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(54) **Combing machine with movement system of the upper jaw of the nipper**

(57) A combing machine comprises a circular comb (20), a nipper (4) with lower jaw (6), upper jaw (8) and a straight comb (10). A driven shaft lower jaw nipper (30), a driven shaft upper jaw (40) rotatable with rotatory alternated motion, which supports at least one cam (42) and a transmission group (50) connected in input to a rotatable shaft with circular movement and in output to the driven shaft upper jaw (40), is provided for the movement of the nipper. The transmission group (50) comprises non-circular moving parts, to transform the circular movement into alternated rotatory movement according to a desired law of motion.

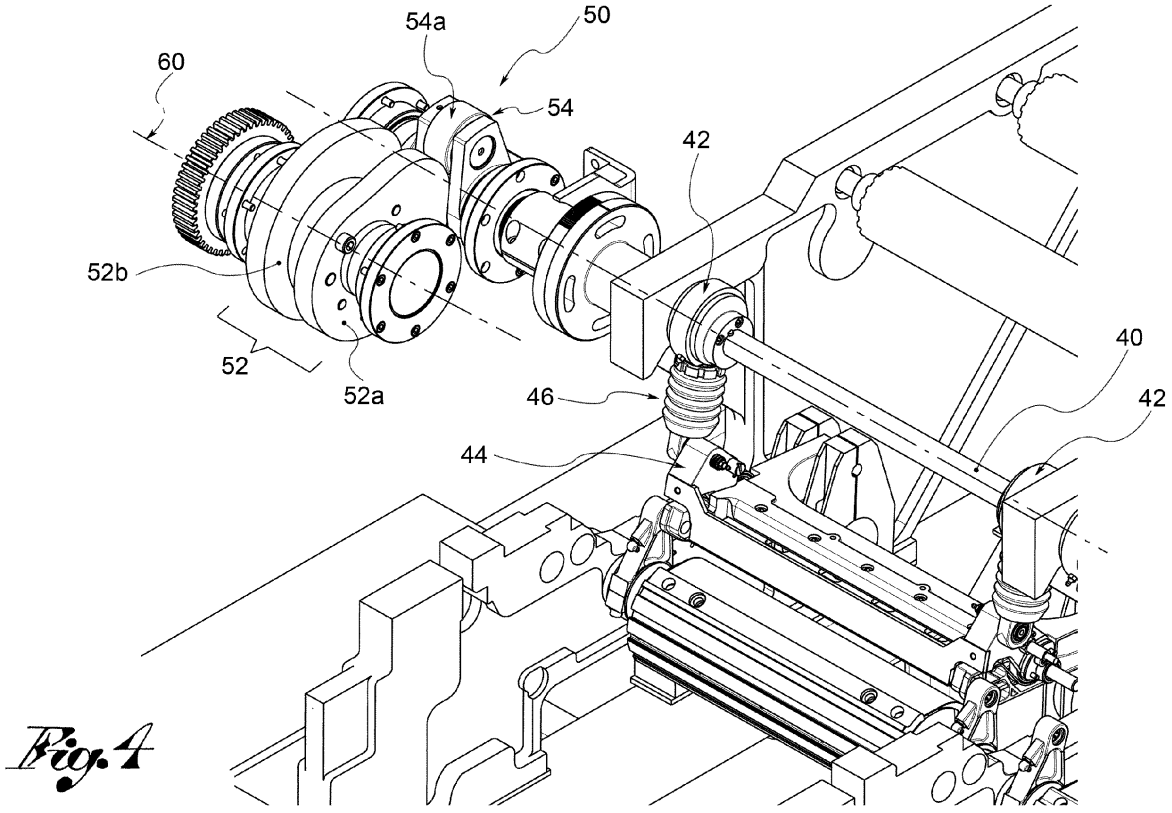

Fig. 4

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Description

[0001] The present invention relates to a combing machine on a yarn spinning line, and in particular a device for moving the upper jaw of the nipper of the combing machine.

[0002] On a yarn spinning line, after the initial phases of opening and cleaning the fibre, carding is performed by carding machines, after which the fibre appears in the form of a web.

[0003] After processing, if any, on a lap-winder, in which various separate webs are combined to form a lap, the web or lap is combed by a combing machine, so as to obtain a web in which the fibres have been rendered highly clean and parallel.

[0004] The basic combing operations, which in the most recent machines are performed at 450-500 strokes a minute, are:

[0005] - intermittent feeding of the lap;

[0006] - combing, by means of a rotary comb, of the head of the incoming tuft, with the nipper closed;

[0007] - overlapping and joining of the head of the tuft to the web already combed in the previous cycle, moved suitably back, by means of tearing rollers during their rotation backwards;

[0008] - combing of the tail using a rectilinear comb of the nipper, with the nipper open,

[0009] - advancement of the combed tuft by the tearing rollers during their forward rotation.

[0010] Processing is therefore alternated and the dynamic stresses of the moving parts, which are subject to repeated stopping and starting, constitute one of the critical design aspects of combing machines.

[0011] The circular comb is provided with a continuous rotatory movement, synchronised with the alternate movement of the nipper, so as not to interfere structurally with it.

[0012] The circular comb has a uniform or variable rotation speed. Generally, when it is variable the rotation is slower when the nipper is near the tearing rollers (and the circular comb is therefore idle) and faster when the circular comb combs the fibre (and the nipper is therefore distant from the tearing rollers) and when the tearing rollers move the previously combed tuft backwards for overlapping with the new one.

[0013] The alternate movement of the lower jaw and the upper jaw of the nipper also occurs at variable speed, according to a desired law of motion.

[0014] However, the prior solutions have several drawbacks. In particular they do not permit optimal management of the characteristics of the relative movement (position and speed above all) of the lower and upper jaw in significant moments of the combing cycle.

[0015] The purpose of the present invention is to satisfy the aforementioned requirements and overcome the drawbacks of the prior solutions.

[0016] Such purpose is achieved by a combing machine according to claim 1 below.

