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(72) Inventor: **Mantovani, Daniele**
Benvignante di Argenta (Ferrara) (IT)

(74) Representative: **Negrini, Elena**
Agazzani & Associati S.r.l.
Via dell'Angelo Custode 11/6
40141 Bologna (IT)

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(71) Applicant: **Tecno System S.r.l.**
44015 Portomaggiore (Ferrara) (IT)

(54) **Punching machine of section bars for roller shutter**

(57) A punching machine of section bars for roller shutter includes: moving means (10) of punching means (20) of said section bars to which are kinematically connected stop means (15); feeding means (30) fit to move section bars; indexer means (40) which are kinematically connected in input to the moving means (10) for driving the motion and in output are connected to driving means (50) fit to move the feeding means (30) of the section bars in correspondence of a punching condition in which the punching means (20) punch the section bars according to a preset pitch; fast forward moving means (60) kinematically connected to the driving means (50) and fit to fast move forward the section bars in correspondence of a non-punching condition of the machine (1) in which the section bars move forward along this latter without being punched.

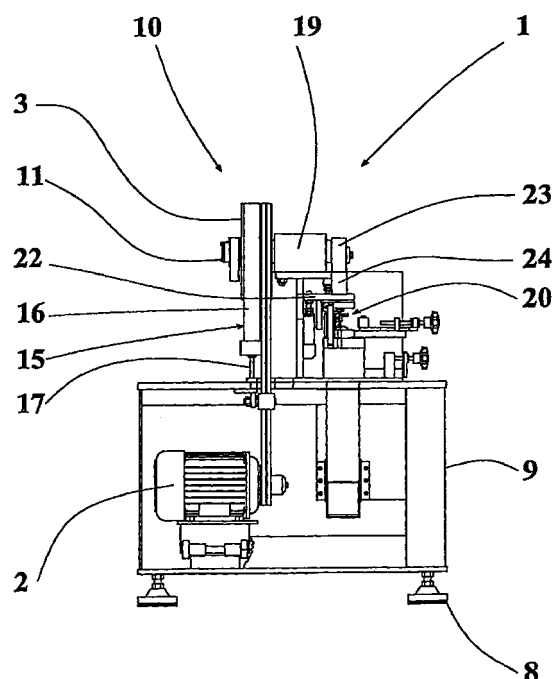


FIG. 1

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Description

[0001] The present invention relates to machines for punching metallic and non-metallic section bars, in particular refers to a punching machine of aluminum section bar for roller shutter.

[0002] Electromechanical punching machines are known which carry out the slots in the section bars continuously moving, without stopping the section bars to operate the punching. However, these machines have a section bar feeding maximum speed limit of 33-34 meters per minute, because in each punching cycle the punches must at first to follow the moving section bars, then to punch these latter keeping the same feeding speed of the section bars and finally to lift the punches from the section bars, always keeping the punches in accordance with the motion of the section bars.

[0003] Other drawback of these known machines consists in often loosing the phase relationship between the section bar movement and the back-and-forth motions of the punches, especially when it is necessary to modify the punching pitch: also because of this reason the feeding speed is very low.

[0004] A further drawback is that the punches wear out easily due to their continuous movement during the punching phase and in other words, when the punches carry out and leave the slots in the continuous moving of the section bars.

[0005] They are also known punching machines for section bars which punch the slots when section bars are stopped. These machines operate a step-by-step feeding of the section bar by means of brushless electric motors, and a bi-directional motion of punches driven by hydraulic cylinders.

[0006] The brushless electric motors and the hydraulic cylinders cause a relevant increase of the production costs of these punching machines in comparison with the electromechanical machines and even more, generally they consume very much energy.

[0007] Further drawback of said machines is the continuous and progressive consumption of the rotating feeding means, in particular consisting of rubber wheels, for the section bars, essentially caused by the stop-and-go movement. So unavoidably it causes irregular punching pitch due to the consumption of said rubber wheels, obliging to continuously adjust the punching pitch of the machinery.

[0008] Object of the present invention is to propose a punching machine avoiding nearly all the drawbacks of the known machines.

[0009] So the main object is to propose a punching machine for reducing the punches wear out and meanwhile for increasing the feeding and punching speeds of the section bars.

[0010] Further object is to propose a machine automatically setting the punching pitch, keeping it constant despite the wear out of feeding means for the section bar.

[0011] A further object is to propose a machine of simple realization, of low cost and of high reliability.

[0012] The objects above mentioned are reached according with the contents of the claims.

[0013] The features of the invention are underlined as follows with particular reference to the attached drawing sheets, in which:

- figure 1 shows a side view of the punching machine;
- figure 2 shows a further side view of the machine in figure 1 in which some parts have been removed for better highlighting others;
- figure 3 shows a front view of the machine in figure 1;
- figure 4 shows a top view of the punching machine in figure 1;
- figure 5 shows a schematic front view of the kinematic connections of the punching machine in figure 1;
- figure 6 shows a side view of the punching machine in figure 1 in a second embodiment;
- figures 7A and 7B each shows a front view of the punching machine of figure 6, in which some parts have been removed for better highlighting others;
- figures 8A and 8B each shows an enlarged view of a detail of the moving means of the punches in figures 7A and 7B;
- figure 9 shows a side view of the moving means in figures 8A and 8B.

[0014] With reference to figures from 1 to 5, numeral 1 indicates a punching machine of section bar for roller shutters, according to the preferred embodiment, that essentially comprises a supporting frame 9, moving means 10, punching means 20, feeding means 30, indexer means 40, driving means 50, stop means 15 and fast forward moving means 60.

