forms which are being printed.

Such tractors have been used in both large and small volume and high and low speed precision printers to provide in the movement of the paper web and to minimize requirements for the drive motors. Illustrative of such tractors are U.S. Patents No. 4,614,287, No. 4,735,352 and No. 4,790,466.

In smaller, lower speed printers, the motors are generally of lower power and accordingly provide lower driving torque to the pin tractor (generally less than 100 g/cm). To minimize the driving torque, it is desirable to provide an idler pulley on the idler side as is shown in Japanese Utility Model Registration Application Laid Open Gazette No. 62-102556. However, the provision of an idler pulley increases the number of parts and the steps for assembling, resulting in higher manufacturing costs.

In place of the idler pulley, some tractors employ a guide surface formed integrally with the tractor frame and the tractor belt slides over the guide surface. However, under load this results in relatively large frictional resistance to the sliding of the tractor belt and the driving torque becomes larger. Obviously, this does not meet the objective of using a motor with a small driving torque.

It is an object of the present invention is to provide a novel form feeding tractor which done not require a motor with a large driving torque.

It is also an object to provide such tractors which may be fabricated at relatively low cost and which are reliable in operation.

SUMMARY OF THE INVENTION

It has now been found that the foregoing and related objects may be readily attained in a form feeding tractor having a tractor chassis and an endless belt rotatably supported on the chassis. The belt has an inner driven surface and an outer driving surface and defines a closed path of travel about the chassis. On its outer driving surface the belt has drive pins adapted to engage in the perforations of a web passing through the tractor.

A tractor cover is pivotably mounted on the chassis and extends over the belt along the upper side of the path, and a drive sprocket is rotatably supported on the tractor chassis adjacent an end thereof and is drivingly engaged with the inner driven surface of the belt. The chassis has a belt guidance portion adjacent the other end of the chassis, and the belt path extends about the drive sprocket and the belt guidance portion. The chassis also has a belt deflecting portion thereon along the path of travel of the belt opposite from the cover, and it deflects the belt in the direction of the cover and reducing the contact between the belt and the surface of the belt guidance portion at the end opposite the drive sprocket.

In the preferred embodiment, the tractor chassis is comprised of a frame member having a cover support upon which the tractor cover is mounted, and a guide member which is fixedly engaged with the frame member. The frame member and the guide member have opposed ribs adjacent the lower edges thereof and the ribs have projections on the upper surface thereof intermediate their length to provide the belt deflecting portion. The belt deflecting portion is desirably elongated in the direction of belt travel.

Desirably, the frame member and the guide member have opposed ribs at the end thereof adjacent the drive sprocket which retain the belt in driving engagement with the drive sprocket, and the frame member and the guide member also have opposed ribs on the end thereof outwardly of the guidance portion to limit movement of the belt away therefrom.

Generally, the tractor has an aperture through the chassis and the sprocket for the associated drive shaft and an aperture in the chassis for the associated support shaft, and wherein the belt deflecting portion is provided on the chassis between the apertures therein.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a fragmentary perspective view of a tractor drive assembly using the tractors of the present invention to drive a perforated paper web therethrough;

Figure 2 is a front elevational view of a tractor of Figure 1 drawn to an enlarged scale;

Figure 3 is a top plan view thereof;

Figure 4 is an end elevational view thereof with the cover in partial section and shown in open position in phantom line;

Figure 5 is a top plan view of the frame member;

Figure 6 is an elevational view of the back surface of the frame member;

Figure 7 is a front elevational view of the guide member with other components being shown in

phantom line;

Figure 8 is a longitudinal sectional view of the guide member;

Figure 9 is a perspective view of the tractor belt;

Figure 10 is a perspective view of the drive sprocket;

Figure 11 is a top plan view of the tractor cover;

Figure 12 is a top plan view in partial cross section of the locking lever;

Figure 13 is a front view of the locking lever;

Figure 14 is a front elevational view in partial cross section of a modified embodiment of the tractor of the present invention; and

Figure 15 is a similar view of another embodiment.

DETAILED DESCRIPTION OF THE INVENTION

The paper feeding tractor assembly fragmentarily shown in Figure 1 is mounted on a printer (not shown), and it includes two tractors generally designated by the numeral 1 spaced apart a distance related to the width L of the paper web S. As is conventional, the assembly has a drive shaft 2, a guide shaft 3 which is circular in cross section, and the shafts 2, 3 are parallel. The drive shaft 2 is provided with diametrically axial spaced notches as shown by the numeral 2a for engagement with the drive sprockets 8 of the tractors 1. The drive motor (not shown) of the printer (not shown) effects rotation of the drive shaft 2 which in turn rotates the sprockets 8.