[0017] The characteristics and advantages of the combine machine according to the present invention will be evident from the following description, made by way of a non-limiting example, with reference to the attached drawings, wherein:

[0018] - figure 1 shows a diagram of a combing machine, in a forward position of the nipper (nipper open);

[0019] - figure 2 shows the diagram of figure 1, in a rearward position of the nipper (nipper closed);

[0020] - figure 3 shows a diagram of a lateral view of the combing machine according to the present invention, in a nipping configuration;

[0021] - figure 4 shows a diagram of an axonometric view of the combing machine in figure 4;

[0022] - figure 5 shows a transmission group of the combing machine in the previous figures;

[0023] - figures 6a and 6b show diagrams of the transmission group in figure 5, respectively during an outward phase of the combing cycle and during a return phase of the combing cycle;

[0024] - figure 7 shows relief points and trajectories for the combing cycle of the combing machine according to the invention.

[0025] A combing machine according to the invention comprises a fixed frame, a nipper 4 and a circular comb 20.

[0026] The nipper 4 comprises a lower jaw 6, an upper jaw 8 and a straight comb 10, suitable for combing the tail of the tuft, generally joined to the lower jaw.

[0027] In addition, the nipper 4 comprises a feed roller 12, rotating on command, supported by the lower jaw 6.

[0028] Downstream of the nipper 4, are pairs of tearing rollers 14, 16, rotating on command with alternate rotatory movement.

[0029] The nipper 4 has an alternate back and forth movement; in a forward position (figure 1), the nipper occupies a processing zone and the jaws 6, 8 are next to the tearing rollers 14, 16 and open, so as to permit the advancement of the web and the combing of the outgoing tails by the rectilinear comb 10; in a rearward position of the nipper (figure 2), the jaws 6, 8 are distal from the tearing rollers 14, 16 and closed in nipping, so as to permit the combing of the outgoing heads by the circular comb.

[0030] The circular comb 20 is joined in rotation to a driven shaft circular comb 18 and has a continuous rotatory movement, preferably according to a desired law of motion.

[0031] To achieve the desired law of motion of the circular comb, the driven shaft circular comb 18 is for example commanded by a switch. The details of such embodiment are described in t h e International Application PCT/IB2010/055880 in the name of the Applicant.

[0032] For example, the combing machine comprises an electric motor and a mechanical belt and/or gear transmission for the transmission of the rotatory movement from the electric motor to the driven shaft circular comb 18.

[0033] According to one embodiment, the transmis-

sion comprises a cam transformation device suitable for transforming a uniform circular movement in input into a non-uniform rotatory movement in output, transmitting it to the driven shaft circular comb 18.

[0034] The rotatory movement of the circular comb 20 is synchronised with the alternate movement of the nipper 4, so that when the nipper is in the forward position, in other words in the processing zone immediately upstream of the tearing rollers, the comb 20 is inactive, that is to say outside the processing zone; when the nipper is in the rearward position, in which the jaws do not occupy the processing zone, the comb is in said processing zone and performs combing of the head of the tuft.

[0035] The combing machine further comprises a driven shaft lower jaw nipper 30, with rotatory alternated motion, joined in rotation to an oscillating arm 32, hinged to a lower frame 34 of the nipper 4, which supports the lower jaw 6.

[0036] Furthermore, the lower frame of the nipper is supported by a further oscillating arm, hinged at one end to the lower frame and hinged at the other end to the driven shaft circular comb.

[0037] Preferably, the driven shaft lower jaw nipper 30 is kinematically connected to the same electric motor as moves the circular comb 20.

[0038] According to one embodiment variation, the combing machine comprises a further electric motor, dedicated to the movement of the driven shaft lower jaw nipper.

[0039] In addition, the combing machine comprises a driven shaft upper jaw 40, rotatable with rotatory alternated motion, which at least one cam 42, joined in rotation, is positioned on.

[0040] For example, a pair of axially distanced cams 42 are provided, for each combing head.

[0041] The cams 42 are operatively connected to an upper frame 44, which supports the upper jaw 8 of the nipper 4, for example by means of a shock absorber device 46 for each cam 42.

[0042] In a solution of the prior art, the driven shaft upper jaw is kinematically coupled to the driven shaft circular comb by means of a system of circular moving parts, that is to say gears. as a result, the law of motion of the driven shaft lower jaw nipper, according to such embodiment of the prior art, is identical to that of the driven shaft circular comb, short of a speed reducing ratio.

[0043] According to the invention rather, the driven shaft upper jaw 40 is connected to a transmission group 50 kinematically connected in input to a rotatable shaft with continuous circular motion, for example of an electric motor, and in output to the driven shaft upper jaw 40, comprising non-circular moving parts, to transform the continuous circular movement of the upper jaw drive shaft 60 into the alternated rotatory movement of the driven shaft upper jaw bearing the cams 42, according to a desired law of motion.

[0044] The non-circular moving parts are, for example, cams, non-circular toothed wheels, for example elliptical, and wheels symmetric or non-symmetric to a centre of rotation.

[0045] According to a preferred embodiment, the combing machine comprises an upper jaw drive shaft 60, for example out of axis with the driven shaft upper jaw 40, preferably moved by an electric motor.

[0046] Preferably, said electric motor for the movement of the upper jaw drive shaft is the same electric motor as moves the circular comb or the entire combing machine.

[0047] According to one embodiment variation, the electric motor for the movement of the upper jaw drive shaft is different from the electric motor which moves the circular comb or the remaining parts of the combing machine.

[0048] The upper jaw drive shaft 60 is provided with a uniform circular movement, gives over its movement to the transmission group 50, which the driven shaft upper jaw 40 comes out of, having an alternate rotatory movement according to a desired law.

[0049] Preferably, the transmission group 50 is a cam device and comprises a cam motor device 52, joined in rotation to the upper jaw drive shaft 60, and a driven oscillator device 54 joined in rotation to the driven shaft upper jaw 40.

[0050] Preferably, the cam motor device 52 comprises at least two flat cams 52a, 52b in axial succession, for example axially distanced along the upper jaw drive shaft 60.

[0051] Similarly, the driven device 54 comprises a pair of non-motorised rollers 54a, 54b rotatable on respective arms 56a, 56b, in axial succession, for example axially distanced along the driven shaft upper jaw 40, respectively engageable with the flat cams 52a, 52b.

[0052] Preferably, both non-motorised rollers are always engaged with the respective cams to ensure a regularity of movement and the absence of play, which is essential for limiting the vibrations generated by the elevated dynamic forces at play.

