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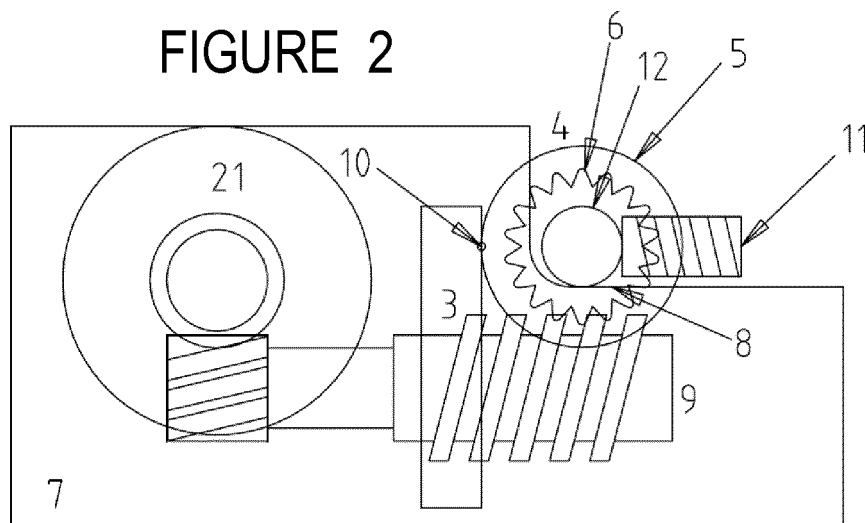
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(54) **Fixed thermal head print mechanism with controlled gear play**

(57) Thermal printer mechanism comprises a frame (7) comprising on each side a flat profile portion (8), a thermal printhead integral and fixed to the frame (7) (3) with a thermal dot line (10), a platen roller (4) having a gear (6) at one end of its axle (12) that is able for tangent contact with and to move in translation along the flat profile portion (8), in order to be guided and aligned to the thermal printhead (3) dot line (10), pressure means (11)

to urge the platen roller (4) against the printhead, a motor (21) to move in rotation the platen roller (4), a helicoid screw (9) for transmitting of the mechanical power from the motor (21) to the platen roller gear (6), said helicoid screw (9) being positioned substantially perpendicular to the printhead (3) and engaged into the platen roller gear (6) when the platen roller axle is in tangent contact with the flat profile portion (8) of the frame.

FIGURE 2



Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention concerns a direct thermal printer mechanism.

PRIOR ART

[0002] It is widely known that a thermal print mechanism comprises a frame for holding all the constitutive printers elements, a thermal printhead, where a dot line can be electrically activated in order to heat a thermal paper sheet, a platen roller that is kept in contact with the thermal printhead by pressure means and a motor with a gear train in order to activate the platen roller in rotation. The last gear of the gear train is integral with one end of the platen roller. The thermal paper sheet is pressed between the platen roller and the thermal printhead by the pressure means, and combining the motion of the paper by the motor and the selection of the portion of the thermal printhead dot line to be heated a printout is formed on such a thermal paper sheet.

[0003] In almost all the cases and to simplify the mechanical force transmission from the motor to the platen roller, and also avoid any tolerance issue between all the elements of the gear train including the last one which is the gear of the platen roller, all the motion elements forming the gear train are integral with the frame. Doing so, the play from one gear to the adjacent ones can be very tight, allowing good print quality, mechanical efficiency and low noise.

[0004] Since the platen roller is made of a metallic shaft over-moulded with a soft rubber which is pressed against the thermal printhead via the pressure means, the distance between the platen roller shaft axis and the thermal dot line may vary according to the force of the pressure means and the paper thickness, to the concentricity of the platen roller, but also according to temperature and humidity which affect the rubber hardness.

[0005] In order to keep a stable pressure between the thermal paper sheet and the thermal dot line to get a consistent printout all along the thermal paper sheet, the thermal printhead is always mounted on a thermal head holder, assembled through hinges on the frame, ideally with two freedom degrees, but also often only along a rotation axis parallel to the printhead dot line, and is pushed on its back by some pressure means in order to compensate the geometrical dimensions variations of the platen roller and the thermal paper sheet when printing.

[0006] Many documents since years are describing such configuration.

[0007] In a further step, the platen roller has been made detachable from the frame in order to simplify the paper insertion between the platen roller and the thermal printhead. Many arrangements have been described in order to remove and locate the platen roller to a closed, so called, printing position.

[0008] Then, the trend has always been to decrease the thermal print mechanism overall dimensions, in particular, the distance from the back of the print mechanism to the thermal printer dot line.