Each tractor 1 has an endless tractor belt generally designated by the numeral 7, and it has a plurality of pins 4 on its outer surface which engage in the perforations S1 along both edges of the paper web S and which project from the surface of the belt surface 5 at regular intervals. As can be seen, the paper web S is engaged on the pins 4 of the tractor belt 7 and is held between the tractor chassis 9 and the tractor cover 13. On the inner surface of the belt 7 are transversely extending gear teeth 6 which engage with the teeth 41 of the drive sprocket 8 (best seen in Figure 10). When the tractor belt 7 is rotated by the drive shaft 2, the paper web S is moved at a predetermined speed. To provide the driving engagement with the shaft 2, the bore 38 of the hub of the sprocket 8 has a pair of diametrically opposed ribs 42 which engage in the notches 2a of the shaft 2.

The tractor chassis 9 is fabricated from symthetic resin ans is comprised of the frame member generally designated by the numeral 10 and the guide member generally designated by the numeral 11 and which are fixedly engaged as shown in Figure 4. Pivotably supported on the chassis 9 is the cover generally designated by the numeral 13.

As shown in Figures 5 and 6, the frame member 10 has an elongated base plate portion 12 with parallel top and bottom edges and convexly arcuate ends. Projecting from one face of the base plate portion 12 are the cover support elements 16, 17, the spring mounting post 19 and the lock post 18. An assembly pin 20 projects from the other or back surface of the base plate portion 12. A convexly arcuate rib 22 is formed on the inner or back surface at the drive sprocket end of the frame member 10, and the plate portion 12 which has an aperture 21 therein to seat the sprocket 8. An elongated rectilinear rib 23 connects to the arcuate rib 22 and extends along the lower edge of the tractor frame member 10, i.e., the edge opposite that over which the cover 13 extends. On its inner or upper surface and intermediate its length, the rectilinear rib 23 has a convex projection 24 which bears against and deflects upwardly the belt 7.

The tubular lock post 18 has four axially extending slits 25 which divide it into four arcuate segments 26, 26, 27, 27. Convexly arcuate surfaces 26a which engage with the locking lever 51 are formed at the outer periphery of the outer end portions of the segments 26 and 27.

As shown in Figures 7 and 8, the guide member 11 has a base plate 30 with a belt guidance portion 32 formed on its inner or front face, and this portion 32 provides a peripheral guide surface 31 comprising upper and lower planar portions 31a, 31b and a convexly arcuate portion 31c at the end spaced from the drive sprocket 8. A relatively thick convexly arcuate rib 34 is provided at the opposite end and outwardly of the bearing aperture 33 in which is rotatably seated the drive sprocket 8. An elongated rib 35 extends from the convexly arcuate rib 34 along its lower edge, and this rib 35 has a convex projection 36 on its upper surface intermediate its length which also deflects the belt 7 upwardly.

In the guide member 11 are also provided an aperture 38 which receives the lock post 18, and the engaging pin aperture 37. When assembled, the engagement pin 20 of the frame member 10 seats in the engagement pin aperture 37 of the guide member 11, and the belt guidance portion 32 of the guide member 11 abuts the base plate 12 of the frame member 10.

When assembled in the tractor assembly, the guide shaft 3 slidably extends through the aligned apertures 21, 33 of the members 10, 11 and through the locking post 18 and aperture 38.

As shown in Figure 9, the teeth 6 formed on the inner surface of the belt extend transversely across the width of the belt 7. As also seen, the teeth 6 are offset from the positions of the pins 4, and are provided in sets of three. Between each set of these teeth 6 is a planar portion underlying a pin 4. Cooperating with the teeth 6 of the belt 7 are the teeth 41 in the drive sprocket 8.