[0053] Figure 7 shows the trajectory followed during a combing cycle by some of the relief points of the nipper.

[0054] During nipping, the lower jaw and the upper jaw come into contact along the nipping line, defined in cross-section by a point.

[0055] The point Pi is the point of the lower jaw which comes into contact with the upper jaw; during the combing cycle, the point Pi follows the trajectory Ti.

[0056] The point Ps is the point of the upper jaw which comes into contact with the lower jaw; during the combing cycle, the point Ps follows the trajectory Tsa during the outward phase towards the closed position and the trajectory Tsr during the return phase towards the open position (that is during the movement towards the maximum aperture).

[0057] In addition, for a combing machine according to the prior art, T' is the trajectory followed during the combing cycle, both back and forth, by the point Ps.

[0058] In the points of intersection between the trajectory Ti and the trajectories Tsa, Tsr and T', the real physical contact between the lower jaw and upper jaw takes place.

[0059] In particular:

[0060] - the point Pea identifies the contact between the upper jaw and the lower jaw at the end of the outward phase (from maximum aperture towards closure);

[0061] - the point Pcr identifies the contact between the upper jaw and the lower jaw at the end of the nipping phase, that is at the instant of incipient detachment (from closure towards maximum aperture).

[0062] For a combing machine made according to the prior art, the point Pc identifies the contact between the upper jaw and the lower jaw at the moment of nipping.

[0063] Advantageously, in the combing machine according to the present invention, during the outward phase, the point Ps of the upper jaw initially moves rapidly towards the point Pi of the lower jaw, and then more slowly and with a direction of the speed similar to that of the point Pi of the lower jaw, thereby greatly limiting impact (very similar incline of the trajectory Ti and the trajectory Tsa in Pca).

[0064] Advantageously, moreover, in the combing machine according to the invention, the detachment of the lower jaw and the upper jaw is sudden, (different incline between the trajectory Ti and the trajectory Tsr in Pcr.

[0065] In addition, advantageously, during the return phase, the upper jaw follows a trajectory Tsr connected to the outbound trajectory Tsa (connection at the point of maximum raising of the upper jaw), limiting or eliminating sudden changes of direction.

[0066] Advantageously, in addition, by modifying the construction parameters of the transmission group it is possible to regulate as needed the anticipation or delaying of nipping, the duration of the nipping phase, the speed of approach of the upper jaw to the lower jaw etc.

[0067] Preferably, in addition, the driven shaft upper jaw 40 is positioned above the nipper 4, thereby considerably simplifying the arrangement of the mechanical components.

[0068] Innovatively, the present invention makes it possible to improve the reliability of the combing machine, in that the jaws of the nipper are subject to impact of limited intensity, so that breakages are much more infrequent.

[0069] In particular it is possible to considerably improve the approach trajectories between the jaws and the speed thereof, in particular upon contact.

[0070] Advantageously, in addition, the combing machine is quieter, thanks to the less violent contact of the jaws.

[0071] According to yet a further advantageous aspect, the transmission group with cam and oscillator is particularly simple to produce and highly reliable.

[0072] Advantageously, in addition, the transmission group with cam and oscillator is able to support very high loads, in that it is structurally very robust.

[0073] According to a further advantageous aspect, the transmission group with cam and oscillator shows limited wear, due mainly to the absence of rubbing between the motor device and the driven device, unlike a gear mechanism for example.

[0074] According to yet a further advantageous aspect, the transmission group with cam and oscillator makes it possible to substantially eliminate the play between the motor device and the driven device.

[0075] Advantageously, in addition, the transmission group with cam and oscillator makes it possible to create highly complex laws of motion, unlike transmissions with gears, thanks to the desired profiling of the cams.

[0076] It is clear that a person skilled in the art may make modifications to the combing machine described above so as to satisfy specific requirements.

[0077] For example, according to one embodiment variation, the combing machine comprises:

[0078] - a circular comb 20 joined in rotation to a driven shaft circular comb 18 rotatable with a circular movement by means of a first electric motor;

[0079] - a mobile nipper 4 with alternated motion, comprising:

[0080] a) a lower frame 34 and a lower jaw 6, supported by the lower frame;

[0081] b) an upper frame 44 and an upper jaw 8, supported by the upper frame 44;

[0082] c) a rectilinear comb 10;

[0083] - a driven shaft lower jaw nipper 30 rotatable with rotatory alternated motion, connected to the lower frame 34 of the nipper;

[0084] - a driven shaft upper jaw 40 rotatable with rotatory alternated motion, which supports at least one cam 42 operatively connected to the upper frame 44 of the nipper;

[0085] - a transmission group 50 connected in input to a dedicated electric motor having circular movement and in output to the driven shaft upper jaw 40, comprising non-circular moving parts, to transform the circular movement into alternated rotatory movement according to a desired law of motion.

Claims

1. Combing machine of a yarn spinning line, comprising:

- a circular comb (20) joined in rotation to a driven shaft circular comb (18) rotatable with a circular movement;
- a mobile nipper (4) with alternated motion, comprising:

a) a lower frame (34) and a lower jaw (6), supported by the lower frame;
b) an upper frame (44) and an upper jaw (8), supported by the upper frame (44);

c) a rectilinear comb (10);

- a driven shaft lower jaw nipper (30) rotatable with rotatory alternated motion, connected to the lower frame (34) of the nipper;
- a driven shaft upper jaw (40) rotatable with rotatory alternated motion, which supports at least one cam (42) operatively connected to the upper frame (44) of the nipper;
- a transmission group (50) connected in input to a rotatable shaft with circular movement and in output to the driven shaft upper jaw (40), comprising non-circular moving parts, to transform the circular movement into alternated rotatory movement according to a desired law of motion.

2. Combing machine according to claim 1, wherein the transmission group (50) comprises

i) a cam motor device (52) joined in rotation to the upper jaw drive shaft (60); and
ii) a driven oscillator device (54) joined in rotation to the driven shaft upper jaw (40).

3. Combing machine according to claim 2, wherein the motor device (52) comprises at least one pair of flat cams (52a, 52b) in axial succession, and wherein the driven device (54) comprises non-motorised rollers (54a, 54b) engageable with the respective flat cams (52a, 52b).