[0015] This machine 1 is supported by the frame 9 having adjustable feet 8 and to which is connected an adjustable table 7 fit for supporting the section bars to move through the machine along its operating axis and having an adjustable guide 7a, which keeps these section bars aligned.

[0016] The moving means 10 comprise an electric motor 2 connected by means of belts 4 to a flywheel 3 keyed to a main shaft 11 which is rotationally supported by the frame 9 by means of a bearing central body 19 positioned in between.

[0017] The punching means 20 comprise a plurality of punches 21, in number of five in the embodiment in figure 4, which are aligned along the motion direction of the section bars and are supported by means of a vertically moving carriage 22 on which an eccentric 23 acts keyed on the main shaft 11 of the moving means 10. Said carriage 22, at its upper part, is provided with a tilted surface 24 for contacting the eccentric 23 and is elastically supported by a pair of studs 25 on which are

inserted elastic return means 26, in other words, each stud 25 is a guide for a spring 26.

[0018] With particular reference to the figure 4, the feeding means 30 comprise two double pairs of rubber wheels 31 respectively positioned downstream and upstream of the punching means 20. In each double pair, the upper pair of rubber wheels 31a is keyed on respective shafts 32 connected to the driving means 50 by a chain 33 which engaged related pinions 34, while the lower double pair of rubber wheels 31b is freely supported by respective shafts 35. Two first shafts 32 are connected to the driving means 50 by means of the chain 33 while one of the remaining two shafts 32 is connected to one of these first shafts 32 by a timing belt 36 fit to engage related pulleys 37 keyed to the two connected shafts 32. The remaining two shafts 32 are mutually connected by a timing belt 38.

[0019] Referring to figure 2, the indexer means 40 include an indexer 41 on whose input shaft 42 is keyed a pulley 43 connected to a correspondent pulley 45 keyed on the main shaft 11 by a timing belt 44. On the output shaft 46 of the indexer 41 is keyed a pulley 47 connected by means of a timing belt 48 to a correspondent pulley 49 keyed on the input shaft 6 of a variator 5 sequentially connected to the indexer 41 and whose output shaft is connected to the driving means 50 by a timing belt 53 which engages a pulley 59 keyed on the output shaft of the variator 5.

[0020] The driving means 50 comprise a shaft 51 that is rotationally supported by the frame 9 under the adjustable table 7 by interposing a pair of bearings 58. The shaft 51 supports a pair of unidirectional rotating "free" wheels, first 55a and second 55b and on which are also keyed a first pulley 52 for connecting the indexer means 40, by means of the timing belt 53, a second pulley 54 for connecting the fast forward moving means 60, by means of a timing belt 56, one of the pinions 34 on which is engaged the chain 33 for connecting the feeding means 30 of the section bars.

[0021] With particular reference to figure 5, the fast forward moving means 60 comprise a speed motovariator 61 whose output shaft is connected to the driving means 50 by means of a timing belt 56 and by pulleys respectively indicated by the numerals 57 and 62.

[0022] Referring to figure 2, the stop means 15 comprise a flat belt 16 whose middle portion is fit to slide on the flywheel 3 and whose ends are fixed to the stem of a cylinder 17, vertically mobile between two extreme conditions, one is the free condition and another is the stop condition, in which, respectively, the flat belt 16 slides almost without friction on the flywheel 3 and the belt 16 stops by friction the flywheel 3, stopping it.

[0023] The operation of said device provides firstly the setting of the variator 5 and of the speed motovariator 61 to regulate respectively the pitch length between the various series of slots, in the preferred embodiment the number of the slots is five, because five is the

number of the punches 21, and then the output speed of the section bars already punched by the machine 1.

[0024] The operation of the electric motor 2, allows the rotation of the main shaft 11, and therefore the rotation of the eccentric 23 that cyclically lowers the carriage 22 supporting the punches 21 toward the adjustable table 7. The punches movement and therefore the consequent realization of a series of slots in the section bar is in phase relationship with the stop and the activation of section bar motion and therefore with the stop or the rotation of the rubber wheels 31a of the feeding means 30.

[0025] In other words, at first between the double couple of rubber wheels 31a and 31b upstream of the punches 21 it is inserted a section bar to be punched and therefore their rotation, by means of the motor 2, causes at first the forward moving of the section bar under of the punches 21 and then the rotation stop of the rubber wheels 31a, 31b and the advancement of the section bar, in correspondence with the punching condition in which the eccentric 23, acting on the tilted surface 24, depresses the punches onto the section bar and the indexer 41 stops the rotation of its output shaft.

[0026] The rotation of the main shaft 11 causes, in sequence, the rotation of the eccentric 23, the disengaging of the punches 21 from the section bar slots, by means of the spring 26, the restart of the rotation of the output shaft of the indexer 41 and the consequent rotation of both the shaft 51 of the driving means 50, by means of the engaging of the first free wheel 55a, and the rubber wheels 31a, so effecting the forward moving of the section bar of a determined pitch length between a series of slots and the following one.

[0027] At the end of a series punching cycles and forward moving of the section bar, and therefore close to the end of the section bar, this latter must be removed from the machine 1 in order to allow the insertion and the punching of a following section bar.

[0028] For such purpose the moving means 10 are stopped during a predetermined time interval by means of the activation of the stop means 15, in correspondence of a not punching condition and therefore of not interference of the punches with the section bar. The cylinder 17 provides to pull under tension the flat belt 16 that, because of friction, stops the flywheel 3 allowing it only 60 degrees of free rotation before the complete stop and therefore the speed motovariator 61 which provides to activate the rubber wheels 31a by means of the rotation of the shaft 51 of the driving means 50 by virtue of the kinematic coupling with the second free wheel 55b and because the shaft 51 can freely rotate by means of the first free wheel 55a.