As shown in Figure 11, the tractor cover 13 has an elongated central slot 13b in which the pins 4 of the tractor belt 7 move. Projecting from one side thereof are mounting portions 14, 15 which comprise spaced ears 14b, 14c, 15b, 15c and the pivot pins 14a, 15a extend therebetween. As can be seen, the pivot pins 14a, 15a seat in concave recesses 16a, 17a of the cover support posts 16, 17 of the frame member 10. Between the mounting portions 14, 15 is a spring mounting post 43, and the ends of the spring 45 seat on the spring mounting post 43 of the tractor cover 13 and the spring mounting post 19 on the frame member 10. This spring 45 normally biases the tractor cover 13 into its closed position, but, when the cover 13 is pivoted over center, it will bias the cover 13 into the open position.

As shown in Figures 12 and 13, the tractor 1 is fixed on the guide shaft 3 by a locking action provided by the locking lever 51 which is rotatably mounted on the tubular lock post 18 of the frame member 10. The locking lever 51 has a tubular hub 52 with an inside diameter which is slightly larger than the outside diameter of the tubular post 18, and a lever arm 53 extends radially from the hub 52. On the inner peripheral surface of the tubular hub 52 are four convex cam surfaces 54 which reduce the inside diameter over half the axial length of the hub 52. Upon rotation of the locking lever 51 relative to the lock post 18, the four segments 26, 26, 27, 27 of the tubular post 18 are cammed inwardly by the cam surface 54 to clamp them onto the guide shaft 3 and thus lock the tractor 1 in a fixed position thereon.

In this tractor of the present invention, the tractor belt 7 is deflected upwardly at the center of its longitudinal lower run to provide closed path of eyeglass-like shape. As can be seen, the tractor belt 7 is deflected upwardly by the convex projections 24, 36 provided on the ribs 23, 35. Because of the dimensioning of the belt 7, this causes the belt 7 to lift off the convexly arcuate guide surface 31 of the belt guidance portion part 32. Therefore, frictional resistance between the tractor belt 7 and the guide surface 31 of the belt guidance portion is 32 lessened and the driving torque necessary for the tractor belt 7 can be reduced, with a reduction in the power required to be delivered by the motor of the printer.

Although the belt 7 is deflected outwardly from the guide surface 31, this deflection is limited by the convexly arcuate ribs 23, 35 at the one end of the chassis. Deflection of the belt 7 outwardly of the drive sprocket 8 is restrained by the arcuate ribs 22, 34.

In the embodiments of Figures 1-13, the convex projections parts 24, 36 are formed on the ribs 23, 35. In the embodiment of Figure 14, only a single convex projection 61 is provided directly on the base plate 30 rather than on a linear rib. As shown in the embodiment of Figure 15, the deflecting surface may be provided by the inside surface of a lower rib which is elongated and of increasing thickness.

Because the present invention may be embodied in various types without departing from its principles, the above embodiments have been provided solely for explanation purposes and are not of a restrictive nature. Furthermore, the scope of the present invention is not limited by the description made preceding the claims but is limited only by the scope of claims.

Claims

1. A form feeding tractor comprising:
   (a) a tractor chassis;
   (b) an endless belt rotatably supported on said chassis, said belt having an inner driven surface and an outer driving surface and defining a closed path of travel about said chassis, said belt having drive pins on its outer driving surface adapted to engage in the perforations of a web passing through said tractor;
   (c) a tractor cover pivotably mounted on said chassis and extending over said belt along the upper side of said path; and
   (d) a drive sprocket rotatably supported on said tractor chassis adjacent an end thereof and drivingly engaged with said inner driven surface of said belt, said chassis having a belt guidance portion adjacent the other end of said chassis, said path extending about said drive sprocket and said belt guidance portion, said chassis having a belt deflecting portion thereon along the path of travel of said belt opposite from said cover, said belt deflecting portion deflecting said belt in the direction of said cover and reducing the contact between said belt and the surface of said belt guidance portion at the end opposite said drive sprocket.

2. The form feeding tractor in accordance with Claim 1 wherein said tractor chassis is comprised of a frame member having a cover support upon which said tractor cover is mounted, and a guide member which is fixedly engaged with said frame member.

3. The form feeding tractor in accordance with Claim 2 wherein said frame member and said guide member have opposed ribs adjacent the lower edges thereof and said ribs have projections on the upper surface thereof intermediate

their length to provide said belt deflecting portion.

4. The form feeding tractor in accordance with Claim 3 wherein said belt deflecting portion is elongated in the direction of belt travel.

5. The form feeding tractor in accordance with Claim 3 wherein said frame member and said guide member have opposed ribs at the end thereof adjacent said drive sprocket which retain said belt in driving engagement with said drive sprocket.