4. Combing machine according to claim 3 wherein the cams (52a, 52b) are axially distanced.

5. Combing machine according to any of the previous claims, comprising

- an upper jaw drive shaft (60), rotatable with circular movement, entering the transmission group (50);
- an electric motor (21) operatively connected to the driven shaft circular comb (18) and operatively connected to the upper jaw drive shaft (60).

6. Combing machine according to claim 5,comprising a cam transmission device positioned between the electric motor (21) and the driven shaft circular comb (18) to transform the circular movement of the electric motor into a rotatory movement of the driven shaft circular comb (18) according to a desired law of motion.

7. Combing machine according to any of the previous claims, wherein the driven shaft upper jaw is out of axis with the upper jaw drive shaft.

8. Combing machine according to any of the previous claims, wherein the driven shaft circular comb is out of axis with the driven shaft upper jaw (40).

9. Combing machine according to any of the previous claims, wherein the driven shaft upper jaw nipper (30) is out of axis with the driven shaft circular comb (18).

10. Combing machine according to any of the previous claims, comprising a shock absorber device (46) positioned between the cam (42) and the upper frame (44).

11. Combing machine of a yarn spinning line, comprising:

- a circular comb (20) joined in rotation to a driven shaft circular comb (18) rotatable with a circular movement by means of a first electric motor;
- a mobile nipper (4) with alternated motion, comprising:

a) a lower frame (34) and a lower jaw (6), supported by the lower frame;
b) an upper frame (44) and an upper jaw (8), supported by the upper frame (44);
c) a rectilinear comb (10);

- a driven shaft lower jaw nipper (30) rotatable with rotatory alternated motion, connected to the lower frame (34) of the nipper;
- a driven shaft upper jaw (40) rotatable with rotatory alternated motion, which supports at least one cam (42) operatively connected to the upper frame (44) of the nipper;
- a transmission group (50) connected in input to a dedicated electric motor having circular movement and in output to the driven shaft upper jaw (40), comprising non-circular moving parts, to transform the circular movement into alternated rotatory movement according to a desired law of motion.

