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(54) Ink ribbon cassette.

(57) Ink ribbon cassette having a housing 2 and running within the housing 2 an endless ribbon 10, which is stored in fan fold fashion within a stuffing box 12 of the housing, and with a drive roller and a counter roller contained in the ribbon feed mechanism 100 at the entrance of the stuffing box 12, which has a shaft that can be coupled to a motor of the typewriter or printer.

In order to achieve optimal folding patterns of the endless ribbon 10 even with low ribbon drive speeds into the stuffing box 12, there is a gearing provided between the drive shaft and the drive roller.

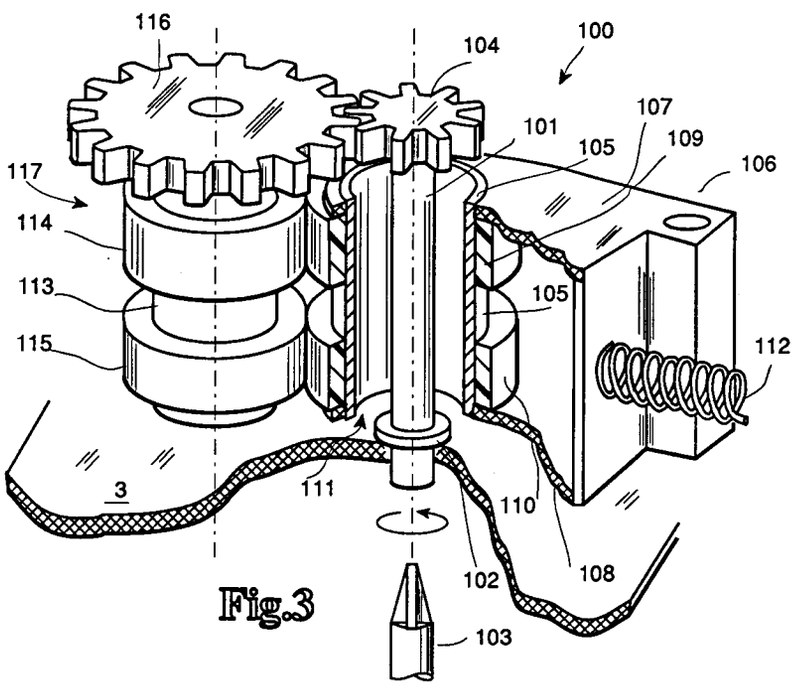

Fig.3

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The invention is an ink ribbon cassette for printers or typewriters. It consists of a housing, an endless ribbon going round the housing, the ribbon is stored in a stuffing box within the housing in fan folded loops. There is also a roller-driven ribbon feed mechanism at the entrance of the storage section which can be coupled by a shaft to a motor in the typewriter/printer.

Such ink ribbon cassettes often consist of a fabric ribbon. The fabric ribbon is a carrier for a coloured liquid (oil and dye mixture) which is contained between the fibres of the fabric ribbon. If this textile containing the ink liquid is struck by the needles of a printer or by a print head, the ink liquid is pressed out of the ribbon and transferred on to the paper. Thereafter the ink liquid flows from the surrounding area back into the used section so that the ink ribbon is regenerated.

Sometimes ink ribbons with carrier films are also used, which as opposed to the fabric ink ribbons, have certain advantages, since the carrier film works like a barrier layer between the coating and the print head. The needles never penetrate the carrier film and thus do not come into contact with the coating. The wear on the print head in this case is only caused by the contact of the print head with the carrier film and is therefore considerably less than the friction from fabric ink ribbons.

Ink ribbons with carrier films (plastic underlayer) however require especially delicate handling in the cassette and in particular with such cassettes, excessive folding should be avoided.

The invention is based on the task of creating an ink ribbon cassette of the type described at the outset, which is suitable for fabric ink ribbons as well as ink ribbons with carrier films and which provides optimal folding of the ink ribbon in the stuffing box. Furthermore there should also be provision for optimal ribbon feed speed to be achieved at the same time.

This task is fulfilled by the fact that a gear is introduced between the shaft, which can couple the motor of the printer/typewriter to the drive roller of the ribbon feed mechanism.

Surprisingly it has been found that particularly in the case of ink ribbons with carrier foils, delicate handling of the ink ribbon in the ribbon feed mechanism is achieved when the ribbon feed mechanism is fitted with as large a diameter roller as possible. It has been observed that a large diameter drive roller brings about an especially even fan fold pattern and as a result, particularly for ink ribbons with carrier films, damaging narrow folds and creases are avoided.

On the other hand a drive roller with a large diameter leads to an increased ribbon feed speed, which particularly for ink ribbons with carrier films has been recognised as damaging. It was in fact found that in particular for ink ribbons with carrier films, i.e. ink ribbons which have a so-called plastic support layer, an increased ribbon feed speed leads to an increased friction at the print head. A reduced ribbon speed correspondingly leads to a smaller torque in the cassette and as a result more material can be introduced into the ribbon stuffing box. In this way print yield per cassette is increased, leading to prolonged life of the cassette and thus leads to a lesser strain on the environment from discarded cassettes.

In the case of cassettes which move together with the print head, the relative speed between the ribbon and the paper varies depending on whether the print head moves from left to right or from right to left. This leads to lines with varying intensity values. Because the invention causes a reduction in the ribbon feed speed the difference in the relative movement between ribbon and paper is less, so that this drawback is virtually eliminated. Furthermore an increased exit tension of the ribbon from the cassette as a result of the reduced torque can be capitalised on. For cassettes which do not move with the print head, this can contribute towards the reduction of ribbon transport problems.

With fabric ribbons on the other hand, an increase in the ribbon feed speed leads to lessening the risk of the needles of a print head snagging in the fabric threads and bringing about a premature failure of the print head.

The procedure in the invention therefore not only ensures that the ink ribbon cassette can be operated with the most suitable ribbon feed speed for the relevant inked ribbon irrespective of the set number of revolutions of the drive motor, but it can achieve the optimal handling of the ribbon within the stuffing box for the given ribbon type by means of the selection of the most suitable diameter of drive roller; by the procedure in the invention it can be ensured that also when a drive roller with a large diameter is chosen, a low ribbon feed speed can be obtained.

One specially advantageous design form of the invention is where the ink ribbon has a plastic carrier and the gearing is a step-down gearing for the revolutions of the drive roller. As already mentioned, it has been found that plastic sub-strata ribbons with drive rollers of the largest diameter possible are made in order for this ribbon type to achieve optimal fan folding pattern within the cassette stuffing box. The use of a step-down gearing in accordance with this design version of the invention enables the use of drive rollers with large diameters to be used and ensures that not only does the ribbon speed not increase, as opposed to traditional cassettes the speed can be additionally reduced.

In accordance with another favourable design version, the ribbon is a fabric ribbon and the gear is a step-up gearing increasing the revolutions of the drive roller.

It has proved especially advantageous if at least one roller of the feed mechanism is positioned vertically displaceable to its axis of rotation and with springs tensioned against a second roller of the feed mechanism. Such a construction is especially beneficial if the drive roller as well as the counter roller is made of solid plastic (gear profile / or smooth). This gives the further advantage that rollers can be made in one piece to include the carrying shafts, which is especially economical.