[0009] International publication WO9817475 discloses such arrangement, where the thermal printhead is mounted integral to the printer frame and the platen roller is removable. In this arrangement, the printhead is fixed on the frame and the gear train is made of circular gear up to the last one which is mounted on the platen roller.

[0010] When sizing-down such arrangement, the play between the gear mounted on the platen roller and the last gear mounted on the frame cannot be kept under control, in particular, if the pressure of the pressure means increases or if the rubber gets softer, the play will be dramatically reduced leading to a gear interference between the last gear of the gear train mounted on the frame and the gear mounted on the platen roller.

[0011] One solution to keep the gear play constant is shown on figure 1. A partial circle profile (1) having for center the center of the last circular gear (2) fixed on the frame (7) is arranged on each side of the frame, allowing the platen roller (4) to move back and forth along such profile (1) when urged by the pressure means. Such possibility will keep the gear play constant and will also keep a stable pressure on the thermal paper sheet all along the printhead width, at the same time the alignment between the thermal printhead dot line and the platen roller will be lost, since the platen roller, when moving along the profile (1), will move also in a direction parallel to the thermal printhead, leading to poor print quality due to the alignment loss.

[0012] This problem is of very big importance when the platen roller diameter and the gear module decrease, which is the case for the small thermal print mechanisms widely used in the payment terminal industry and low cost application.

SUMMARY OF THE INVENTION

[0013] The present invention is aiming to size down a thermal print mechanism and to simplify it. In particular the invention object is to provide a compact thermal printing device with simple construction with printhead fixed to the frame and to minimize the number of parts in order to decrease the overall cost of such a printer maintaining the high quality of printing.

[0014] Another object of the invention is to keep the possibility to remove the platen roller for loading and unloading of the thermal paper sheet.

[0015] The present invention proposes a device where the thermal printhead is integral with the frame, the gear play is constant between the platen roller gear and the last gear mounted on the frame and the thermal printhead alignment with the platen roller is also kept constant.

[0016] These objects are achieved by the thermal printing mechanism according to the present invention that comprises:

- a frame comprising on each side a flat profile portion,
- a thermal printhead comprising a thermal dot line, said thermal printhead being integral and fixed to the frame in a direction substantially perpendicular to the flat profile portion of the frame,
- a platen roller having a gear at one end of its axle, said axle being able for tangent contact with the flat profile portion of the frame and being able to move in translation along such flat profile portion of the frame, in order to be guided and aligned to the thermal printhead dot line,
- pressure means to urge the platen roller against the printhead, and
- a motor to move in rotation the platen roller.

[0017] The thermal printing mechanism further comprises a helicoid screw for transmitting of the mechanical power from the motor to the platen roller gear, said helicoid screw being positioned substantially perpendicular to the printhead and engaged with the platen roller gear when the platen roller axle is in tangent contact with the flat profile portion of the frame.

[0018] In a preferred variant of the thermal printer mechanism, on each side of the frame there is a shoulder shape profile adjacent to the flat profile portion of the frame and outlining a nest for the platen roller axle in printing position. Said shoulder shape profile forms a position of unstable equilibrium between two positions of stable equilibrium of the platen roller axis, the platen roller being able to move from the first stable printing position, in tangent contact with the flat profile portion of the frame, to a second stable position, at outer end of the of the shoulder shape profile that is opposite to the flat profile portion.

[0019] According to another embodiment of the thermal printer mechanism the platen roller is rotatably mounted on a platen roller holder.

[0020] Preferably the pressure means pressing the platen roller against the thermal printhead are held by the platen roller holder, and an oblong orifice is arranged on each side of the platen roller holder in a substantially parallel direction to the flat profile portion of the frame in order for the axle of the platen roller to overpass the shoulder profiles of the frame when the platen roller holder moves from an open position to the printing position.

[0021] Preferably on each side of the frame there is an abutment that is arranged at the front of the frame in order to delimit a rest for the platen roller holder and balance the force of the pressure means against the platen roller. Alternatively said abutments are arranged in a hook shape in order to lock the platen roller holder by interconnection with a corresponding element of the platen roller holder.

[0022] In a preferred variant, the platen roller holder also holds a shaft that is substantially parallel to the printhead. Said shaft is able to engage with the hook shape of the abutments of the printer frame when the platen roller engages into the printer frame. Said shaft is spring

loaded in the platen roller holder in order to urge the shaft against the abutments of the frame.