[0029] The activation of the rubber wheels 31a allows therefore the fast moving of the section bar without being punched by the punching means 20. It is important to highlight that the section bars move forward in the machine 1 during the punching at a speed ranging between 60 and 80 meters per minute: the pref-

erable speed is 70 meters per minute, in correspondence of their punching condition.

[0030] Between two steps the section bars are moved or stopped for allowing their punching for a length proportional to the rotation of the main shaft 11 respectively varying from 230 to 250 degrees and from 110 to 130 degrees, and the preferable rotation is 240 degrees in correspondence of the forward moving of the section bar and 120 degrees in correspondence of the punching

[0031] Besides, the stop means 15 stop the rotation of the flywheel 3 in a range from 50 to the 70 degrees of the flywheel 3, and the preferable rotation is 60 degrees, as mention above.

[0032] It is advantageous to underline that in such way the punches don't suffer secondary wear out due to their moving together with the section bar because this latter is stopped during punching and besides the eventual wear out of the rubber wheels 31a and 31b and then the forward motion variation of the section bars inserted therebetween is easily adjusted by setting the pitch length acting on the variator 5, either directly or automatically by feedback.

[0033] In a second embodiment of the invention showed in figures from 6 to 9, the machine 1 has essentially the same means of the machine according to the preferred embodiment except the fast forward moving means 60, the two pairs of unidirectional moving free wheels, first 55a and second 55b of the driving means 50, while shifting means 70 are provided between the moving means 10 and the punching means 20.

[0034] The shifting means 70 include a stop 71 assembled on a slide 72 horizontally sliding on the carriage 22, this latter without the tilted surface 24, by virtue of guides 74 and actuator means 73, for instance a pneumatic or hydraulic cylinder, whose body 73a is fixed to the carriage 22 and whose stem 73b is fixed to the slide 72.

[0035] Said actuator 73 moves alternatively the slide 72 between two extreme conditions, the first illustrated in the figures 7A and 8A in which on the stop 71 it acts sliding on the eccentric 23 in correspondence of the punching operation of the section bar, when the punches must be lowered to punch the section bar and a second condition, illustrated in the figures 7B and 8B, in which the stem 73a it is pull back without any interference between the eccentric 23 and the stop 71 in correspondence of the not punching condition of the section bar, when the section bar moves forward.

[0036] Besides, the driving means 50 include the shaft 51, rotationally supported by the frame 9 and having a pulley 52 fit for connecting the indexer means 40, by means of the timing belt 53 and the pulley 59.

[0037] A variant of the machine 1 does not provide the use of the stop means 15 because the flywheel 3 that drives the eccentric 23 can rotate continuously also in correspondence of the forward movement of the section bar or in correspondence of the not punching of the

same because the shifting means 70 determine the interaction between the eccentric 23 and the punching means 20 and therefore the punching condition of the section bars.

[0038] It is also important to note that all the operations of the machines 1 are in phase relationship and therefore they can be controlled by means of an electronic control unit, not showed, for instance a PLC type controller, to guarantee the phased moving of all the means and the devices of the machine.

[0039] The main advantage of the present invention is to provide a punching machine to increase the feeding and punching speed of the section bars and also to reduce the wear out of the punches.

[0040] Another advantage is to provide a machine fit to automatically regulate the punching pitch length, keeping it constant, despite of the wear out of the moving means of the section bar.

[0041] Further advantage of the present invention is to provide a machine of simple realization, low cost and elevated reliability.

Claims

1. Punching machine of section bars for roller shutter characterized in that includes:

- a supporting frame (9);
- moving means (10) of punching means (20) of said section bars to which are kinematically connected stop means (15);
- feeding means (30) fit to move said section bars;
- indexer means (40) which are kinematically connected in input to said moving means (10) for driving the motion and in output are connected to driving means (50) fit to move said feeding means (30) of said section bars in correspondence of a punching condition of said machine (1) in which said punching means (20) punch said section bars according to a preset pitch;
- fast forward moving means (60) kinematically connected to said driving means (50) and fit to fast move forward said section bars in correspondence of a not punching condition of said machine (1) in which said section bars move forward along this latter without being punched; said section bars being moved forward by said feeding means (30) by means of the kinematic connection of this latter to said driving means (50) whose rotational motion is driven by the main shaft (11) of said moving means (10) by interposition of said indexer means (40) to move discontinuously said section bars in correspondence of said punching condition; said moving means (10) being stopped within a predetermined time interval by means of the acti-

vation of said stop means (15) in correspondence of said condition of not punching in which said moving means (10), by means of said stop means (15) and said indexer means (40) are stopped and said fast forward moving means (60) and said driving means (50) and said feeding means (30) are activated to allow the fast forwarding motion of the section bars without being punched by said punching means (20).

2. Punching machine of section bars for roller shutter characterized in that includes:

- a supporting frame (9);
- moving means (10) of punching means (20) of said section bars;
- feeding means (30) fit to move said section bars;
- indexer means (40) which are kinematically connected in input to said moving means (10) for driving the motion and in output are connected to driving means (50) fit to move said feeding means (30) of said section bars in correspondence of a punching condition of said machine (1) in which said punching means (20) punch said section bars according to a preset pitch;
- shifting means (70) located between said punching means (20) and said moving means (10) and alternatively in contact with these latter, in correspondence of said punching condition to transfer the motion of said moving means (10) to said punching means (20), or without interfering with said eccentric (23) and without transmitting the motion of said moving means (10) to said punching means (20) in correspondence of a not punching condition in which the section bars are moved by said feeding means (30), without being punched by said punching means (20), through the kinematics connection of these latter to said transmission means (50) whose rotational motion is driven by the main shaft (11) of said moving means (10) by interposition of said indexer means (40) whose motion law provides alternatively the stop and the forward moving of the section bars respectively in correspondence of punching and not punching conditions.