One design form where the drive roller and a counter roller built in a fixed position and where the spongy squeezable surfaces for both the rollers is provided, is especially suited if foam elastomer material, such as polyurethane foam for example, is used as material for the drive rollers surface. In this case both rollers (between which the ink ribbon runs) are made with fixed axes. The elastic pliability necessary for a constant print is achieved solely through the surface of the drive rollers. A cassette designed in such a way is preferential for mechanised production, as neither transport guides for one of the two rollers nor pre-tensioning springs need be used.

Another favourable design form of the ink ribbon cassette has strippers, which lift the ink ribbon at the exit side of the ribbon feed mechanism from the drive roller and/or the counter roller. This also contributes towards an optimal ribbon folding within the stuffing box. Especially advantageous with an ink ribbon cassette as per the invention is if the endless ink ribbon has the form of a mobious loop acid so can be used from both sides.

The invention is explained in more detail in the following by means of the schematic design diagrams. It shows:

Figure 1: a perspective view of an ink ribbon cassette as per the invention with lid removed.

Figure 2: a sketch to illustrate the ink ribbon folding within the stuffing channel of the cassette.

Figure 3: the ribbon feed mechanism in the case of the first design form of the invention.

Figure 4: the ribbon feed mechanism in the case of the second design form of the invention.

Figure 5: the ribbon feed mechanism in the case of the third design form of the invention.

Figure 6: the ribbon feed mechanism in the case of the fourth design form of the invention.

Figure 7: the ribbon feed mechanism in the case of the fifth design form of the invention.

Figure 8: the ribbon feed mechanism in the case of a sixth embodiment of the invention, the gear being provided in an external housing.

Figure 9: a perspective view of the gears of the embodiment of figure 8 illustrating schematically the interactions of the gears, the drive shaft and the drive spindle.

Figure 1 represents an ink ribbon cassette as per the invention. The ink ribbon cassette 1 consists of a housing 2, which has a base plate 3 and sides 4, 5, 6, 7a, and 7c. At one side of the housing there is a U-shaped recess cut out of it but enclosed by sides 7a, 7b and 7c and into which the print head of the printer or typewriter (not shown) projects when the cassette is in use. At both sides of the U-shaped cut-out of the cassette are the housing guide slots 8 and 9 for the ink ribbon 10, through which the ink ribbon can be fed from the inside of the cassette to the outside and again back to the inside. The edges of the U-shaped recess adjacent to sides 7a and 7c are rounded off and made thicker so that there is a corresponding guiding edge 11 for the ink ribbon 10, which prevents the ink ribbon from becoming creased when exiting or entering the cassette. The ribbon feed mechanism 100 is only represented diagrammatically by two rollers and will be described in detail further on.

When operating the cassette, the cassette is inserted into the cassette holder of a typewriter or needle printer, whereby automatically a drive ratio is produced between the ribbon feed speed and a ribbon feed motor of the printer. The ink ribbon is pulled through the ribbon feed mechanism 100 in the direction shown by arrow P to the ribbon feed mechanism 100. It therefore moves via slot 8 and out of the cassette and is guided in front of the print head, which is located within the U-shaped cut-out surrounded by sides 7a, 7b and 7c. It enters the cassette again through slot 9 and as mentioned reaches the ribbon feed mechanism 100. Two strippers (from the drawing only one, namely stripper 13, is visible) lift the ink ribbon away from the rollers of the ribbon feed mechanism 100. At the exit side of the ribbon feed mechanism 100 there is a rectangular stuffing box 12 which comprises the rear side 6, the adjacent side to this 7b, and the base of the cassette 3 and the cassette lid. The ink ribbon 10 folds up in a series of fan fold loops within the stuffing box 12. For reasons of simplicity only a few loops have been drawn in the diagram, whereas in reality there are usually considerably more loops.

Figure 2 shows a sketch illustrating the problem which can arise with the folding of the ink ribbon within the storage channel 12 of an ink ribbon cassette. It is important that the rollers of the ribbon feed mechanism 100 in comparison to the size of the stuffing box 12 are sufficiently large enough in diameter to achieve an even folding pattern. In the schematic drawing of Fig. 2, the rollers chosen are too small so that the ink ribbon 10 folds unevenly and this can lead to operational faults and to damage of the ink ribbon.

Figure 3 shows in detail - in perspective as well as partially in cross section - a ribbon feed mechanism 100 as per the invention relating to the first design example. In the drawing the floor of the cassette which is drawn as being partially broken off, is denoted by reference number 3. The ribbon feed mechanism consists of a shaft 101, which is located into a hole in the base plate 3, whereby it is supported at the by a collar (sleeve) 102 which surrounds the hole. On its underside there is a cross-slotted extrusion (Philips type connection) into which a correspondingly shaped drive spindle 103 of the typewriter or needle printer is inserted to give a positive drive connection. There is a drive gear wheel 104 at that end of shaft 101 which is farthest from the base plate 3. The shaft 101 is enclosed by a cylinder 105 with the gap between the two being virtually concentric. The cylinder 105 is situated within a box-shaped housing 106, which has housing plates parallel to the base plate 3. On cylinder 105 two plastic rollers 109 and 110 are attached with a gap between them, so that cylinder 105 together with both the rollers 109 and 110 form a plastic covered roller 111. The housing 106 is suitably positioned on to the base plate 3 in a guiding device (not shown). Housing 106 is supported by a tension spring 112 fitted between it and one of the side walls of the cassette housing (shown in Figure 3).

Some distance away from shaft 101 and with its axis parallel to it, is a cylinder 113 which is pivotally positioned in to base plate 3. The cylinder 113 also carries two plastic rollers 114 and 115, which are fitted in the same arrangement as for plastic rollers 109 and 110 of cylinder 105. Cylinder 113 and the two plastic rollers 114 and 115 form a nip roller 117, which - as explained more fully below - works like a friction roller/driving nip roller 117. At the end of the cylinder 113 farthest away from the base plate 3, a gear wheel 116 is fitted which meshes with gear wheel 104 of shaft 101.

The ribbon feed mechanism works as follows:
Due to the effect of spring 112, the housing 106 is pressed in the direction of the drive roller 117 made up of rollers 114 and 115 and cylinder 113, whereby the rollers 109 and 114 as well as rollers 110 and 115 are pressed against each other. The ink ribbon of the cassette (not shown) is fed between rollers 114 and 109 as well as 115 and 110. When drive spindle 103, powered by the printer motor, interlocks with drive shaft 101 in the cut-out (not shown) when a cassette is inserted, the drive shaft 101 and gear wheel 104 attached to it are set in motion, whereupon the larger gear wheel 116 and the roller 117 firmly attached to it turn. The roller 117 thus works like a nip drive, while roller 111 operates as a freely turning counter pressure roller (friction roller), which is pre-tensioned by the effect of spring 112 against drive roller 117. The friction from the two rollers turning in opposite directions causes the ink ribbon to move forwards into the storage channel of the cassette (Figure 1). In the gap between rollers 114 and 115 and between rollers 109 and 108, strippers (not shown) engage, which continuously lift the ink ribbon and assist in the folding of the ink ribbon in the stuffing box.