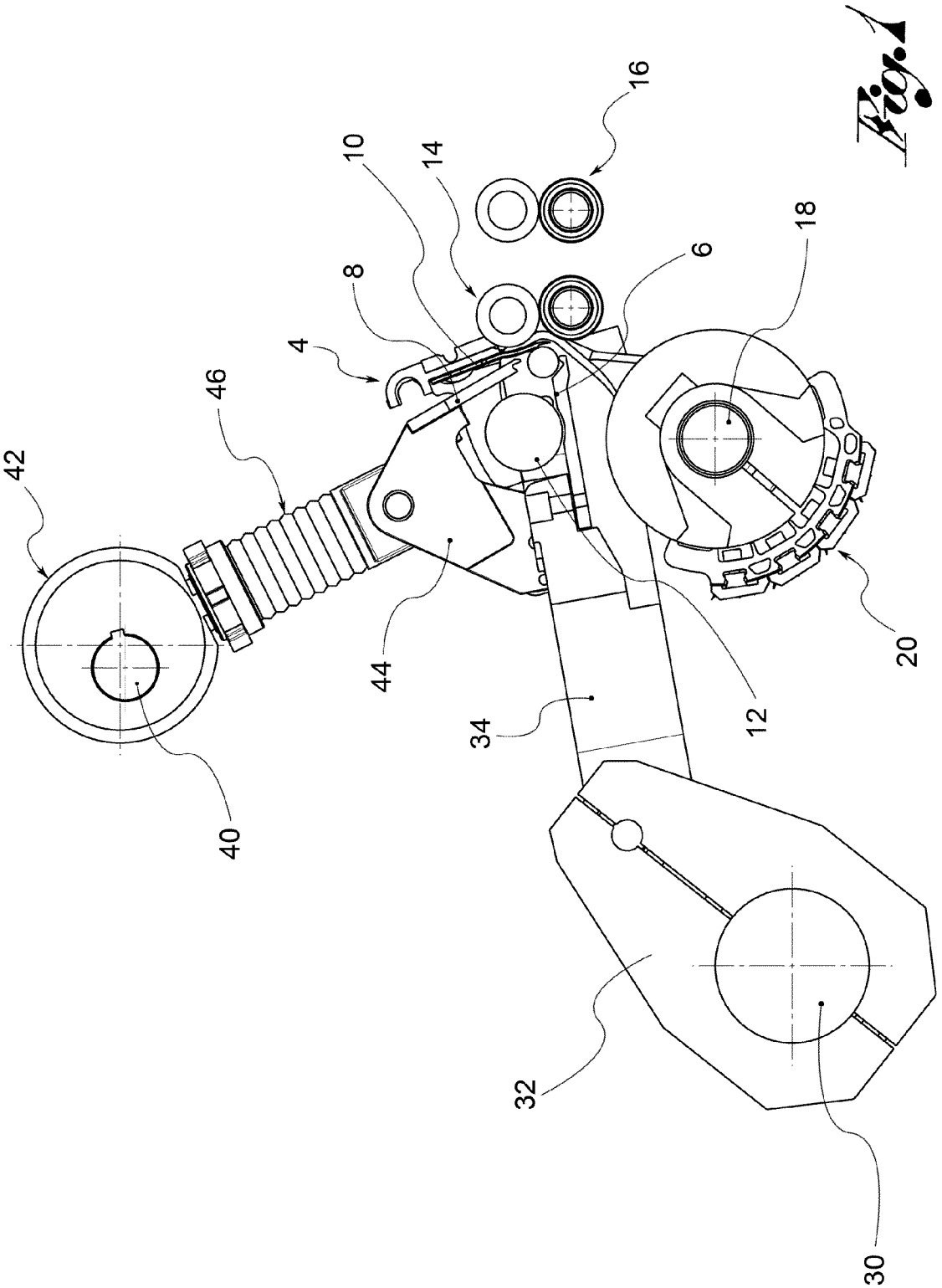

Fig. 1

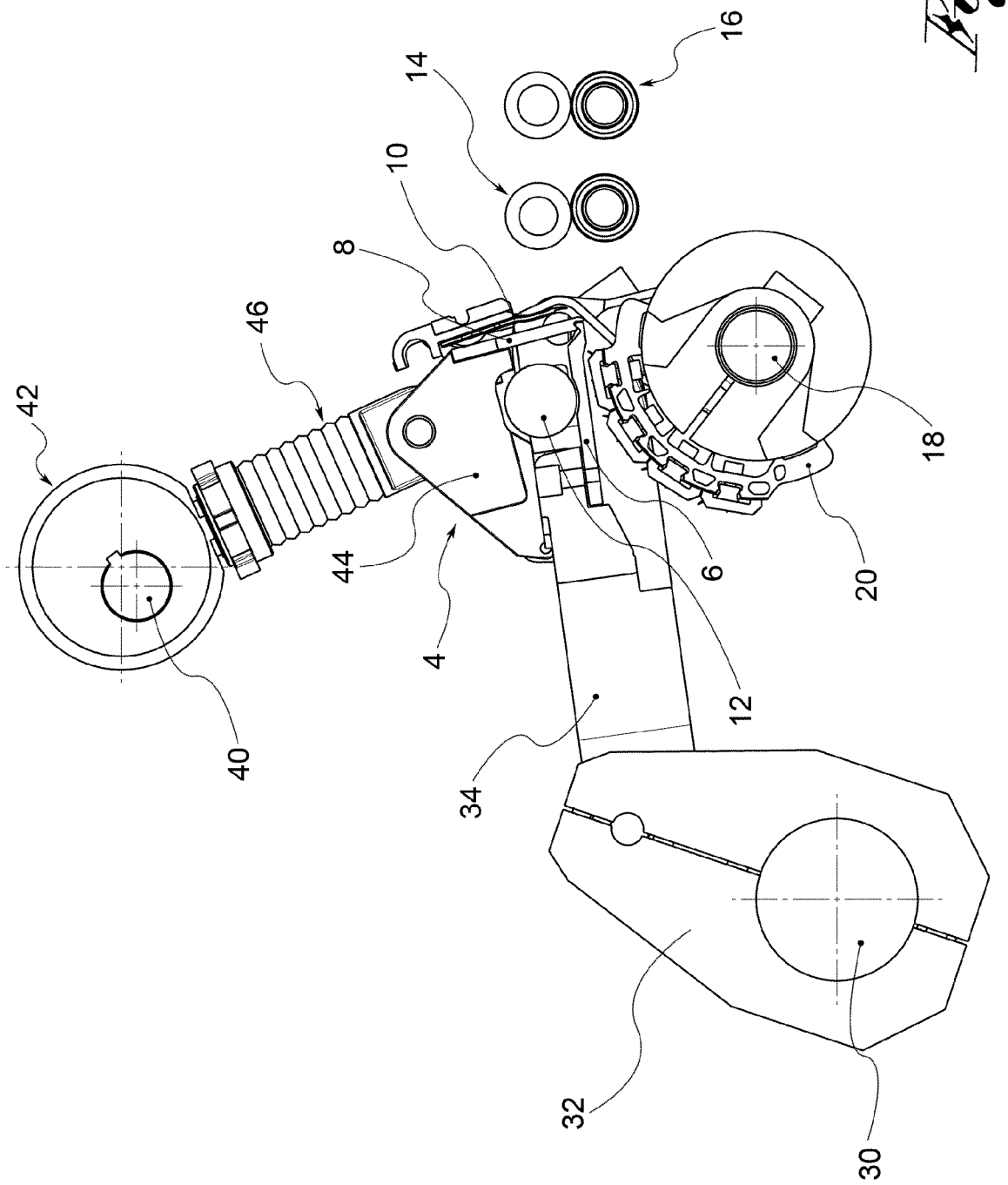

Fig. 2

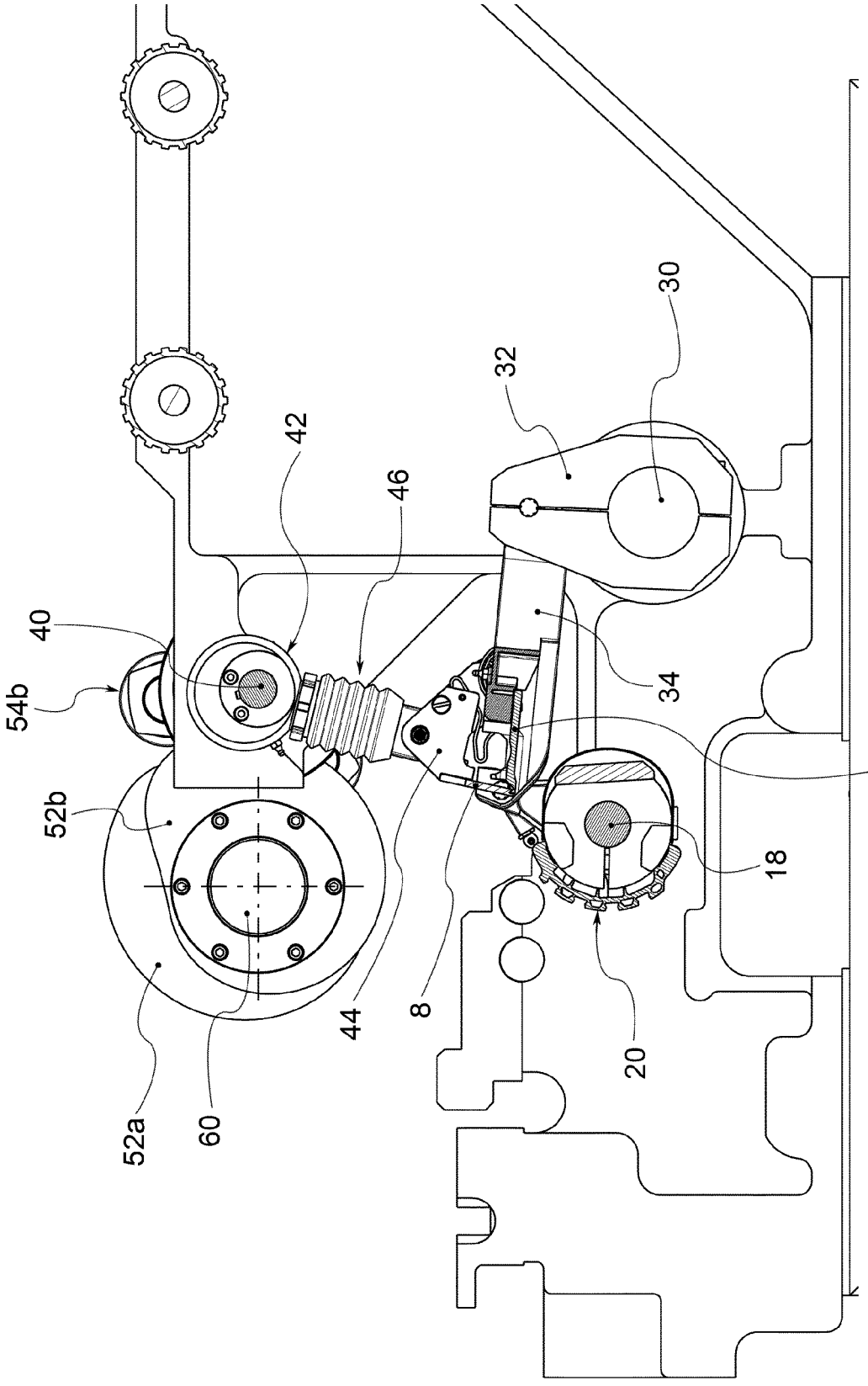

Fig.3

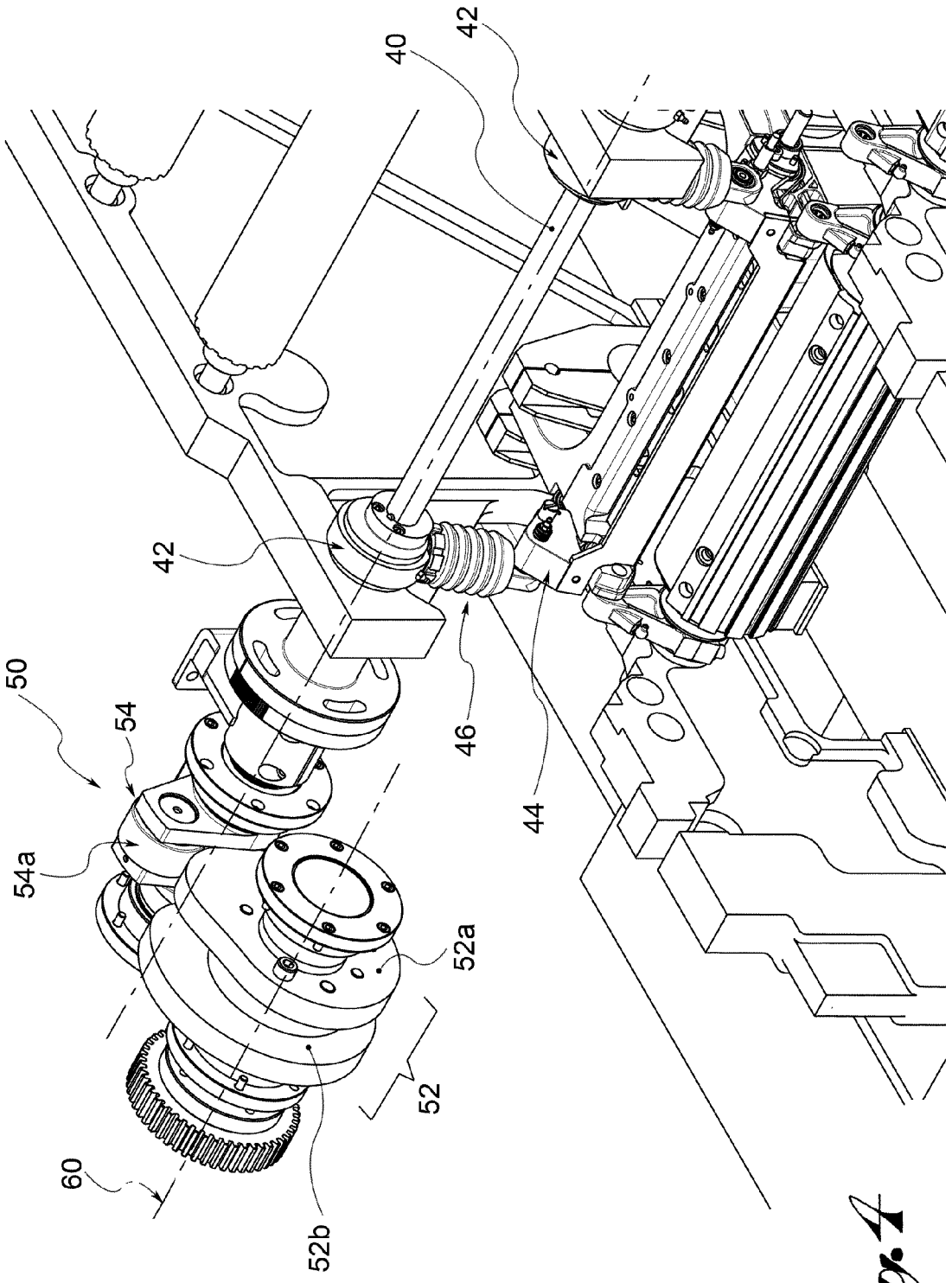

Fig. 4

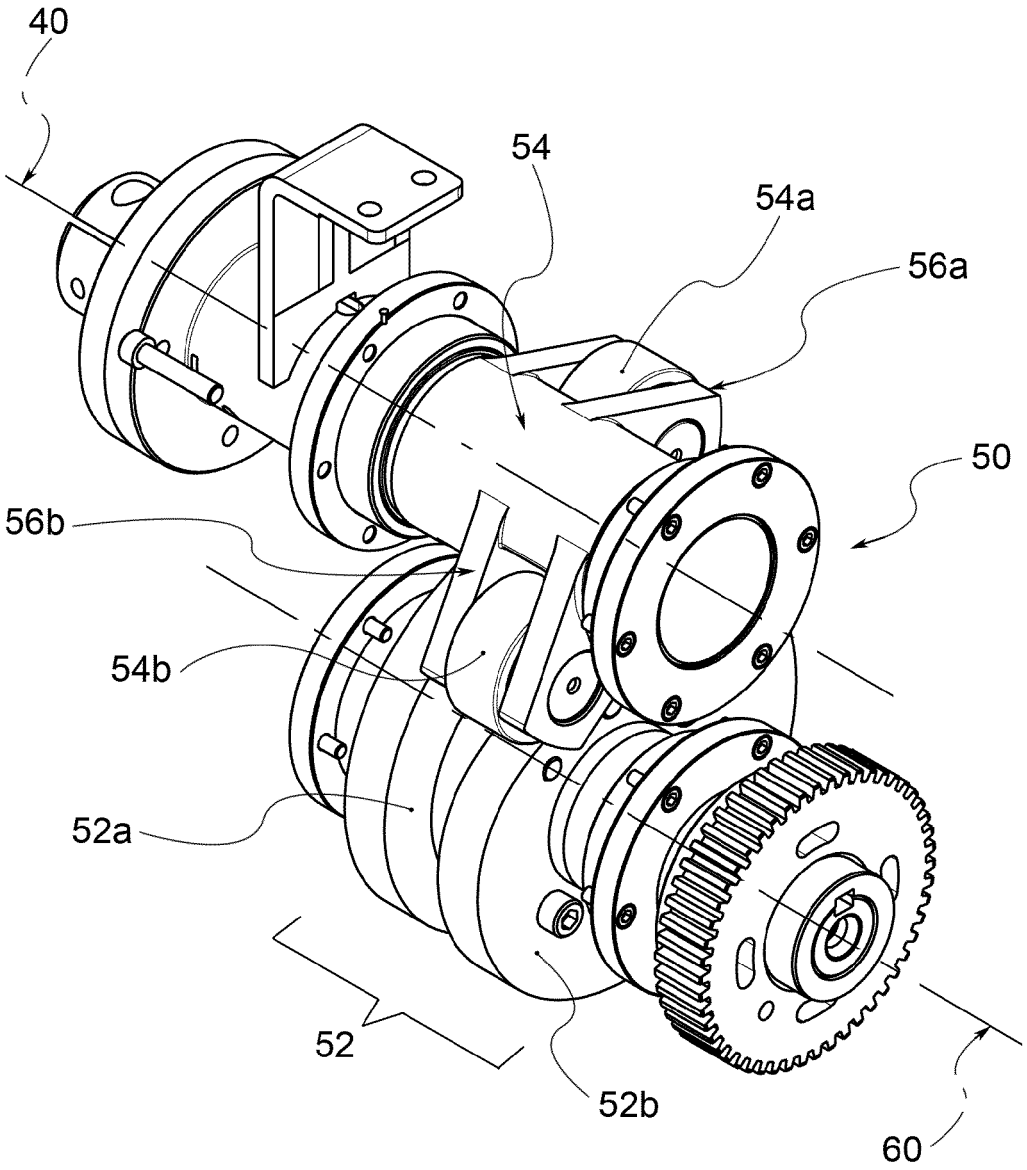