6. The form feeding tractor in accordance with Claim 1 wherein said tractor has an aperture through said chassis and said sprocket for the associated drive shaft and an aperture in the chassis for the associated support shaft, and wherein said belt deflecting portion is provided on said chassis between said apertures.

7. The form feeding tractor in accordance with Claim 3 wherein said frame member and said guide member have opposed ribs on the end thereof outwardly of said guidance portion to limit movement of said belt away therefrom.

8. A form feeding tractor wherein a tractor cover is pivotably supported on and extends along the upper portion of a tractor chassis, a drive sprocket is rotatably supported on said chassis adjacent one end thereof, a belt guidance portion is provided on said chassis adjacent the opposite end thereof, and an endless tractor belt with drive pins on its outer surface side extends about said sprocket and belt guidance portion, characterized in that said belt guidance portion has a guide surface comprising upper and lower parallel portions adjacent the drive sprocket and a convexly arcuate portion between said parallel portions at the opposite end of said chassis, and in that a belt deflection portion is provided adjacent the lower edge of the tractor chassis and deflects said belt upwardly towards said cover to reduce the contact between said belt and said convexly arcuate portion of said guidance portion.

9. The form feeding tractor in accordance with Claim 8 wherein said tractor chassis is comprised of a frame member having a cover support upon which the tractor cover is mounted, and a guide member which is fixedly engaged with said frame member.

10. The form feeding tractor in accordance with Claim 9 wherein the frame member and the guide member have opposed ribs adjacent the lower edges thereof and said ribs have projections on the upper surface thereof intermediate their length to provide said belt deflecting portion.

11. The form feeding tractor in accordance with Claim 9 wherein said frame member and said guide member have opposed ribs at the end thereof adjacent said drive sprocket which retain said belt in driving engagement with said drive sprocket.

12. The form feeding tractor in accordance with Claim 9 wherein said frame member and said guide member have opposed ribs on the end thereof outwardly of said guidance portion to limit movement of said belt away therefrom.

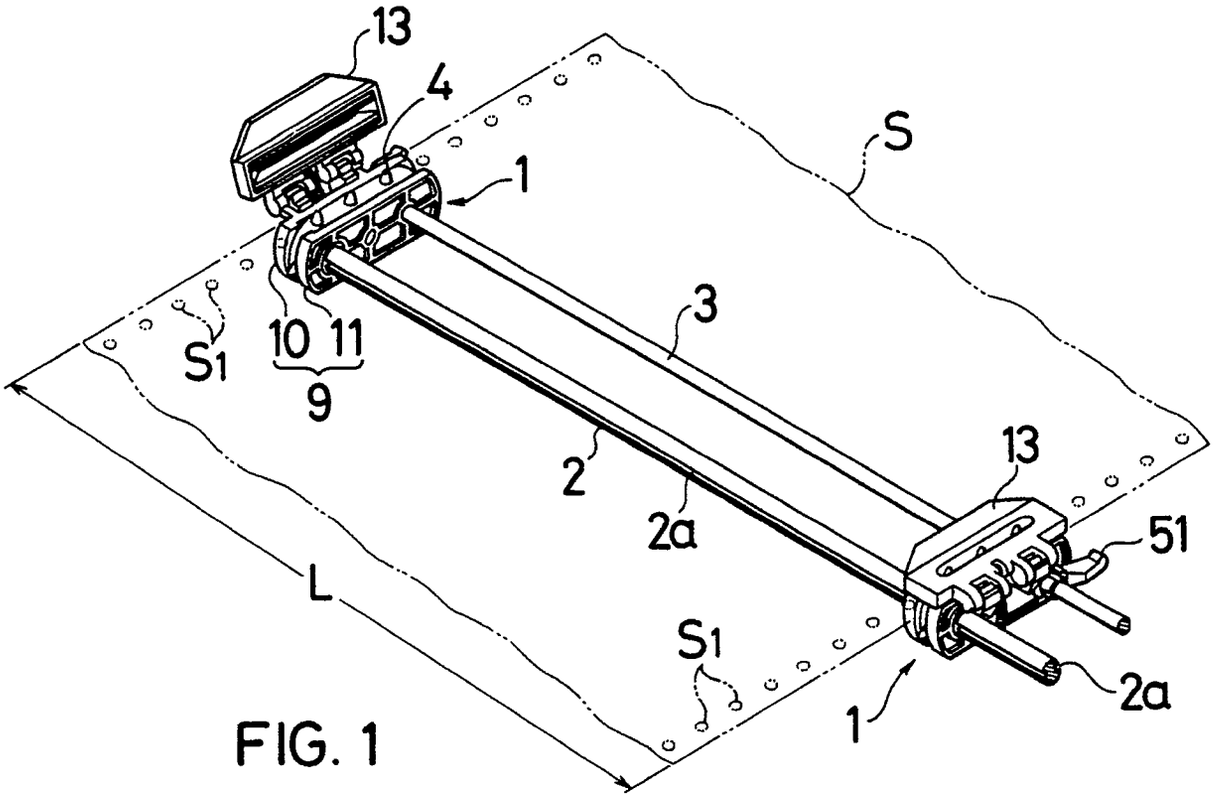
13
4
S
1
3
S1
10 11
9
2
13
2a
51
L
S1
1
2a