[0023] Advantageously the thermal printer mechanism further comprises a lever that is rotatably mounted on the platen roller holder for moving of the platen roller in a direction substantially opposed to the printhead, allowing the platen roller axle to overpass the frame shoulder profiles, thus disengaging the platen roller axle from the frame. When rotated the lever brings closer the platen roller and the spring movable shaft to each other and thus enable the platen roller to overpass the frame shoulder profiles, and the spring movable shaft to overpass the abutments, thus disengaging the platen roller axle from the frame.

[0024] According to alternative embodiment of the thermal printer mechanism the pressure means are hold by the printer frame and put into pressure the platen roller against the thermal printhead when the platen roller engages with the printer frame.

[0025] Preferably each pressure means comprises a wire spring, integral to the frame. Advantageously the outer part of each pressure means is curved for guiding and locking the platen roller against the flat profile portion of the frame.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] The characteristics of the invention will be disclosed in details in the following description of preferred embodiments, given as a non-restrictive example, with reference to the attached drawings wherein:

- | | |
|-----------------|---|
| Figure 1 | is a schematic sectional view of a possible thermal printing mechanism given as a comparative example; |
| Figure 2 | is a schematic sectional view of a first embodiment of the thermal printing mechanism according to the present invention; |
| Figure 3 | is a schematic sectional view of a variant of the first embodiment of the thermal printing mechanism according to the present invention shown on figure 2; |
| Figures 4 and 5 | are schematic sectional views of further embodiment of the thermal printing mechanism according to the present invention with a platen roller holder in open and closed position; |
| Figure 6 and 7 | is a schematic sectional view of a further variant of the embodiment shown on figures 4 and 5 with a lever for unlocking of the platen roller holder from the frame. |
| Figure 8 | is a schematic sectional view of another embodiment of the thermal printing mechanism according to the present invention. |

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0027] Figure 2 shows first embodiment of the thermal printing mechanism according to the present invention. The thermal printing mechanism comprises:

- a frame 7 comprising on each side a flat profile portion 8,
- a thermal printhead 3 comprising a thermal dot line 10, said thermal printhead being integral and fixed to the frame 7 in a direction substantially perpendicular to the flat profile portion 8 of the frame 7,
- a platen roller 4 having a gear 6 at one end of its axle 12, said axle 12 being able for tangent contact with the flat profile portion 8 of the frame 7 and being able to move in translation along said flat profile portion of the frame, in order to be guided and aligned to the thermal printhead 3 dot line 10,
- pressure means 11 to urge the platen roller 4 against the printhead,
- a motor 21 to move in rotation the platen roller 4.

[0028] The device also comprises a helicoid screw 9 for transmitting of the mechanical power from the motor 21 to the platen roller gear 6. Said helicoid screw 9 is positioned substantially perpendicular to the printhead 3 and engaged with the platen roller gear 6 when the platen roller axle is in tangent contact with the flat profile portion 8 of the frame 7.

[0029] The flat profile portions 8, on each side of the frame 7, allow a movement of the platen roller only in a direction perpendicular to the thermal printhead dot line 10. Moving so, the platen roller 4 will always remain perfectly aligned to the thermal printhead dot line 10, whatever is its rubber deformation. The gear 6 integral to the platen roller 4 and mounted on its axle 12 has a helical profile in order to engage into a helicoid screw 9, which is arranged in a direction parallel to the flat profile portion 8. When the platen roller moves back and forth along the flat profile 8, the distance between the center of the platen roller axle 12 and the helicoid screw axis remain constant, keeping the gear play constant whatever is the position of the platen roller on the flat profile.

[0030] With this arrangement, both the play between the last two gears of the gear train and the dot line 10 alignment to the platen roller does not change whatever is the position of the platen roller 4 on the flat profile portions 8 and whatever is the platen roller 4 deformation when the pressure means are pressing the platen roller 4 against the thermal printhead 3.

[0031] The pressure means for the platen roller could be of any suitable kind known from the prior art. For example they could be helical compression springs. The pressure means 11 for the platen roller 4 could be mounted on the frame 7 or on the element that holds the platen roller 4.

[0032] Figure 3 shows a variant wherein on each side

of the frame 7 there is a shoulder shape profile 17 that is arranged adjacent to the flat profile portion 8 of the frame so as to outline the outer board of a nest for the platen roller axis in printing position. Said shoulder shape profiles 17 are forming a position of unstable equilibrium between two positions of stable equilibrium of the platen roller axis, the platen roller 4 being able to move from the first stable printing position, in tangent contact with the flat profile portions 8 of the frame, to a second stable position at outer surfaces of the shoulder shape profiles 17 that are opposite to the flat profile portions 8.