Fig.5

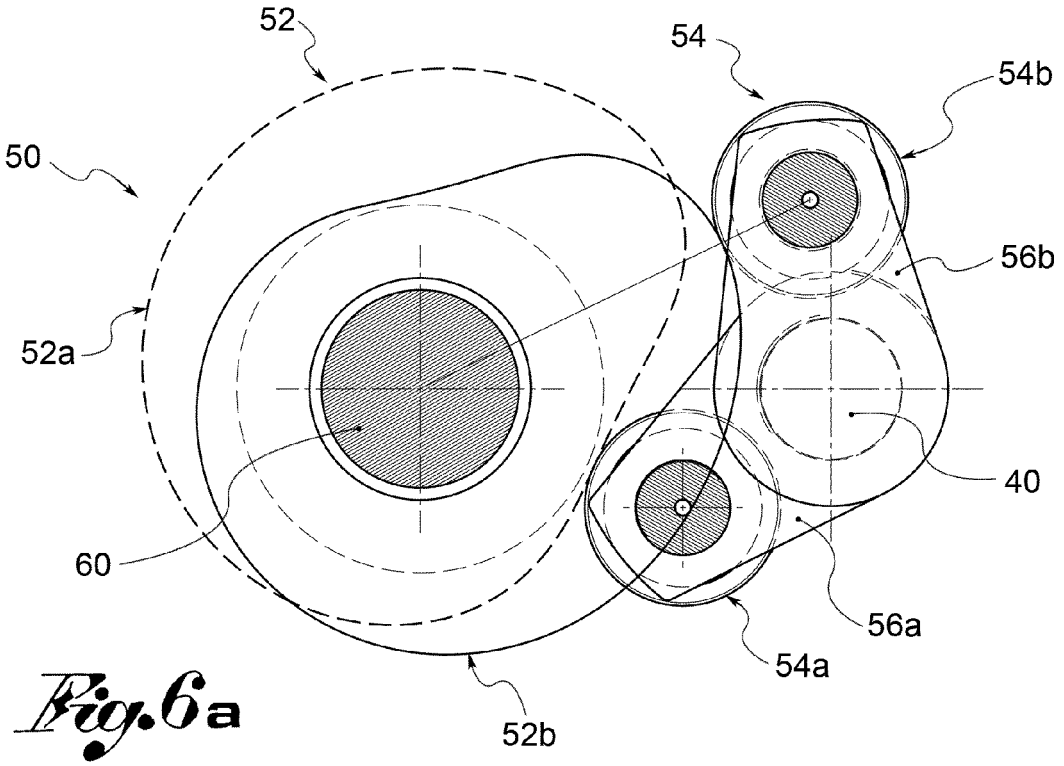
52
54
54b
50
56b
52a
40
60
56a
54a
52b

Fig.6a

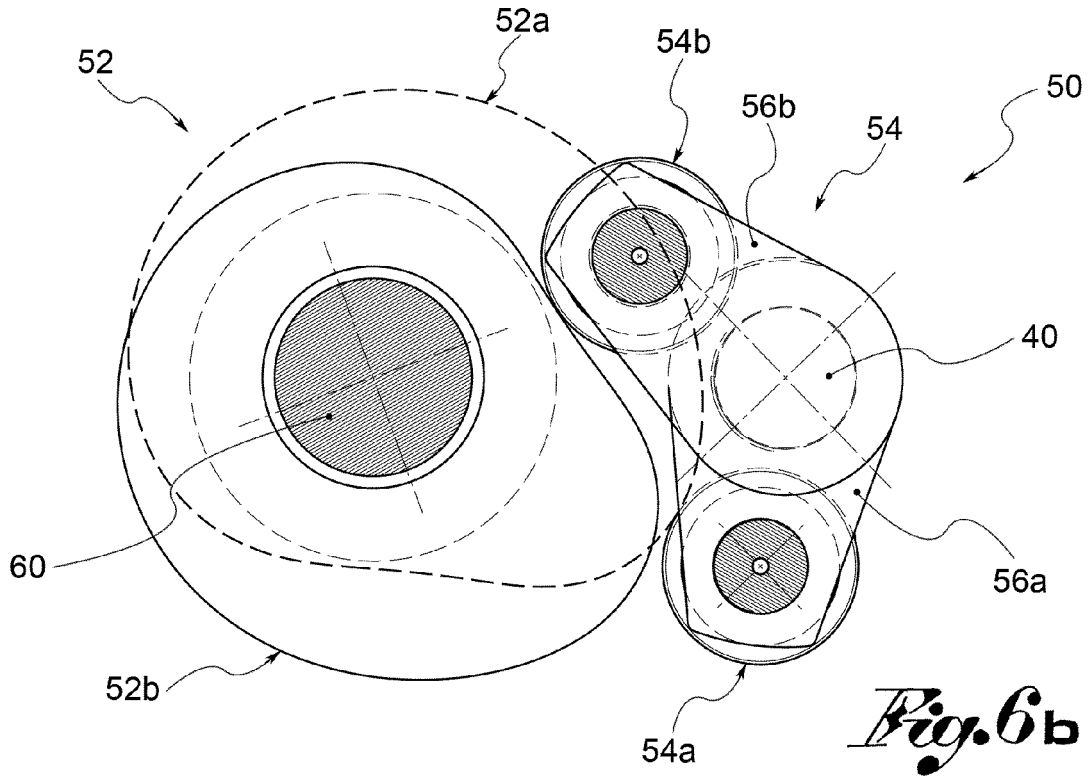
52a
54b
52
56b
54
50
40
60
56a
52b
54a

Fig.6b