The number of revolutions of roller 117 as compared to the number of revolutions of shaft 101 is reduced, whereby the reducing gear ratio is governed by the ratio of the number of teeth on the gear wheel 104 to the number of teeth on the gear wheel 116. The invention makes it possible to drive the drive roller 117 independently of the speed (in the design example chosen - lower) set by the drive spindle 103. The diameter of the drive rollers 111 and 117 can be selected in such a way as to produce an optimal fold pattern in the stuffing box of the cassette.

A further design example of the invention is shown in Figure 4. Identical or similar parts are given the same reference numbers. In Figure 4 one can see the base plate 3 onto which a counter pressure/friction roller 111 can be positioned so that the axes are parallel. The friction roller again consists of a housing 106 and two plastic rollers 109 and 110, which are located in housing 106 and which can turn freely. The housing is elastically supported at the side of the cassette (not shown) by means of spring 112.

A drive roller 117 which consists of a cylinder 113 and two plastic rollers 114 and 115, is in a set position on base plate 3 but can rotate. In the lower part, i.e. the part of the roller 117 which is laid into the base plate 3 is cylinder 113, fitted with an internal ring gear 202. In the space available a drive gear wheel 201 is inserted, which has less teeth than the inner ring gear 202, and which is coupled by a positive lock to a drive shaft located in base plate 3 (not shown). The drive shaft is similar to drive shaft 101 in, the design example shown in Figure 3, making a detailed description unnecessary here. At its lower end is again a "Philips" type or cross-slotted moulding into which

the drive spindle of a typewriter or printer engages, in order to drive the drive shaft and the gear wheel 201 tightly locked to it. The drive gear wheel 201 meshes with the inner ring gear 202, so that the inner ring gear and with it the cylinder 113 as well as rollers 114 and 115 are made to turn. The speed is however reduced by the number of teeth in gear wheel 201 to that of inner ring gear 202 in comparison with the drive speed of the spindle. The ink ribbon is fed between the rotating drive roller 117 and the counter pressure/friction roller 111 which freely turns along with it, causing friction between rollers 115 and 114 and thus moves the ink ribbon forwards. In the groove-shaped space between the rollers 109 and 110 are again strippers which lift the ink ribbon from the rollers continuously, contributing towards a most favourable folding of the ribbon.

A further design example is presented in Figure 5. This shows again the base plate 3 and a counter pressure/ friction roller 111 which operates within a housing 106 which can be slipped into position on base plate 3.

The construction of the friction roller 111 is the same as for the one in Figure 4, making a detailed description unnecessary here. At a distance from the friction roller is a cavity in the base plate 3 where a drive shaft 101 is held in position but is still able to turn freely.

At the opposite end is drive shaft 101 again with a cross-slotted notch, which projects through base plate 3 and out of the cassette. The correspondingly formed drive spindle from the typewriter or printer locks positively into the drive shaft 101. There is a gap between drive shaft 101 and cylinder 113 which encases the shaft. The cylinder holds two plastic rollers 114 and 115, which lie in the same axial position as rollers 109 and 110 of the friction roller 111. At the top of drive wheel 117 made up of cylinder 113 and both rollers 114 and 115 (i.e. opposite facing end to base plate 3), a further gear wheel 300 is attached which connects firmly with drive roller 117 and lies co-axially to it. The drive roller 117 is in a fixed position in the base plate 3 and can turn freely. Parallel to the drive shaft 101 is a further freely turning shaft 301 in the base plate 3, i.e. at the opposite end from the base plate 3, is a gear wheel firmly coupled to shaft 301. The gap between shaft 301 and drive shaft 101 is chosen such that it is the same as the radius of the drive gear wheel 104 plus the radius of gear wheel 302, allowing the two named gear wheels to mesh with each other firmly.

The shaft 301 carries a further gear wheel 303 firmly connected to it and which is in the same axial position as the gear wheel 300 firmly connected to drive roller 117. The radius of gear wheel 303 is smaller than the gear wheel 300 and again is selected so that the sum of both gear wheels is the same as the distance between shafts 101 and 301.

The ribbon feed mechanism per Figure 5 works as follows: Shaft 101 is driven by the drive spindle of the typewriter or printer, onto which sits gear wheel 104 which is set in motion while it is meshed with gear wheel 302. Shaft 301 turns at a slower speed however. The speed is reduced in relation to the number of teeth in gear wheels 104 and 302. By turning shaft 301, gear wheel 303 is also set in motion and meshes with gear wheel 300 which in turn is tightly coupled to drive roller 117. The speed of drive roller 117 is however reduced once more by the ratio of the number of teeth of gear wheel 303 to the number of teeth in gear wheel 300, so that overall the roller 117 turns considerably slower than the drive shaft 101 connected with the printer motor. The ink ribbon runs through the rollers 114 and 115 on the one side and rollers 109 and 110 on the other side, which results in friction which moves it forwards. With this design example, as a result of the double step-down gearing, an especially slow feed can be achieved and at the same time the diameter of the drive roller 117 and friction roller 111 can be selected in a very large size. This brings about a favourable folding pattern of the ink ribbon in the stuffing box.

A fourth design example of the invention is illustrated in Figure 6. In Figure 6 there is again a base plate 3 which is bored through to house the drive shaft 101 similar to the design example of Figure 3. Fitted at the upper end of the drive shaft 101, which meshes with gear wheel 116 of drive roller 117. Drive roller 117 sits on the base plate 3 and consists of a cylinder 113 which stays in the same position but can turn freely. Cylinder 113 carries a solid casing 114 made of spongy foam material, preferably polyurethane foam. The drive shaft 101 is surrounded by a roughly concentric cylinder 115, which similarly carries a solid cylindrical casing 109 made of polyurethane foam. Cylinder 105 is in a fixed position on base plate 3 but can move freely. There is a locating ring for this and the cylinder 105 slips on to it. Similar to the design example of Figure 3, drive roller 117, which consists of cylinder 113 and plastic sleeve 114, turns slower than the shaft 101 due to step-down gearing 104, 116. The friction roller 111 consisting of cylinder 105 and the casing 109, turns freely and due to the friction is made to turn. This causes the ink ribbon to pass between rollers 117 and 111.

The gap between the rotation axes of rollers 117 and 111 is somewhat less than the sum of both their radii, so that the rollers are always pressed up against each other. In this way the foam coverings 114 and 109 are squashed thus

giving the necessary spongy pressure needed.

This design example is a particularly cost effective production method, as the drive roller 117 as well as the friction roller 111 can be formed in fixed position and thus adjustable positioning of the friction roller is not necessary.

Figure 7 shows in detail - in perspective as well as partially in cross section - a ribbon feed mechanism 100 as per the invention relating to a fifth design example. In Figure 7 the floor of the cassette which is drawn as being partially broken off, is denoted by reference number 3. The ribbon feed mechanism consists of a shaft 101, which is located into a hole in the base plate 3, whereby it is supported at the by a collar (sleeve) 102 which surrounds the hole. On its underside there is a cross-slotted extrusion into which a correspondingly shaped drive spindle 103 of the typewriter / needle printer is inserted to give a positive drive connection. There is a drive gear wheel 104 at that end of shaft 101 which is farthest from the base plate 3.