[0033] On the figure 4, 5 and 8 the gear train is not represented to ease the reading of the variant of embodiments.

[0034] In a preferred embodiment of the invention shown on figs 4 and 5 the platen roller is held by a platen roller holder. This is in particular the case when the printer mechanism is also featuring an easy loading cutter.

[0035] On figure 4 the platen roller holder is represented detached from the printer frame to ease the understanding. The platen roller 4 is rotatably mounted on the platen roller holder 15 and the pressure means 11 are held by the platen roller holder 15. One oblong orifice 18 is arranged on each side of the platen roller holder in a substantially parallel direction to the flat profile portion 8 of the frame 7 in order to facilitate the axle 12 of the platen roller to overpass the shoulder profile 17 of the frame 7 when the platen roller holder 15 goes from the open position to the closed position.

[0036] In a preferred variant the platen roller holder 15 is pivotally mounted to the frame 7 (not shown on the figures). It is also possible for the platen roller holder to be suitably attached to a movable part, for example a lid, of the device where the printer mechanism is assembled.

[0037] As shown on the same figure 4, on each side of the frame 7 there are an abutment 20 that is arranged on the front of the frame in order to delimit the rest for the platen roller holder 15 and to balance the force of the pressure means 11 against the platen roller 4.

[0038] Further, a shaft 19 that is substantially parallel to the printhead is mounted on the platen roller holder 15 at the end of the pressure means that is opposite to the platen roller 4. This shaft 19 is able to engage with hook shapes of the abutments 20 of the printer frame when the platen roller 4 engages with the printer frame 7 in printing position as shown on fig. 5. Said shaft 19 is spring loaded in the platen roller holder 15 in order to be urged against the abutments 20 of the frame.

[0039] The figures 6 and 7 show a lever 16 mounted rotatably on the platen roller holder 15, so as to unlock the platen roller holder 15 from the frame 7. When this lever is rotated it brings closer the platen roller 4 and the movable shaft 19 to each other in order for the platen roller 4 to overpass the frame shoulder profiles 17, and for the movable spring-loaded shaft 19 to overpass the abutments 20, thus disengaging the platen roller axle 12 from the frame 7. In a preferred variant shown on the figures the lever 16 is a bracket-like element that on each

lateral side has an arm to engage with the platen roller axle. Additionally the lever 16 has on each lateral side an irregular loop-shape part to engage with the shaft 19. When the lever 16 is rotated said arms push the platen roller axle 12 back in the oblong orifices 18 against the force of pressure means 11 while simultaneously said loop-shape parts of the lever 16 move the shaft 19 toward the platen roller 4.

[0040] Figure 8 shows another embodiment of the present invention with alternative arrangement for the pressure means 11. The pair pressure means 11 that push the platen roller 4 against the thermal printhead 3 are integral to the frame 7. The pressure means 11 are made from a wire spring. Moreover an outer part of this wire spring 11 is curved in order to create a locking profile 13 to generate a component of force to keep the platen roller in contact with the flat profile portion 8 of the frame 7. In a preferred variant shown on the figure 8 said locking profiles 13 have an inclined straight portion for guiding of the platen roller axle 12 when the platen roller 4 is moving to the printing position.

[0041] In a preferred variant not shown on the figures the platen roller is simply attached, by appropriate way known from the state of the art, to a movable part, for example a lid, of the device where the printer mechanism is assembled.

[0042] Various modifications and/or additions of parts will be apparent to those skilled in the art that will remain within the field and scope of the present invention defined in appended claims. All the parts may further be replaced with other technically equivalent elements.

[0043] Reference signs for technical features are included in the claims for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. Thermal printer mechanism comprising:

- a frame (7) comprising on each side a flat profile portion (8),
- a thermal printhead (3) comprising a thermal dot line (10), said thermal printhead being integral and fixed to the frame (7) in a direction substantially perpendicular to the flat profile portion (8) of the frame (7),
- a platen roller (4) having a gear (6) at one end of its axle (12), said axle (12) being able for tangent contact with the flat profile portion (8) of the frame (7) and being able to move in translation along such flat profile portion of the frame, in order to be guided and aligned to the printhead thermal dot line (10),
- pressure means (11) to urge the platen roller

(4) against the printhead,

- a motor (21) to move in rotation the platen roller (4),

characterized in that

it further comprises a helicoid screw (9) for transmitting of the mechanical power from the motor (21) to the platen roller gear (6), said helicoid screw (9) being positioned substantially perpendicular to the printhead (3) and engaged with the platen roller gear (6) when the platen roller axle (12) is in tangent contact with the flat profile portion (8) of the frame (7).