3. Machine according to claims 1 or 2 characterized in that it further comprises first variators (5) connected downstream to said indexer means (40) and fit to vary the rotation speed of the output of said indexer means (40) and of the input of said driving means (50) in order to vary the length of the punching pitch of said section bars.

4. Machine according to claims 1 or 2 characterized in that said punching means (20) comprise a plurality of punches (21) aligned along the motion direction of said section bars and supported by a carriage (22) vertically moving on which a eccentric (23) acts, keyed on said main shaft (11) of said moving means (10); said carriage (22) being elastically supported by a couple of studs (25) on which are inserted elastic return means (26) for lowering it toward said section bars in correspondence of said punching condition and its elastic leaving in correspondence of the not punching condition of said section bars.

5. Machine according to claim 4 characterized in that the upper portion of said carriage (22) is provided with a tilted surface (24) engaging said eccentric (23).

6. Machine according to claim 4 characterized in that said shifting means (70) comprise a stop (71) assembled on a slide (72) horizontally sliding on said carriage (22) by virtue of actuator mean (73) fixed thereto so causing the contact or not of said eccentric (23) against said stop (71) respectively in correspondence of said punching or not punching conditions of said section bars.

7. Machine according to claims 1 or 2 characterized in that said moving means (10) comprise an electric motor (2) connected by means of belts (4) to a fly-wheel (3) keyed on said main shaft (11).

8. Machine according to claims 1 or 2 characterized in that said feeding means (30) include two double couples of rubber wheels (31), respectively located downstream and upstream of said punching means (20), the upper couples (31a) of each double couple is keyed to respective shafts (32) connected to said transmission means (50) by means of a chain (33) engaging related pinions (34), while the inferior double couple (31b) is freely rotationally supported by related shafts (35).

9. Machine according to claim 8 characterized in that two of said shafts (32) are connected to said driving means (50) by means of said chain (33) and the remaining two shafts (32) are connected to the first two shafts by means of a timing belt (36).

10. Machine according to claims 1 or 2 characterized in that said indexer means (40) comprise an indexer (41) on whose input shaft (42) is keyed a pulley (43) connected to a correspondent pulley (45) keyed on said main shaft (11) by means of a timing belt (44).

11. Machine according to claims 3 and 10 characterized in that on the output shaft (46) of said indexer

(41) is keyed a pulley (47) connected by a timing belt (48) to a correspondent pulley (49) keyed on the input shaft (6) of said variator (5).

12. Machine according to claim 1 characterized in that 5
said driving means (50) include a shaft (51) rotationally supported by said frame (9) and which supports a couple of unidirectional rotating free wheels, first 55a and second 55b and to which are keyed a first pulley (52) for the connection to said indexer means (40), by means of a timing belt (53), a second pulley (54) for connecting said fast forward moving means (60), by means of a timing belt (56), a pinion (34) on which a chain (33) is engaged for connecting said feeding means (30) of said section bars. 10 15
13. Machine according to claim 2 characterized in that
said driving means (50) comprise a shaft (51) rotationally supported by said frame (9) and that support a pulley (52) to connect said indexer means (40), by a timing belt (53) and a pulley (59). 20
14. Machine according to claim 1 characterized in that
said fast forward moving means (60) comprise a speed motovariator (61) whose output shaft is connected to said driving means (50) by means of a timing belt (56). 25
15. Machine according to claims 1 or 2 and 7 characterized in that said stop means (15) comprise a flat belt (16) whose middle portion is fit to slide on said flywheel (3) and whose ends are fixed to the stem of a cylinder (17) vertically mobile between two extreme conditions, free and stop, in which respectively said flat belt (16) slide without friction on said flywheel (3) and said belt (16) stops with friction said flywheel (3) so stopping this latter. 30 35
16. Machine according to claim 15 characterized in that
said stop means (15) stop the rotation of said flywheel (3) in a range from 50 to the 70 degrees of said flywheel (3). 40
17. Machine according to claims 1 or 2 characterized in that said section bars move forward in said machine with a speed ranging from 60 to 80 meters per minute, being said speed preferably of 70 meters per minute, in correspondence of their punching condition. 45 50
18. Machine according to claims 1 or 2 characterized in that between a step and another said section bars are moved or stopped to allow their punching for a length proportional to the rotation of said main shaft (11) respectively varying from 230 to 250 degrees and from 110 to 130 degrees, said rotation being preferably 240 and 120 degrees. 55

19. Machine according to claim 1 characterized in that
it is controlled by an electronic control unity to determine the activation in phase relationship of said moving means (10), punching means (20), feeding means (30), indexer means (40), driving means (50), stop means (15) and fast forward moving means (60).

20. Machine according to claim 2 characterized in that
it is controlled by an electronic control unity to determine the activation in phase relationship of said moving means (10), punching means (20), feeding means (30), indexer means (40), driving means (50) and shifting means (70).