FIG. 1

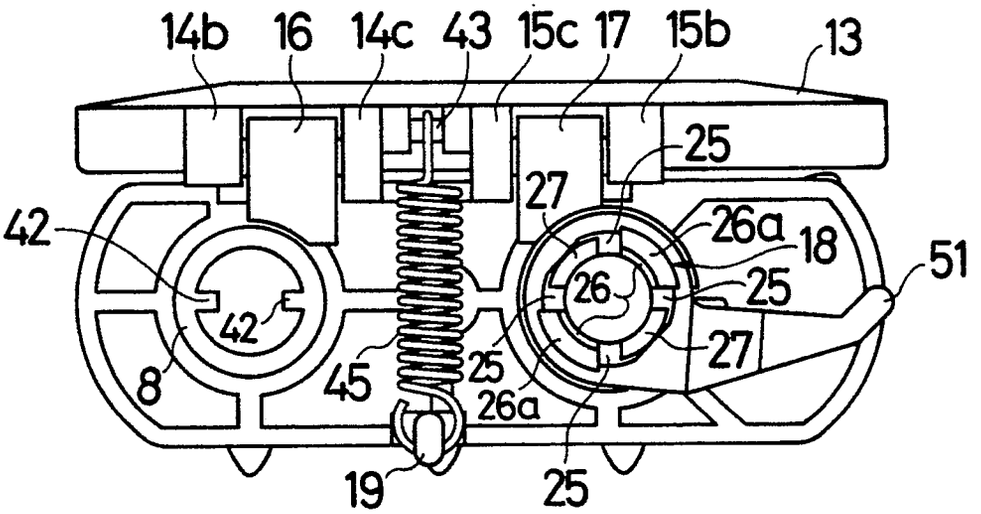
14b
16
14c
43
15c
17
15b
13
25
27
42
26a
18
51
26
25
42
27
8
45
25
26a
19
25

FIG. 2 1

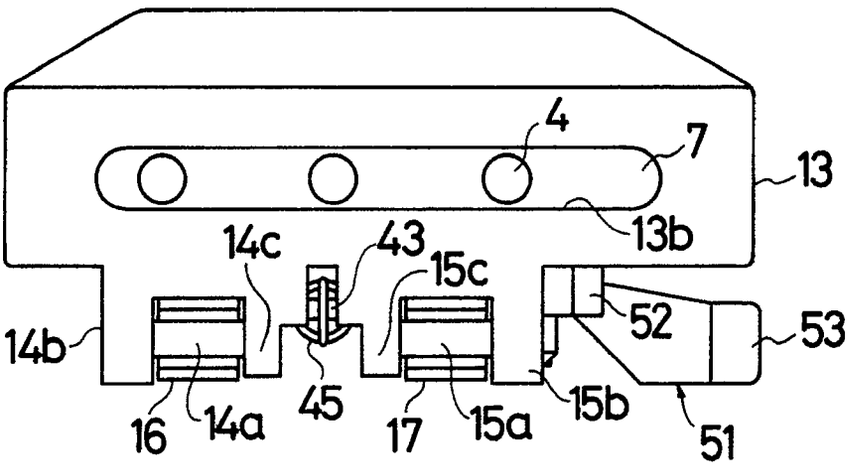
4
7
13
13b
14c
43
15c
52
53
14b
16
14a
45
17
15a
15b
51