2. Thermal printer mechanism according to claim 1 wherein on each side of the frame (7) there is a shoulder shape profile (17) adjacent to the flat profile portion (8) of the frame (7) and outlining a nest for the platen roller axle (12) in printing position, said shoulder shape profile (17) forming a position of unstable equilibrium between two positions of stable equilibrium of the platen roller axis, the platen roller (4) being able to move from the first stable printing position, in tangent contact with the flat profile portion (8) of the frame, to a second stable position, at outer surface of the shoulder shape profile that is opposite to the flat profile portion (8).
3. Thermal printer mechanism according to any of the previous claims wherein the platen roller (4) is rotatably mounted on a platen roller holder (15).
4. Thermal printer mechanism according to claim 3, wherein the pressure means (11) pressing the platen roller (4) against the thermal printhead (3) are held by the platen roller holder (15), and an oblong orifice (18) is arranged on each side of the platen roller holder in a substantially parallel direction to the flat profile portion (8) of the frame (7) in order for the axle (12) of the platen roller (4) to overpass the shoulder profiles (17) of the frame (7) when the platen roller holder (15) moves from an open position to the printing position.
5. Thermal printer mechanism according to claim 4, wherein on each side of the frame there is an abutment (20), that is arranged at the front of the frame (7) in order to delimit a rest for the platen roller holder (15) and balance the force of the pressure means (11) against the platen roller (4).
6. Thermal printer mechanism according to any of the previous claims wherein the abutments (20) are arranged in a hook shape in order to lock the platen roller holder (15) by interconnection with a corresponding element of the platen roller holder (15).
7. Thermal printer mechanism according to claim 6, wherein the platen roller holder (15) also holds a

shaft (19) that is substantially parallel to the print-head (3), said shaft (19) being able to engage with the hook shape of the abutments (20) of the printer frame (7) when the platen roller (4) engages into the printer frame (7), wherein said shaft (19) is spring loaded in the platen roller holder (15) in order to urge the shaft (19) against the abutments (20) of the frame.

8. Thermal printer mechanism according to any of the claims 3 to 7, wherein there is a lever (16) that is rotatably mounted on the platen roller holder (15) for moving of the platen roller (4) in a direction substantially opposed to the printhead (3) direction, allowing the platen roller axle (12) to overpass the frame shoulder profiles (17), thus disengaging the platen roller axle (12) from the frame (7).
9. Thermal printer mechanism according to claims 8, wherein the lever (16) is rotatably mounted on the platen roller holder (15), so as when rotated to bring closer the platen roller (4) and the spring movable shaft (19) to each other in order for the platen roller (4) to overpass the frame shoulder profiles (17) and for the spring movable shaft (19) to overpass the abutments (20), thus disengaging the platen roller holder (15) from the frame (7).
10. Thermal printer mechanism according to claim 1, wherein the pressure means (11) are held by the printer frame (7) and put into pressure the platen roller (4) against the thermal printhead (3) when the platen roller (4) engages with the printer frame (7).
11. Thermal printer mechanism according to claim 10, wherein each pressure means (11) comprises a wire spring, integral to the frame (7).
12. Thermal printer mechanism according to claim 11, wherein the outer part of each pressure means (11) is curved (13) for guiding and locking the platen roller (4) against the flat profile portion of the frame (7).