The shaft 101 is enclosed by a cylinder 105 with the gap between the two being virtually concentric. The cylinder 105 is situated within a box-shaped housing 106, which has housing plates parallel to the base plate 3. On cylinder 105 two plastic gear wheels 702, 701 are fitted on the axis with a gap between them so that cylinder 105 together with both gear wheels 702 and 701 form a gear wheel roller. The housing 106 is suitably positioned on to the base plate 3 in a guiding device (not shown). Housing 106 is supported by a tension spring 112 fitted between it and one of the side walls of the cassette housing (not shown in Figure 7).

Some distance away from the shaft 101 and with its axis parallel to it, is a cylinder 113 which is pivotably positioned into base plate 3. The cylinder 113 also carries two plastic gear wheels 705 and 704, which are fitted in the same arrangement as for gear wheels 702 and 701 of cylinder 105. Cylinder 113 and the two plastic gear wheels 705 and 704 form a roller 706, which - as explained in more detail below - has the effect of a drive roller 706. At the end of cylinder 113 opposite to the base plate 3 a gear wheel 116 is fitted, which meshes with the drive gear wheel 104 of shaft 101.

The ribbon feed mechanism works as follows:
Due to the effect of spring 112, the housing 106 is pressed in the direction of the drive roller 706 consisting of cylinder 113 and gear wheels 704 and 705, whereby the gear wheels 702 and 705 just like gear wheels 701 and 706 are pressed against each other. The ink ribbon of the cassette (not shown) is fed between gear wheels 705 and 702 as well as 701 and 701. When drive spindle 103, powered by the printer motor, interlocks with drive shaft 101 in the cut-out (not shown) when a cassette is inserted, the drive shaft 101 and gear wheel 104 attached to it are set in motion, whereupon the larger gear wheel 116 and the roller 706 firmly attached also turn. Roller 706 thus works like a nip drive, while roller 703 operates as a freely turning counter pressure roller (friction roller), which is pre-tensioned by the effect of spring 112 against roller 706. The ink ribbon is moved forwards between the intermeshing teeth of the gear wheels 703 and 706 towards the stuffing box of the cassette (Figure 1). In the gaps between gear wheels 704 and 705 as well as between gear wheels 702 and 701, strippers (not shown) engage, which continuously lift up the ink ribbon 10 from the gear wheels and assist the folding of the ink ribbon in the stuffing box.

The number of revolutions of roller 706 as compared to the number of revolutions of shaft 101 is reduced, whereby the reducing gear ratio is governed by the ratio of the number of teeth on the gear wheel 104 to the number of teeth on the gear wheel 116. The invention makes it possible to drive the drive roller 706 independently of the speed (in the design example chosen - slower) set by the drive spindle 103. The diameter of the drive rollers 703 and 706 can be selected in such a way as to produce an optimal fold pattern in the stuffing box of the cassette.

A sixth embodiment is illustrated in Figure 8. Figure 8 shows a cross section of an ink ribbon cassette; the plane of intersection lying in the symmetry line of the feed mechanism 100 (cf. Fig. 1). In Figure 8 side walls 6 and 7b, bottom wall 3 and cover lid 3a form the channel 12 of the stuffing box which is rectangular in cross section (cf. Fig. 1). The bottom 3 and the cover lid 3a of the cassette housing are provided with through holes for receiving a cylinder 113 which projects at both of its ends out of the cassette housing. The cylinder 113 is axially fixed in position by means of sleeves 102a and 102b. The cylinder is pivotably supported in the housing walls. On cylinder 113 two plastic rollers 114 and 115 are attached with a gap between them, so that cylinder 113 together with both the rollers 114 and 115 form a plastic covered roller 117. Some distance away from the centre line of cylinder 113 and with its axis parallel to it, there is provided a second cylinder 105 also positioned pivotably in the housing. The cylinder 105 also carries two plastic rollers 110 and 109 which are fitted in the same arrangement as for plastic rollers 114 and 115. Cylinder 105 and the two rollers 109 and 110 form a plastic roller 111 the position of which is however not fixed but is movable by guide means (not shown in the drawings) towards roller 117. A spring method, which is shown only schematically by an arrow 112, presses the roller 111 against the roller 117 so that the

plastic rollers 109 and 114 as well as 110 and 115 are pressed against one another. The ink ribbon (not shown in the drawing) is inserted between the two rollers 111 and 117).

The cylinder 113 of the roller 117 is hollow and its inner diameter is larger than the outer diameter of a normal drive spindle, which is normally provided on the adaptor plate 812 of a printer/typewriter. The end of the cylinder which projects out of the cassette housing at the lower end of the cassette is provided with gear teeth at its periphery to form a gear wheel 807 which is solid with the cylinder 113.

A gear box 801 is provided outside the housing of the ink ribbon cassette. The gear box 801 is rectangular in cross-section and is provided with a through hole 802, the inner diameter of which is larger than the outer diameter of a drive spindle 103 of a normal printer/typewriter. There is a gear wheel 803 provided inside the housing 801 in coaxial relation to the through hole 802. The central part of gear wheel 803 is reduced in thickness in comparison to its peripheral part, so that the gear wheel 803 is held in its position with a relatively large play by axial projections 810 of the housing of the gear box 801. Gear wheel 803 meshes with a second gear wheel 804 also provided inside the gear box 801. Gear wheel 803 comprises a shaft 811 projecting outside the gear box 801 at the upper end thereof, i.e. in direction to the ink ribbon cassette. There is a further gear wheel 806 attached to said shaft 811 which meshes with the gear teeth 807 provided on the periphery of the cylinder 113.

The gear wheel 803 is provided in its centre with a cross-like cut-out which is suitable to receive in positive engagement the drive spindle 103 of a printer/typewriter. The drive spindle 103 projects upwardly from an adaptor plate 812 which is part of the printer/typewriter.

The ink ribbon cassette works as follows:
The gear box, consisting of the housing 801, the gears 803 and 804 arranged inside the said housing and the gear 806 outside the housing 801 is clipped on the adaptor plate of a printer/typewriter 812 so that the drive spindle 103 projects through hole 802 of the housing 801 and comes into positive engagement with the cross-like cut-out in the middle of gear wheel 803. The clip means are not shown for reasons of simplicity in the drawing. The gear box 801 as well as its external gear wheel 806 are very flat in reality and do not occupy much space (the drawings are very schematic for the sake of better illustration). Then the ink ribbon cassette is clipped on the gear box 801 in such a manner that the drive spindle 103 of the motor projects into the interior of the cylinder 113 and gear wheel 806 engages gear teeth 807 of the cylinder 113. The clip means are not shown in the drawings.

When the drive spindle 103 is driven by the motor of the printer/typewriter, gear wheel 803 is rotated due to the positive engagement of the drive spindle. Also gear wheel 804 will be rotated because it meshes with gear wheel 803. However since gear wheel 804 has more teeth than gear wheel 803 it rotates under reduced speed. This is also true for gear wheel 806 which is solid with the shaft 811 connecting gear wheels 804 and 806. Since the number of teeth of the gear wheel 806 is also smaller than the number of teeth provided on the periphery of cylinder 113, the cylinder 113 and therefore the advance roller 117 is driven with a speed which is reduced by two steps with regard to the speed of drive spindle 103. Since there are no means for positive engagement between the cylinder 113 and the drive spindle 103 (contrary to prior art devices) the roller 117 can turn at a lower speed than the drive spindle 103.