FIG. 3

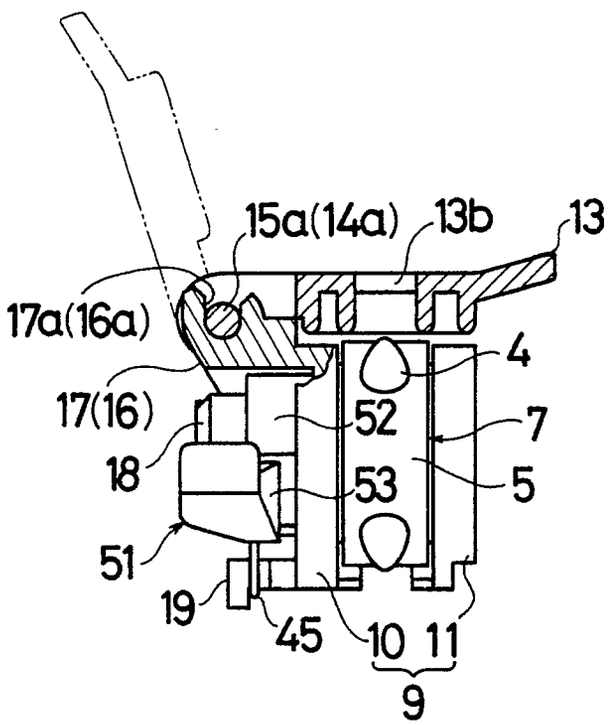
15a(14a)
13b
13
17a(16a)
4
17(16)
52
7
18
53
5
51
19
45
10
11
9