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FIGURE 1

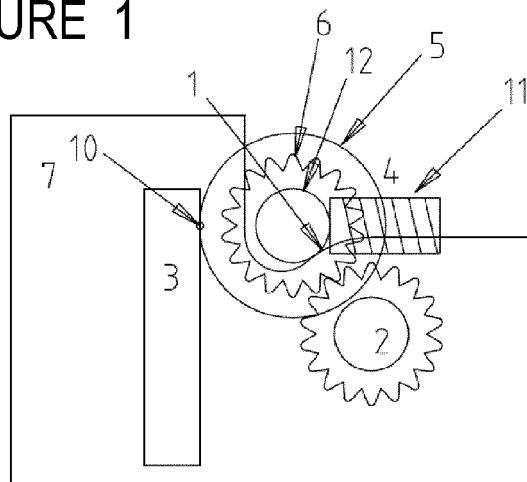


FIGURE 2

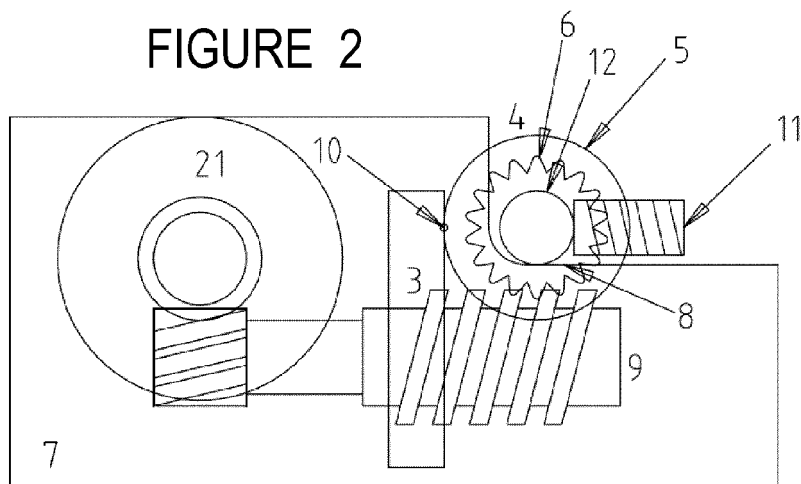


FIGURE 3

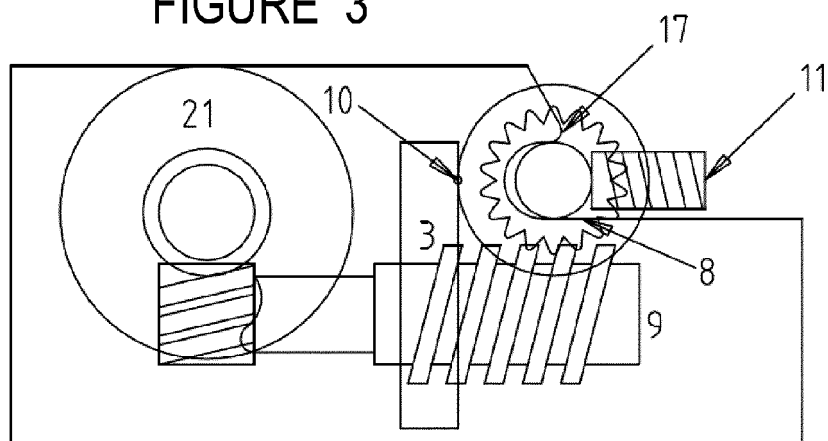


FIGURE 4

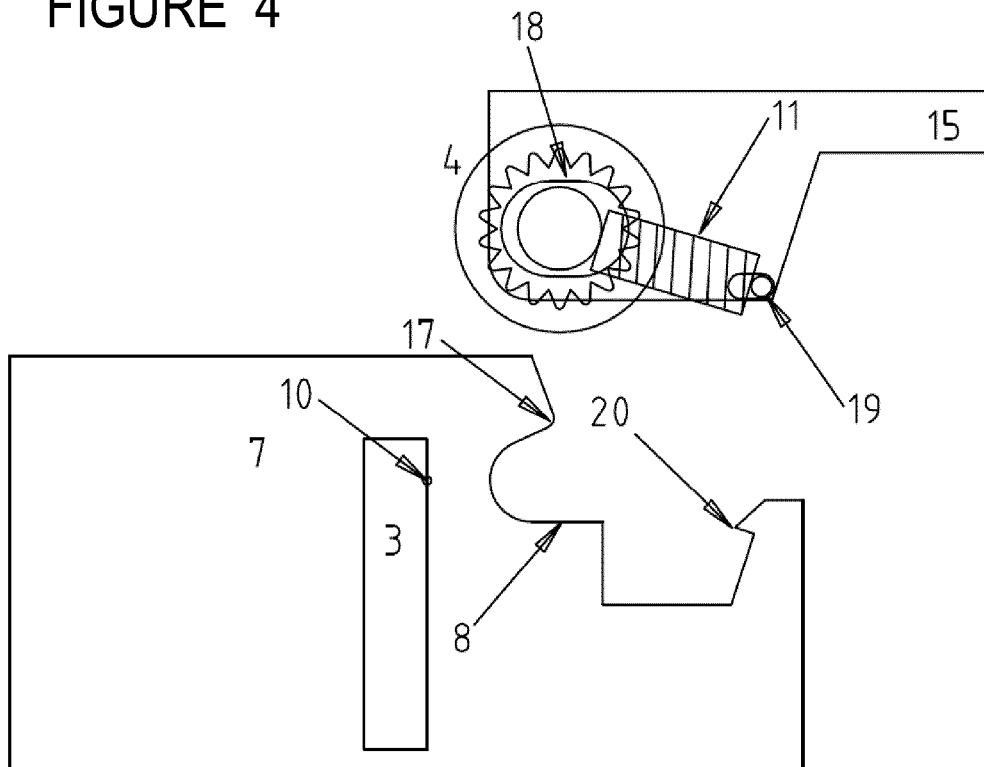


FIGURE 5

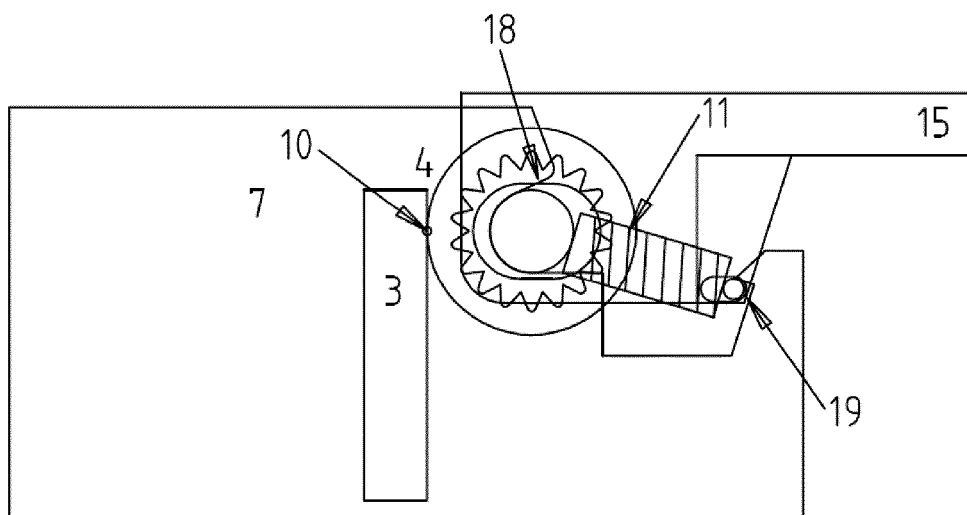