Now when the ink ribbon in the ink ribbon cassette is used and must be replaced by a fresh one, the ink ribbon cassette can be discarded however the gear box 801 may remain on the adapter plate 812. So the disposable parts can be produced at very low costs, because they do not include the gears. This provides also obvious environmental benefits.

Figure 9 shows in a self-explanatory manner, the interaction of the motor spindle 103, the gears 803, 804, 806 and 807 and the cylinder 113 of the drive roller 117. Apparently the spindle is positively engaged with gear wheel 803, however there is no direct engagement between the drive spindle 103 and the cylinder 113. Since the number of teeth of the small gear wheels 803 and 806 is nine and the number of teeth of the large diameter gear wheels is sixteen, the speed reduction factor is
(9 ÷ 16) x (9 ÷ 16) = 0.32. So that rotational speed of the speed of the cylinder 113 is reduced approximately by one third with regard to the rotational speed of the spindle 103.

Claims

1. Ink ribbon cassette for printers or typewriters with a housing (2), within the housing (2) a stuffing box (12) where stored endless ink ribbon (10) runs through in fan fold loops and with a drive roller (117) and a counter roller (111) forming the ribbon feed mechanism (100) at the entrance of the stuffing box (12), the said drive roller can be coupled to the drive spindle (103) of a motor of the printer/typewriter; this cassette is characterised by the fact that between the drive spindle (103) and the drive roller (117) there is a gear in-

serted (104, 116; 201, 202; 104, 300, 302, 303; 803, 804, 806, 807).

2. Ink ribbon cassette in accordance with Claim 1 which is characterised by the fact that the ink ribbon (10) has a plastic support layer and that the gearing (104, 116; 201, 202; 104, 300, 302, 303) is a step-reduction gear.

3. Ink ribbon cassette in accordance with Claim 1 which is characterised by the fact that the ink ribbon (10) is a fabric ribbon and that the gearing is a step-increasing gear.

4. Ink ribbon cassette in accordance with Claim 1 which is characterised by the fact that the counter roller (111) of the feed mechanism (100) is adjustably positioned vertically to its axis of rotation and pre-tensioned by means of springs (112) against the drive roller (117) of the feed mechanism (100).

5. Ink ribbon cassette in accordance with any one of Claims 1 to 3 and characterised by the fact that the drive roller (117) and the counter roller (111) are of fixed construction and have spongy, squeezable surfaces.

6. Ink ribbon cassette in accordance with any one of Claims 1 to 5 is characterised by the fact that the drive roller and the counter roller each consisting of a cylinder (105, 113) with two plastic rollers (109, 110, 114, 115) displaced in axial direction mounted on the cylinders.

7. Ink ribbon cassette in accordance with any one of Claims 1 to 6 which is characterised by the fact that the gearing consists of a drive gear wheel (104) mounted to a drive shaft (101) and a second gear wheel (116) mounted to the drive roller (117) which meshes with the drive gear wheel (104).

8. Ink ribbon cassette in accordance with any one of Claims 1 to 7 which is characterised by the gearing consisting of a drive gear wheel (201) inserted within the roller (117) and an inner ring gear (202) which meshes with and is linked to this drive gear wheel.

9. Ink ribbon cassette in accordance with any one of Claims 1 to 8 which is characterised by the gearing having a drive gear wheel (104) with a drive shaft in it (101) and parallel to the drive shaft (101) a second shaft is fitted (301) and that two gear wheels (302, 303) are mounted to the second shaft (301) and which are linked with the drive gear wheel (104) or meshes with another gear wheel (303) linked to the drive roller (117).

10. Ink ribbon cassette in accordance with any one of Claims 1 to 9 which is characterised by the fact that the strippers (13) are provided for lifting the ink ribbon (10) at the exit side of the feed mechanism (100) from the rollers (111, 117; 703, 706).

11. Ink ribbon cassette in accordance with any one of Claims 1 to 10 which is characterised by the fact that the endless ink ribbon can be in the form of a mobious loop or non-mobious loop.

12. Ink ribbon cassette according to any one of Claims 1 to 7 characterised, in that the said gear (803, 804, 806, 807) is included in a gear box (801) external to and separate from the housing of the cassette.

13. Ink ribbon cassette according to Claim 12, characterised in that the said gear box (801) contains a first gear wheel (803) having in its centre a cut-out, suitable to receive the said drive spindle (103) in positive engagement, a second gear wheel (804) in intermeshing relation to the first gear wheel (803), a third gear wheel (806) coaxially arranged and rigidly attached to the second gear wheel (804), the said drive roller (117) having one end projecting out of the housing of the cassette, the said one end of the said drive roller (117) being provided with outer gear teeth (807) forming a fourth gear wheel, the said third (806) and the said fourth gear wheel (804) being in intermeshing relation, and the said drive roller (117) being hollow and having an inner diameter larger than the outer diameter of the said drive spindle (103).

14. Ink ribbon cassette according to Claim 13, characterised in that the said first gear wheel (803) and the said third gear wheel (806) have less teeth than the said second (805) and the said fourth gear wheel (807) respectively.

15. Ink ribbon cassette according to any one of Claims 12 to 13, characterised in that the said gear box (801) is provided with a clip-on-means, by which it can be clipped on the adaptor plate (812) of the printer/typewriter which is normally provided for receiving the ink ribbon cassette.