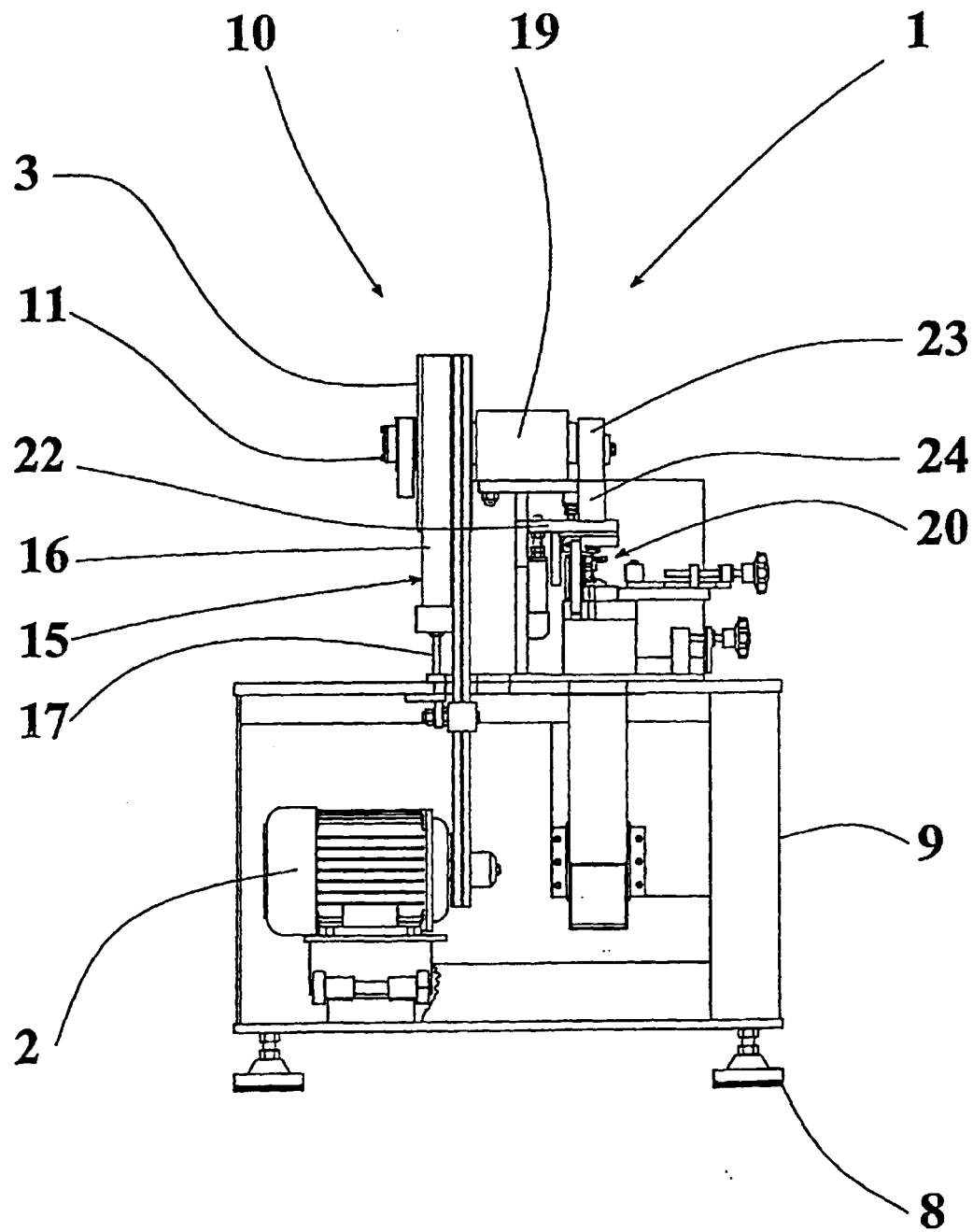


FIG. 1

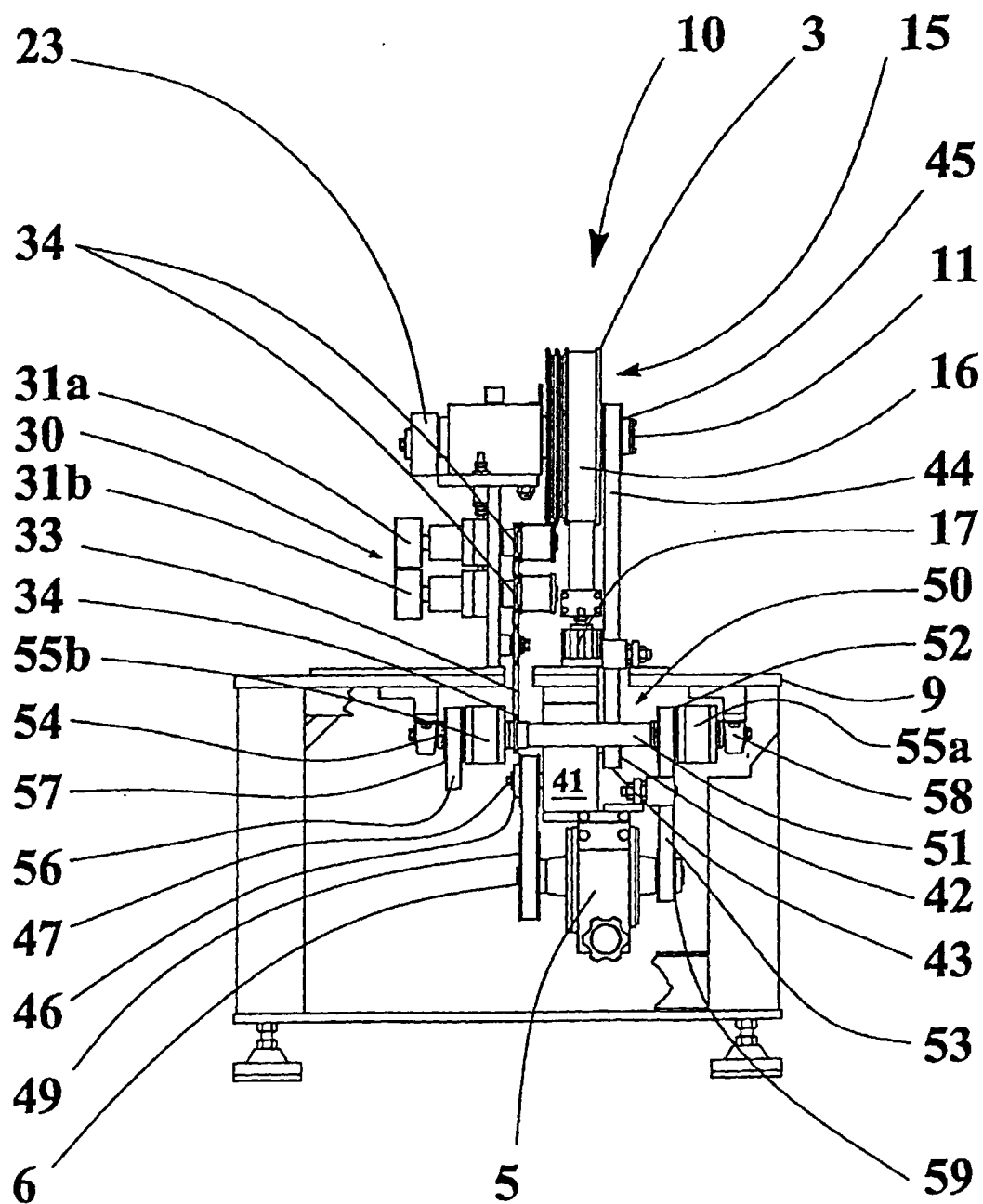