FIGURE 6

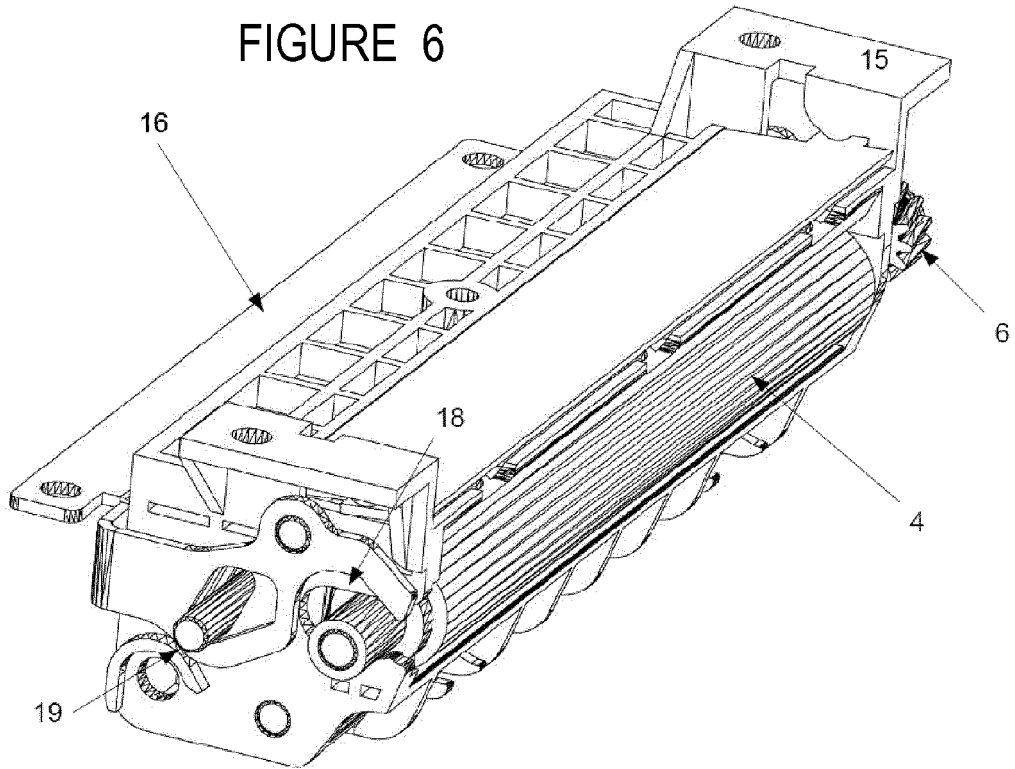


FIGURE 7

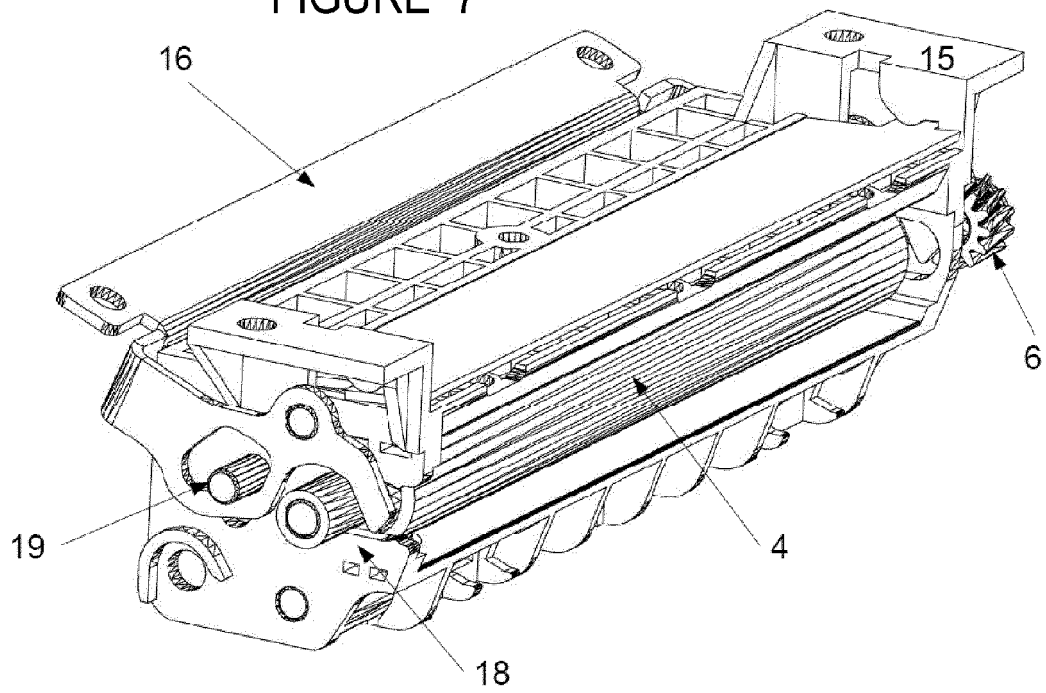
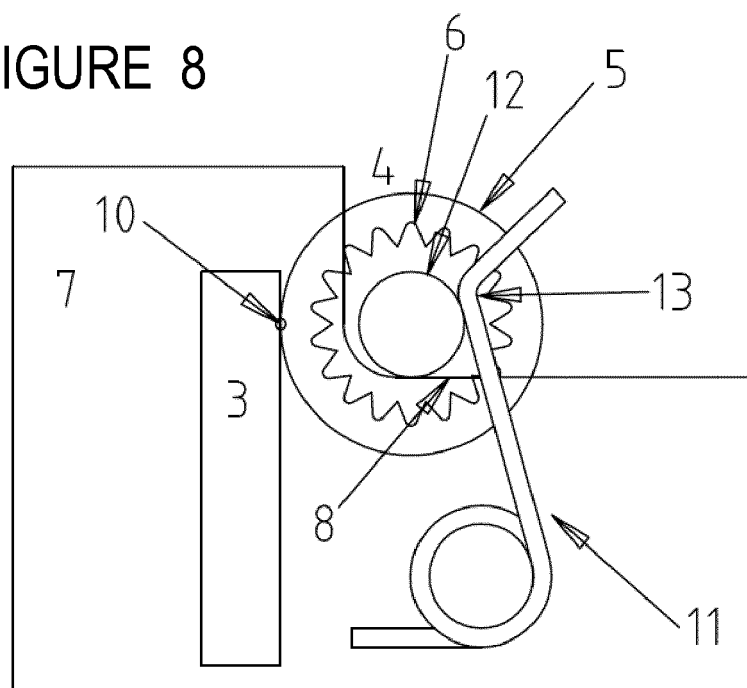


FIGURE 8





EUROPEAN SEARCH REPORT

Application Number
EP 13 17 7105

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Place of search The Hague		Date of completion of the search 1 September 2014	Examiner Curt, Denis
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 13 17 7105

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The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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