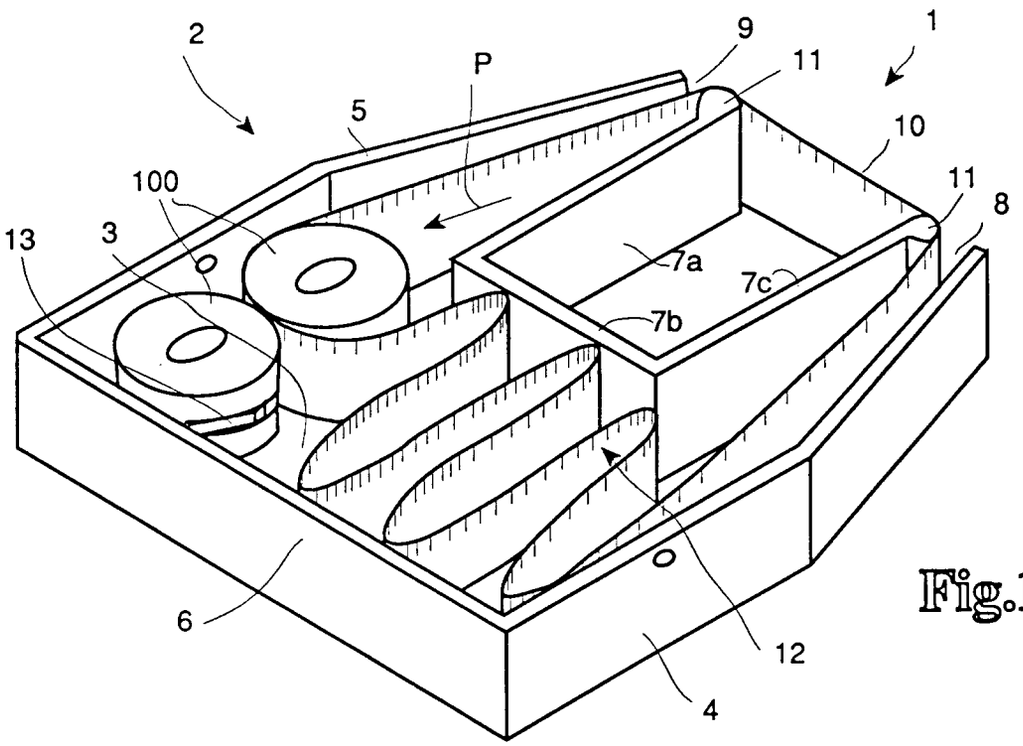

Fig.1

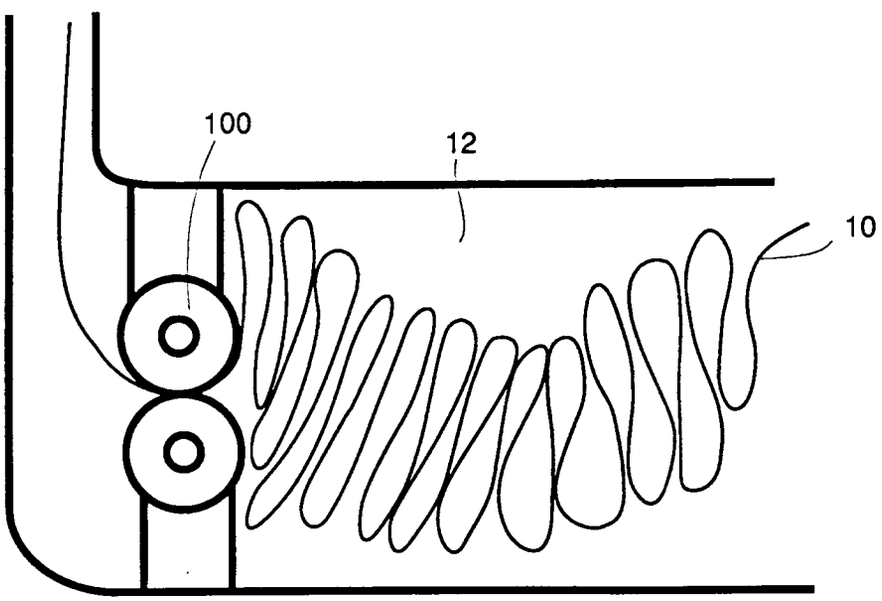

Fig.2

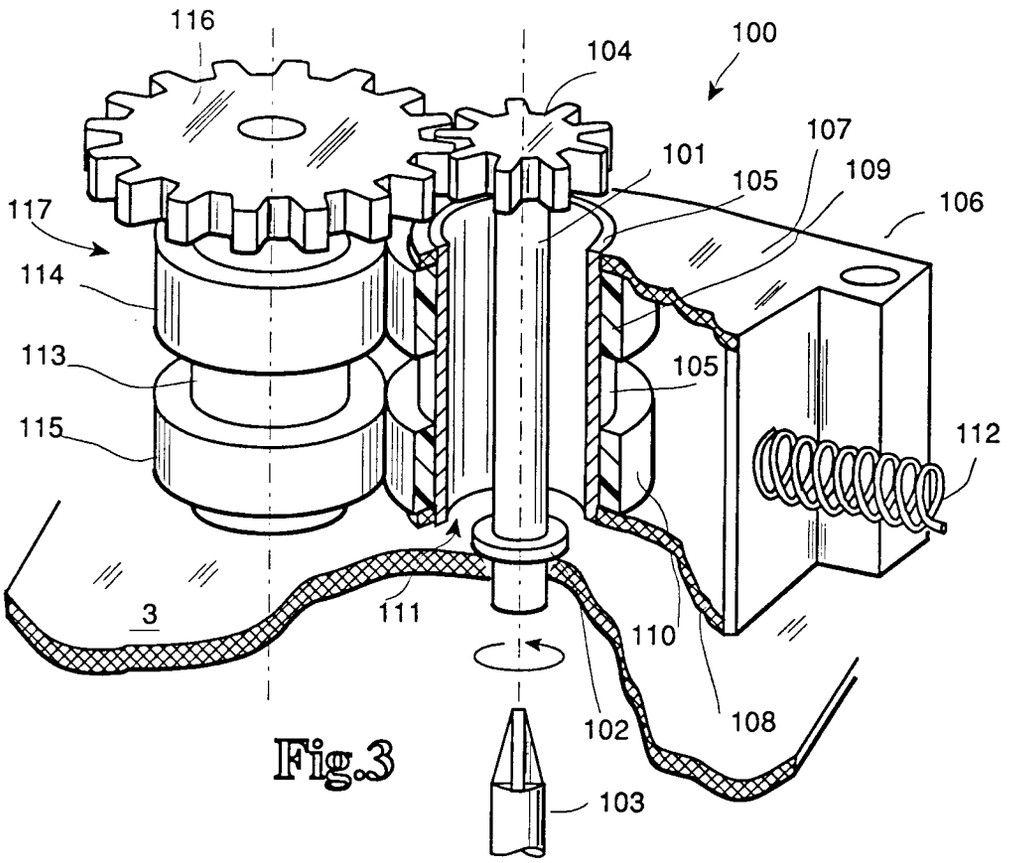
116
104
100
107
101
109
105
106
117
114
113
105
112
115
3
111
110
102
108
103

Fig.3

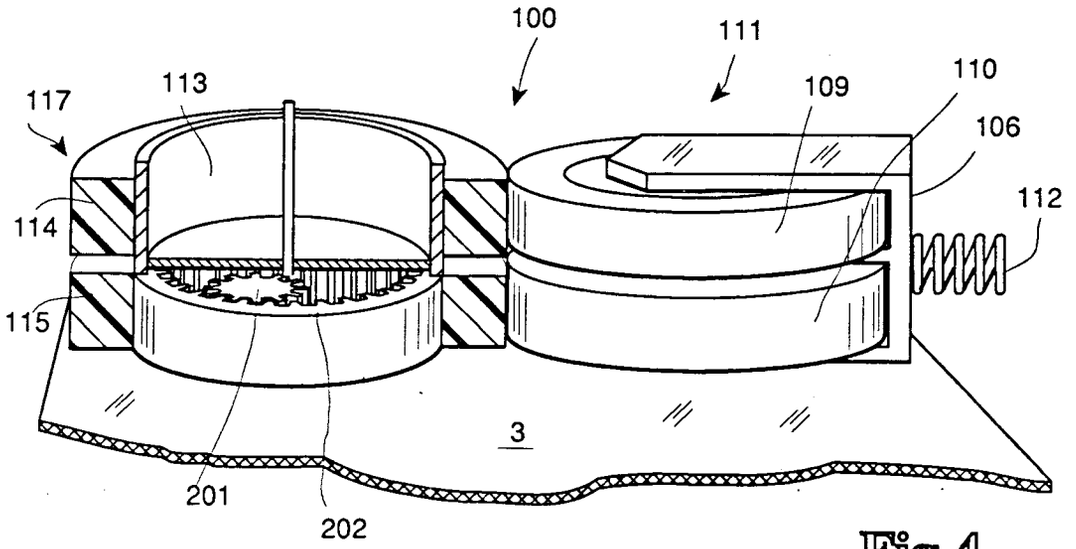
100
111
117
113
109
110
106
112
114
115
3
201
202