FIG. 2

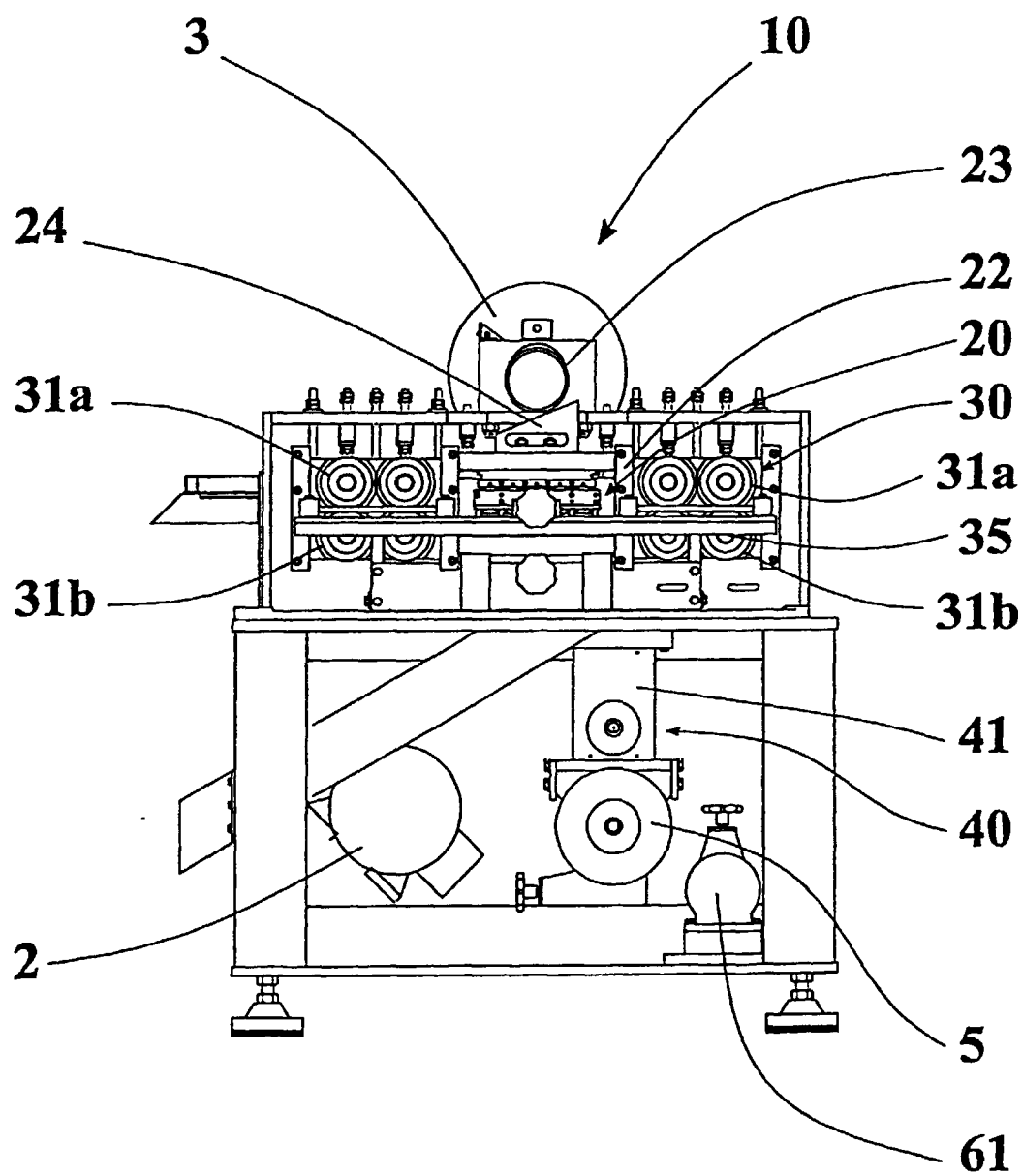


FIG. 3