FIG. 4

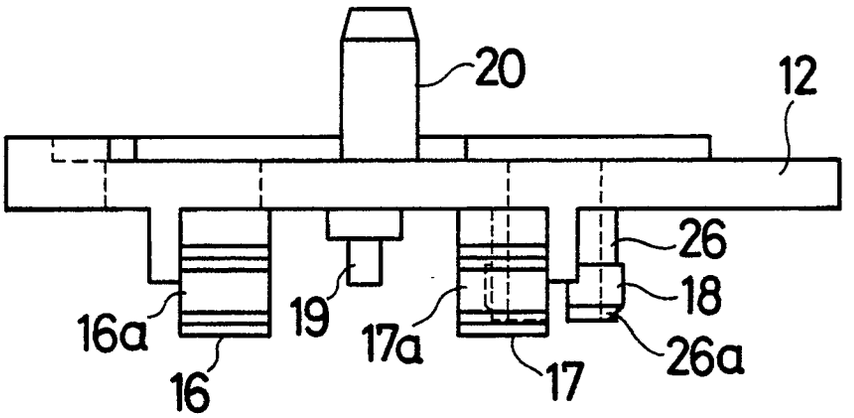

FIG. 5 10

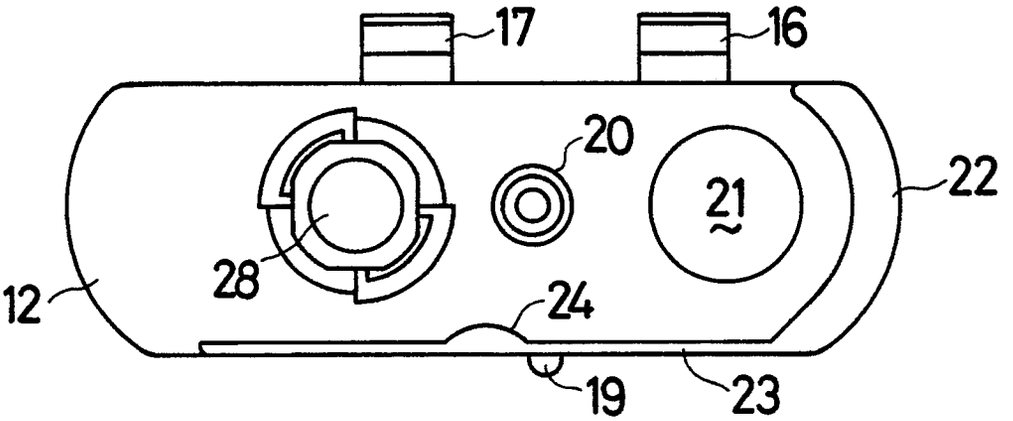

FIG. 6 10

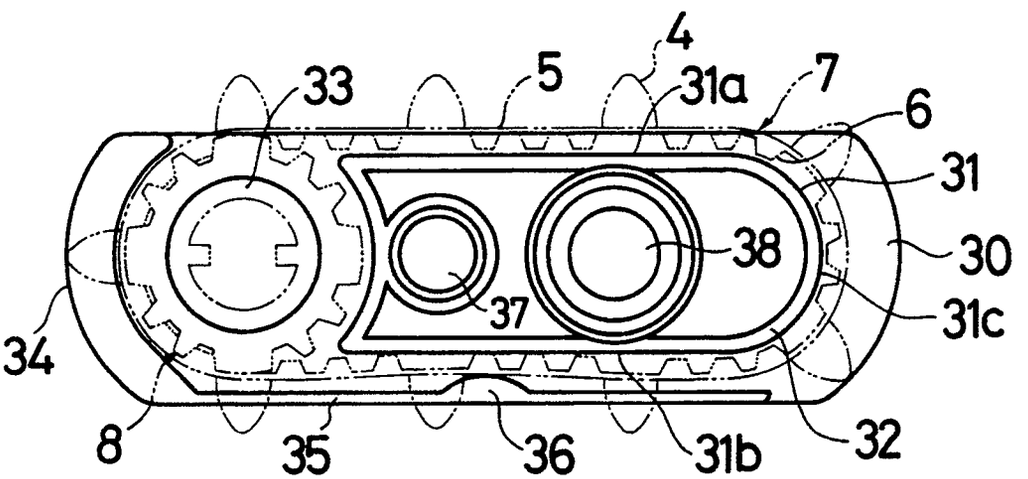

FIG. 7 11

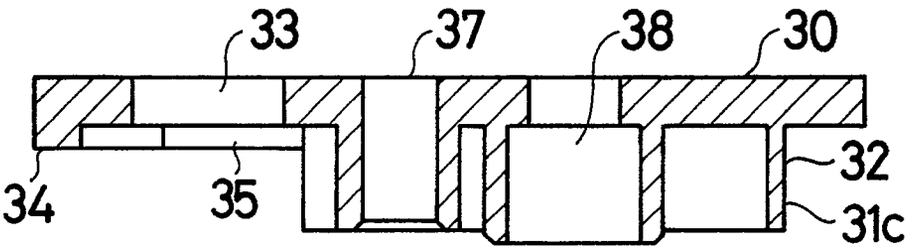

FIG. 8 11

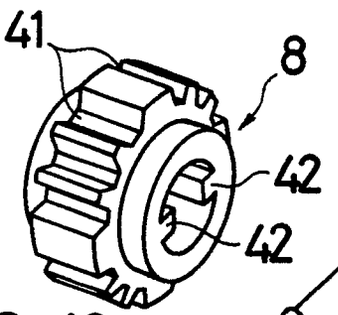

FIG. 10

FIG. 9

FIG. 12 51

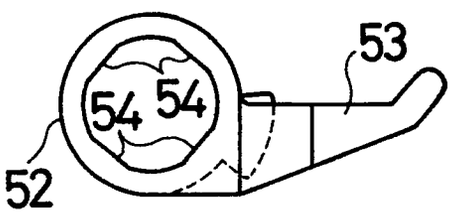

FIG. 13 51

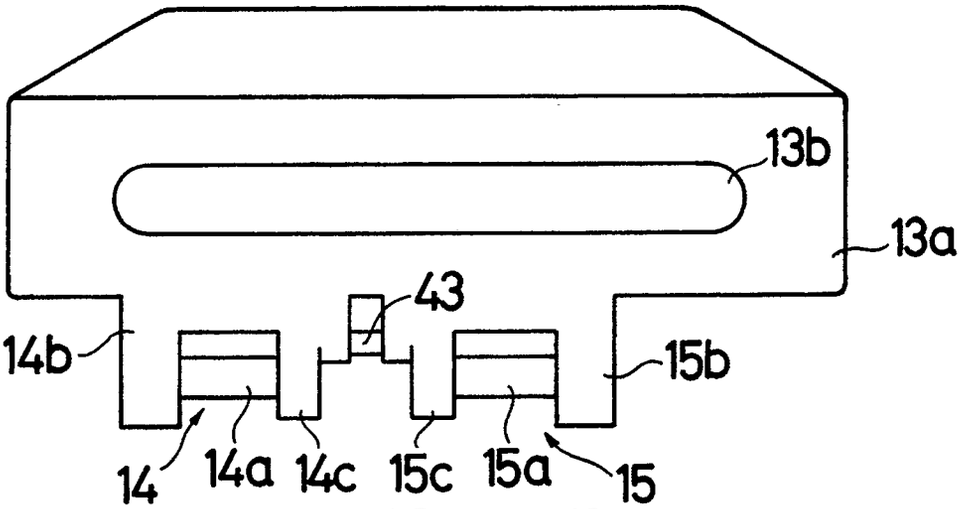

FIG. 11 13

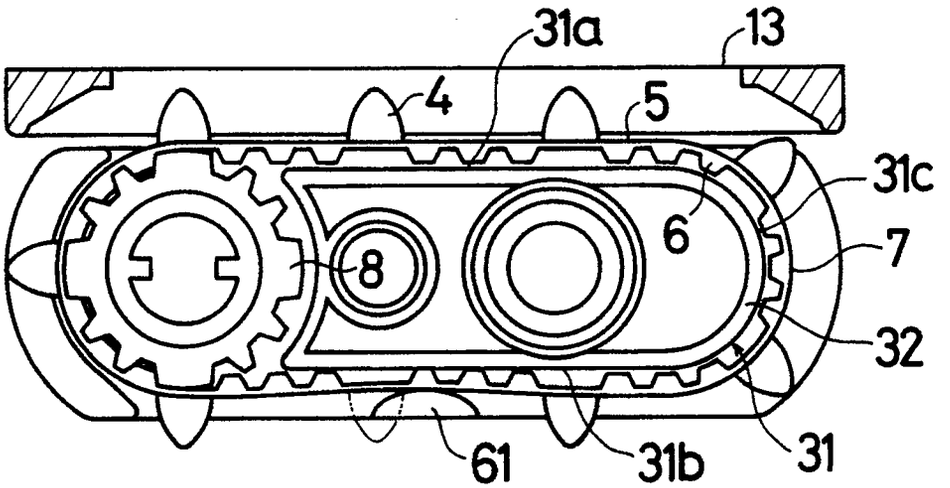

FIG. 14

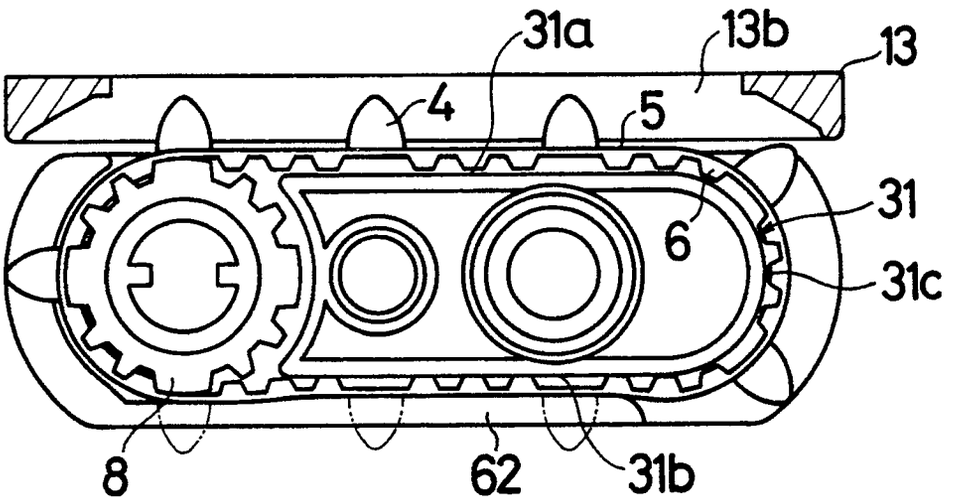

FIG. 15

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 10 0708

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)
P,Y	FR-A-2 648 394 (TOKAI KOGYO KABUSHIKI KAISHA) * page 7, line 6 - page 8, line 16 * * page 10, lines 24 - 28; figures 1, 7, 8 *	1-12	B 41 J 11/30
Y	EP-A-0 226 228 (BANDO) * page 6, line 5 - page 13, line 24; figures 1-21 *	1-12	
A	US-A-4 723 697 (TANO)		
A	DE-A-3 903 288 (TOKAI KOGYO KABUSHIKI KAISHA)		
A	GB-A-2 149 763 (MANNESMANN)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B 41 J
B 65 H

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	27 May 91	ADAM E.M.P.

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
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