Fig.4

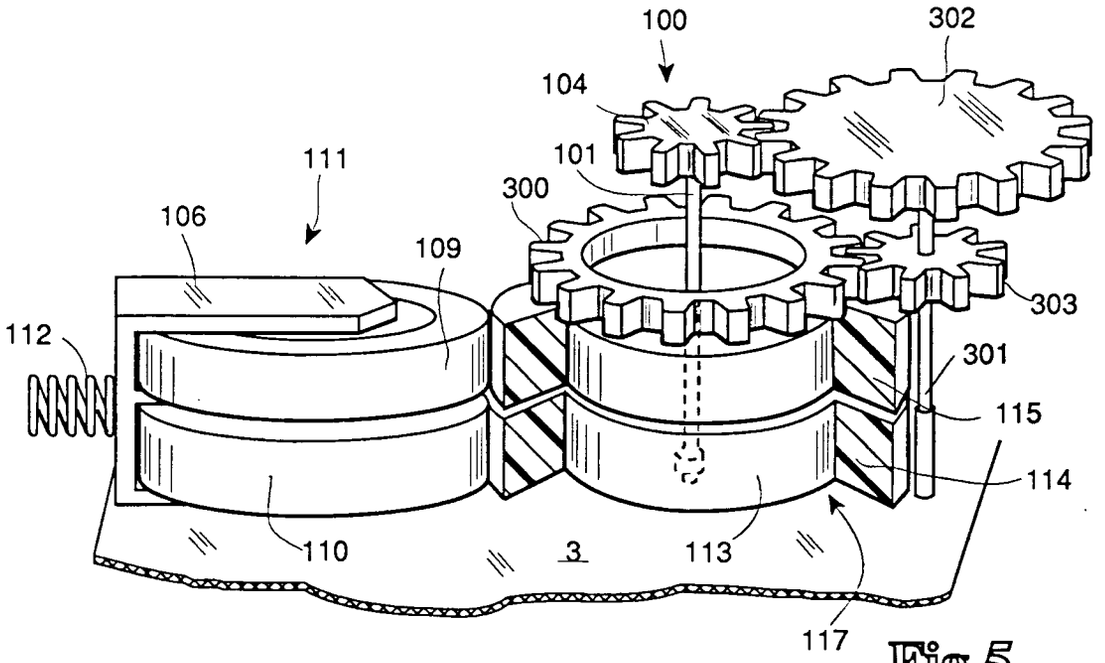
100
302
104
111
101
300
106
109
303
112
301
115
114
110
3
113
117

Fig.5

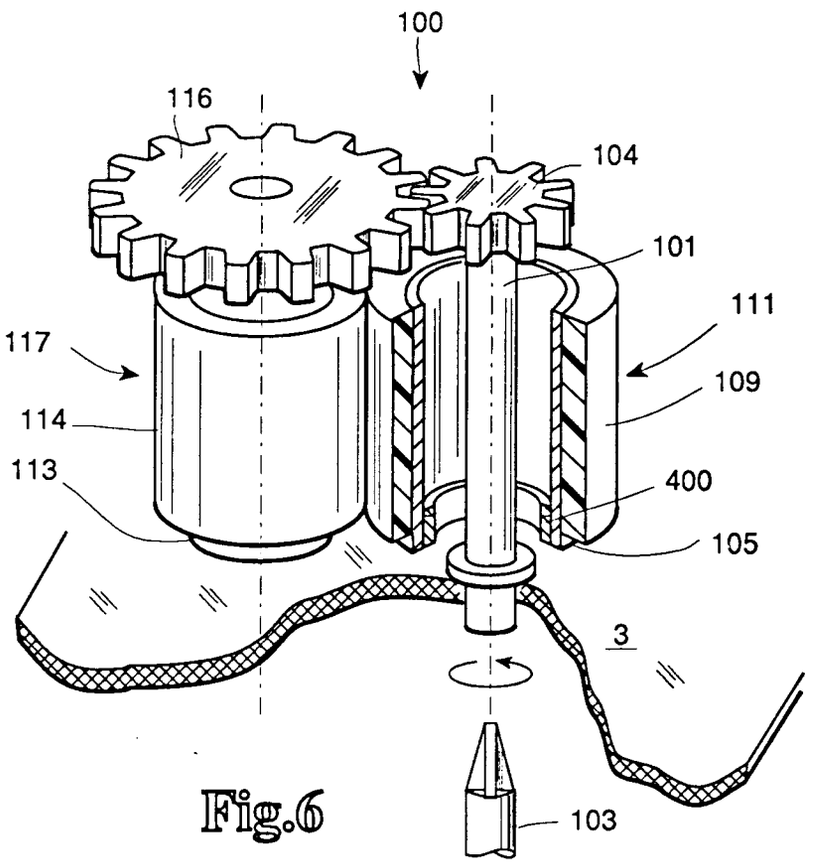
100
116
104
101
111
117
109
114
400
113
105
3
103

Fig.6

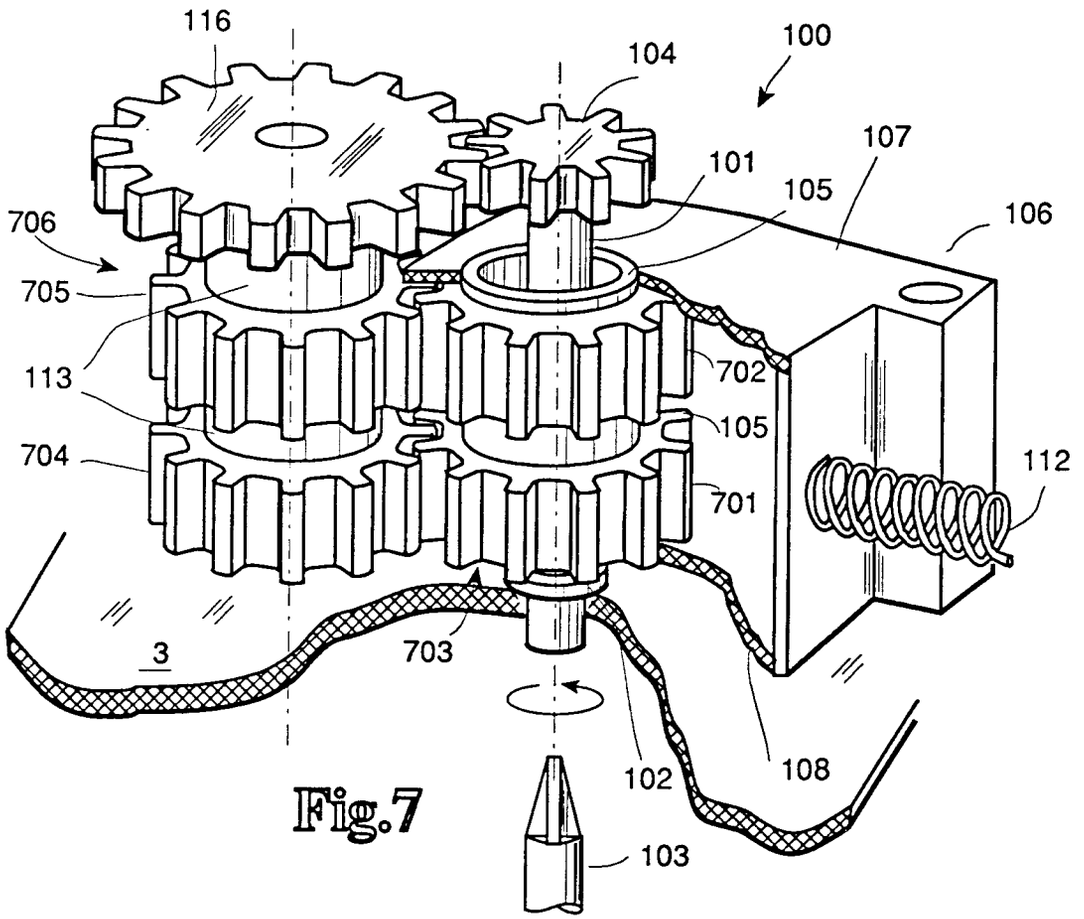
116
104
100
107
101
105
106
706
705
113
702
105
704
112
701
3
703
102
108
103