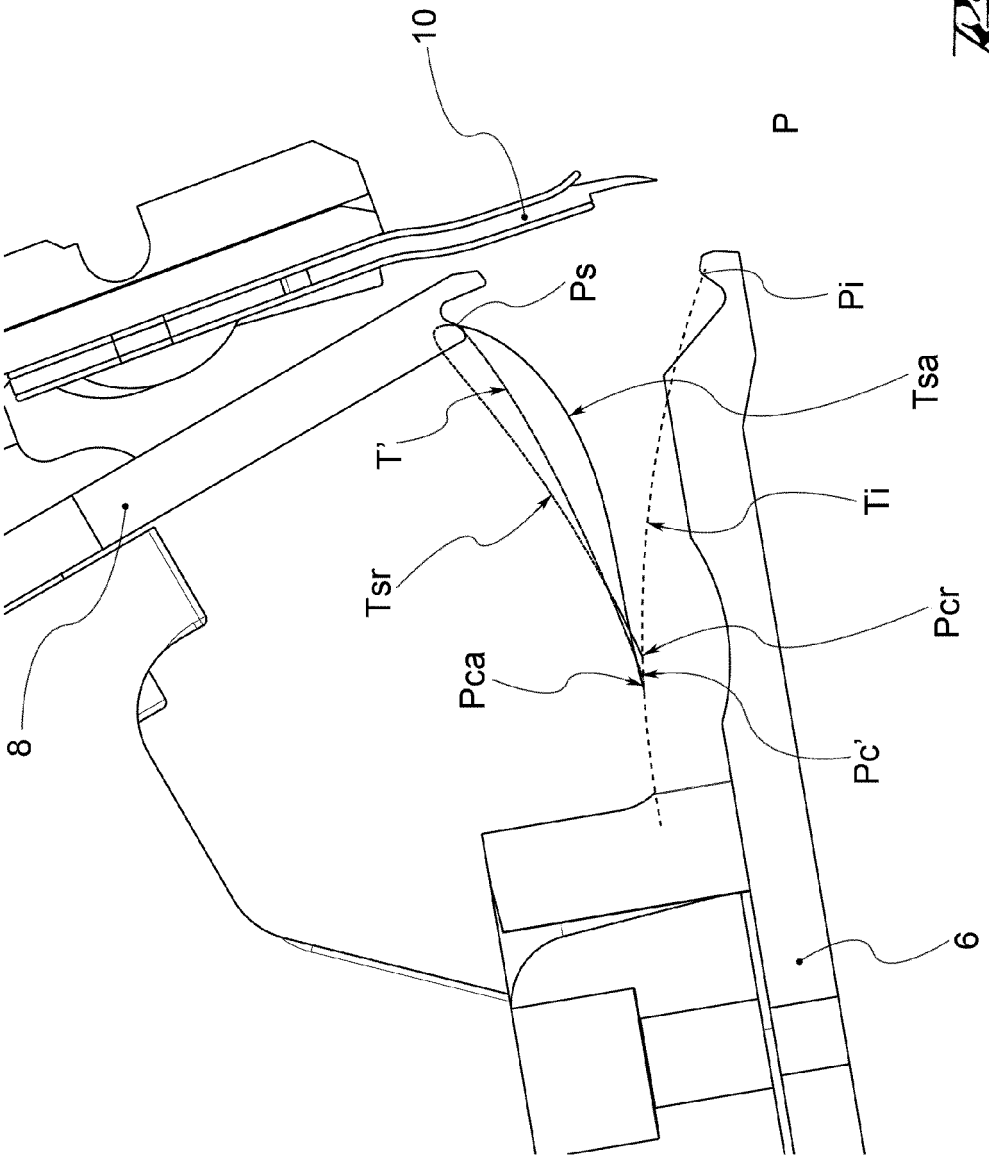

Fig.7

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EUROPEAN SEARCH REPORT

Application Number
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TECHNICAL FIELDS SEARCHED (IPC)

D01G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	3 May 2012	Dupuis, Jean-Luc

CATEGORY OF CITED DOCUMENTS

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1

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