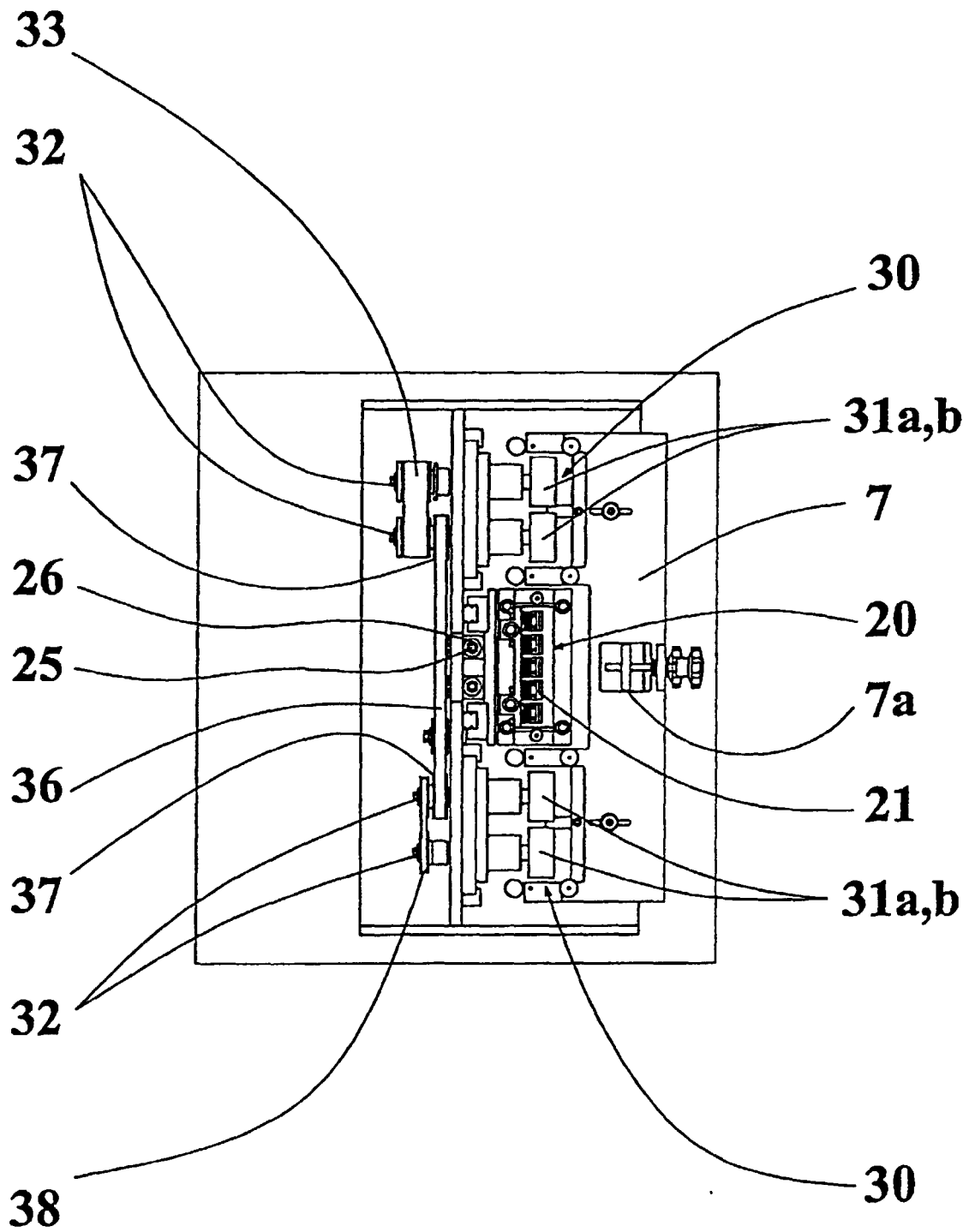


FIG. 4

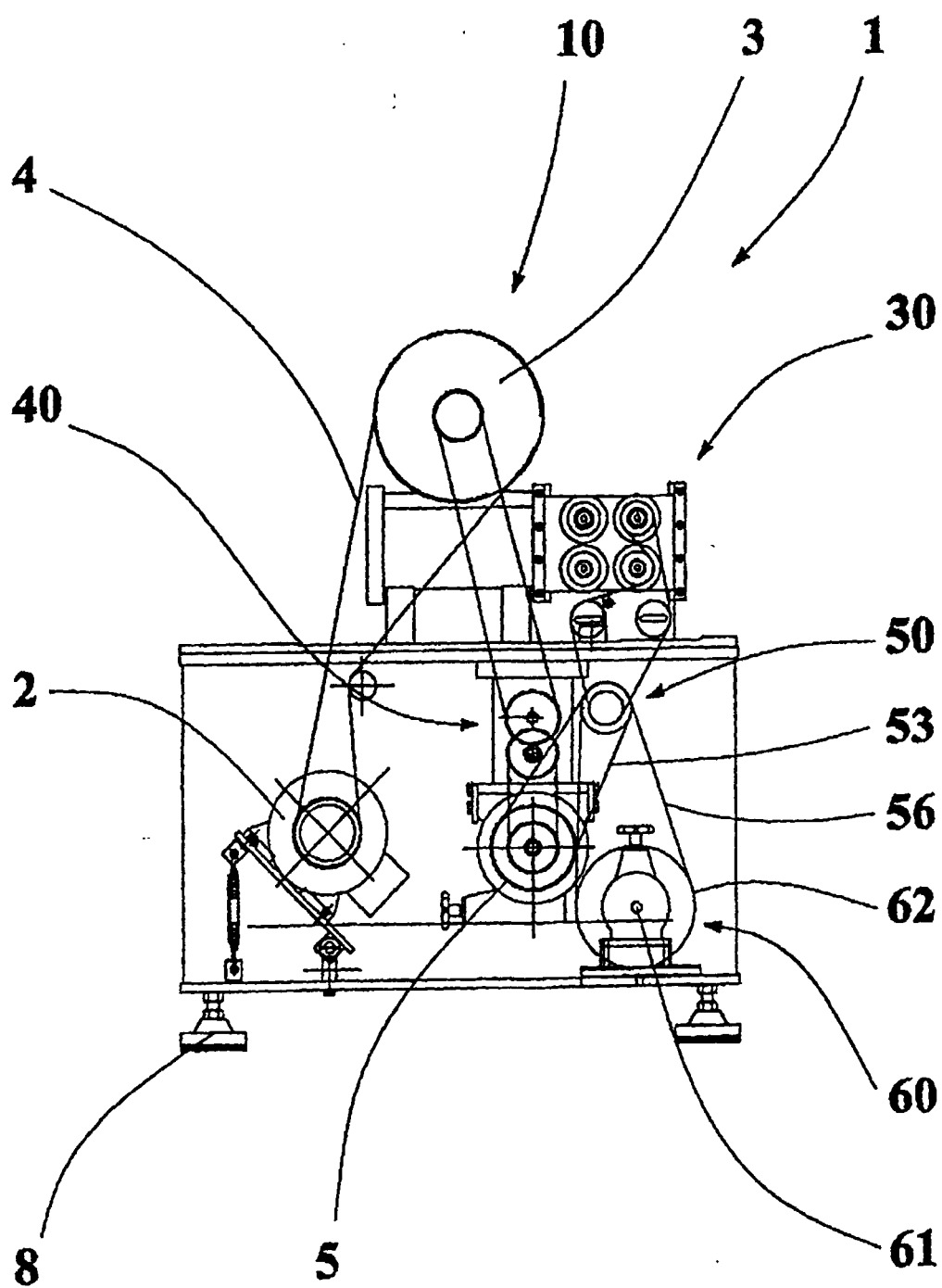