Fig.7

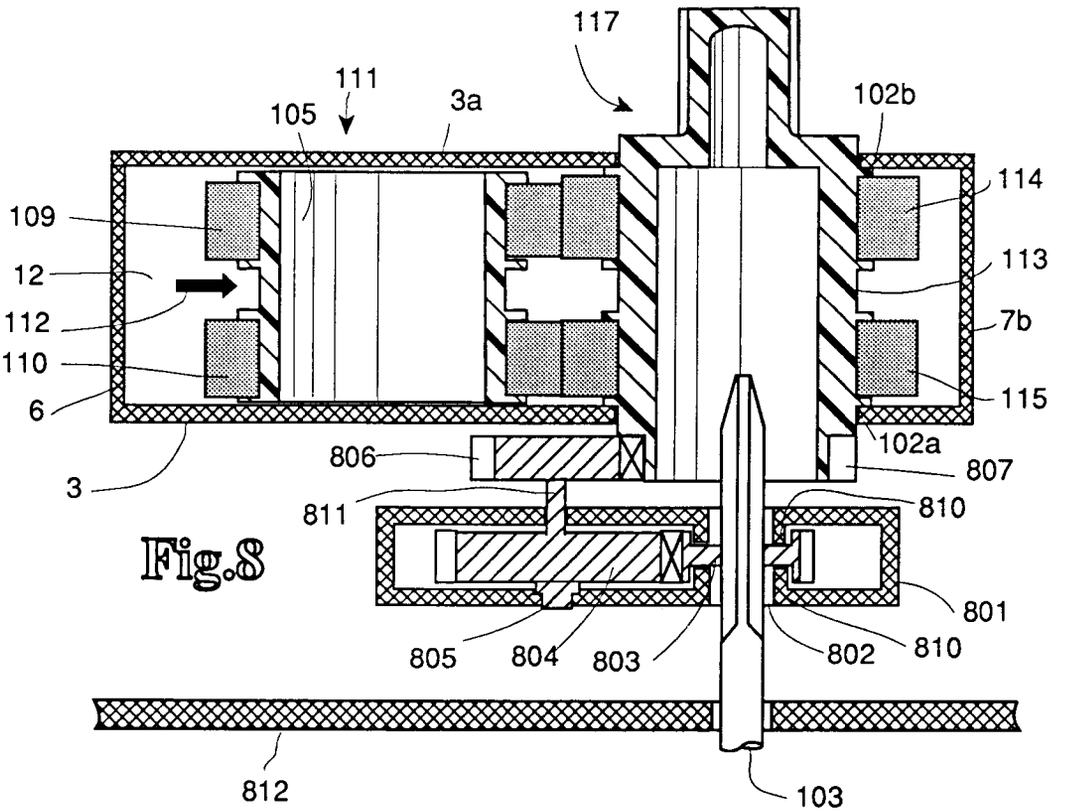
117
111
105
3a
102b
114
109
113
12
112
7b
110
115
6
102a
806
807
3
811
810
801
805
804
803
802
810
812
103

Fig.8

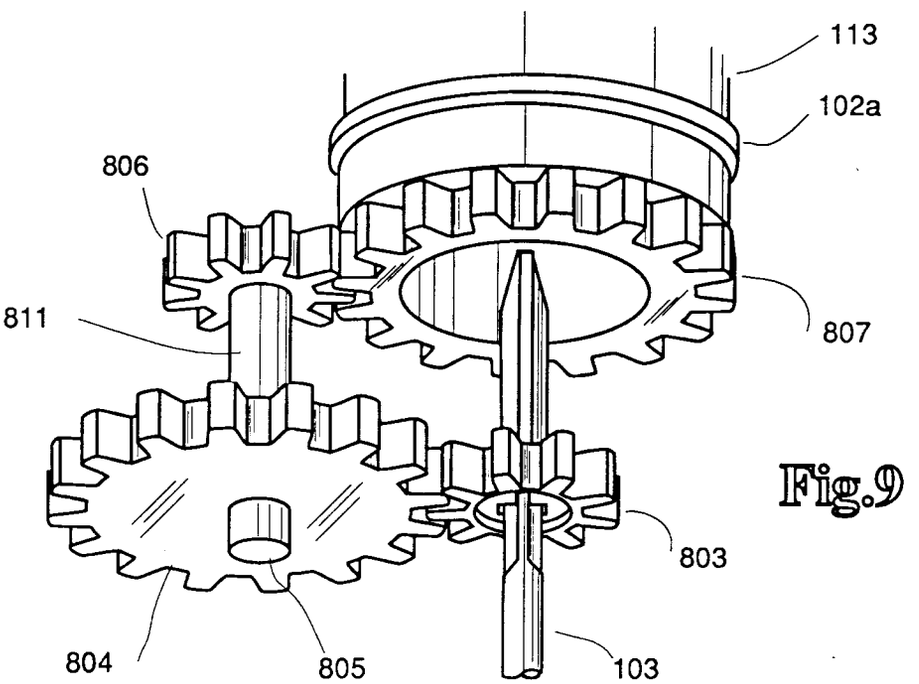
113
102a
806
811
807
803
804
805
103

Fig.9

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 10 2012

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)
X	DE-U-8 526 530 (TRIUMPH-ADLER) * page 4, paragraph 1 - page 5, last paragraph; figures 1,2 *	1,2,7,11	B41J32/02 B41J33/16
Y		3,4	
Y	DE-U-8 528 635 (TURBON INTERNATIONAL) * page 8, line 1 - line 10; figure 4 *	4	
Y	EP-A-0 336 872 (IBM) * abstract; figures 2,3 *	3	
A		1	
A	DE-U-8 124 890 (SIEMENS) * claim 1 *	1,7	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B41J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	17 SEPTEMBER 1992	DUCREAU F.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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