FIG.5

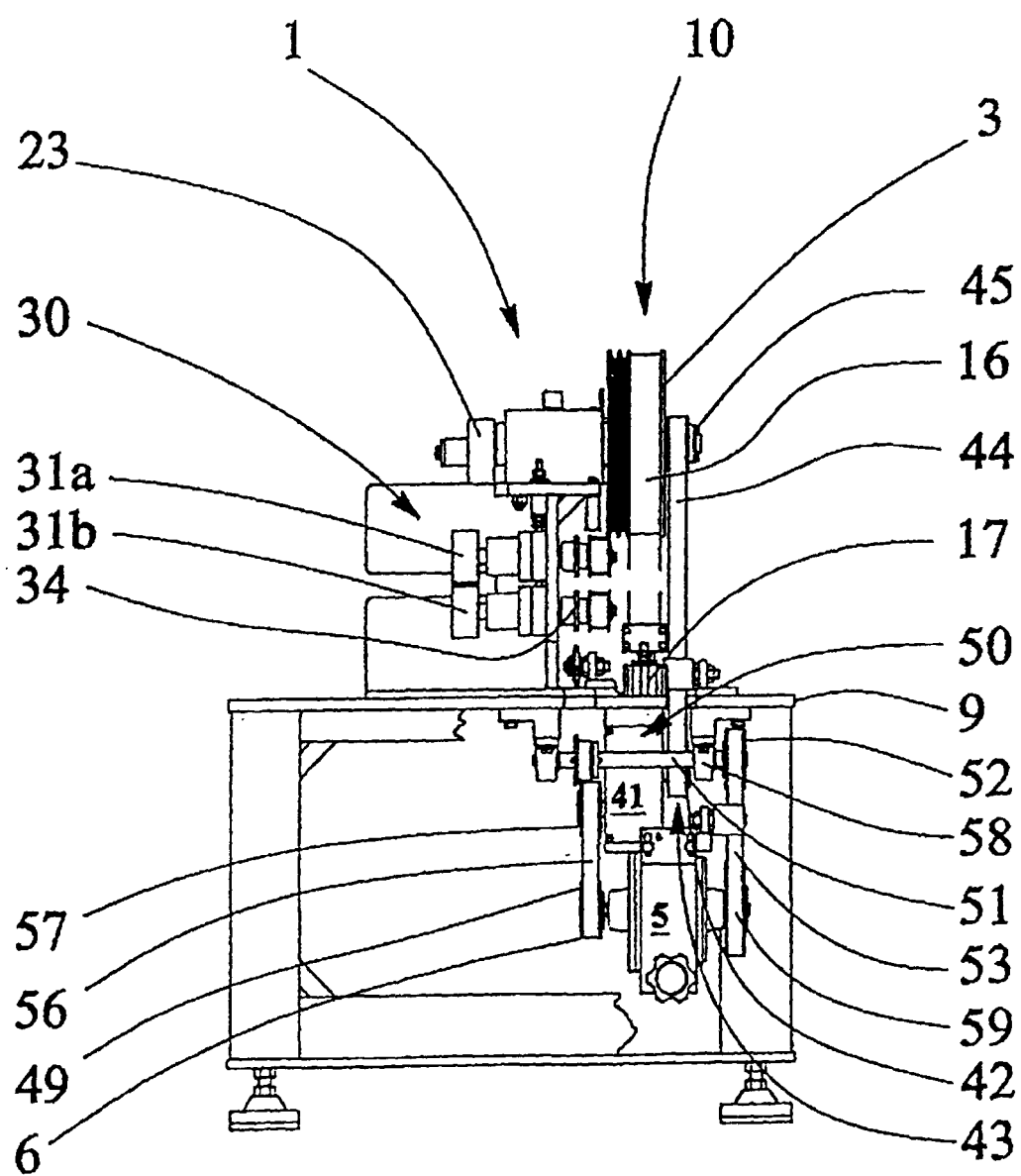


FIG. 6

