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(54) **Apparatus for drilling book or magazine portions**

(57) An apparatus for drilling book or magazine portions (11) each consisting of a plurality of sheets, comprising:
means (10, 12, 13) for feeding said book or magazine portions (11) to drilling means (18);
said apparatus comprising a first saddle (15) which re-

ceives said book or magazine portions (11),

characterised in that said drilling means (18) comprise, positioned outside said first saddle (15), a drilling head (30, 31) including a plurality of spindles (30) with relative drill bits (31) for drilling said book or magazine portions (11) from the top downwards.

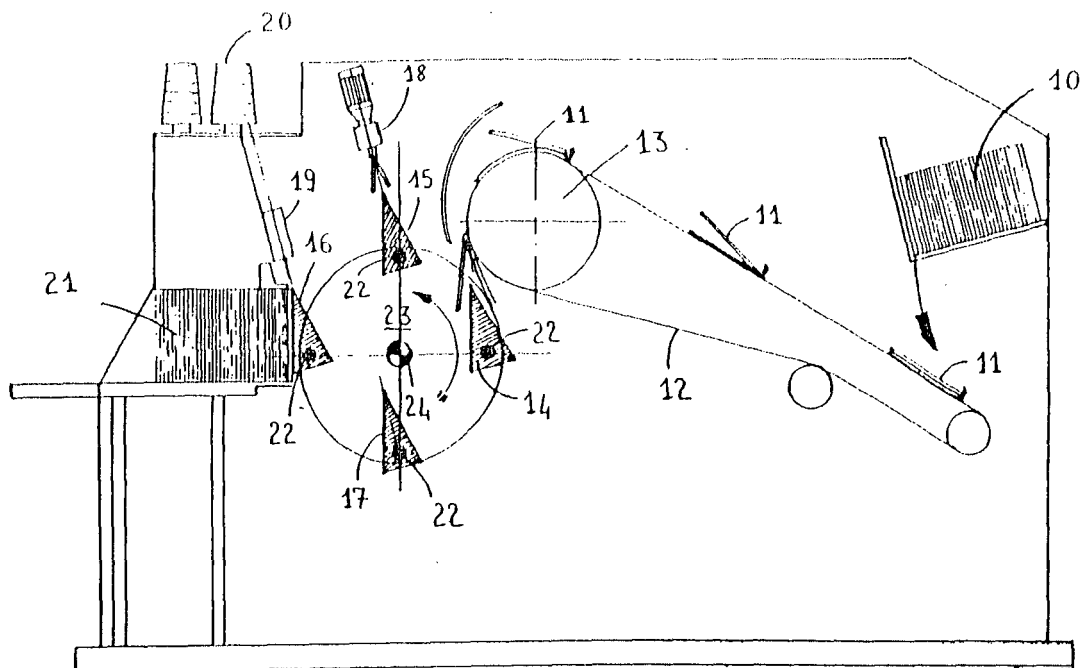


Fig. 1

Description

[0001] The present invention relates to an apparatus for drilling book or magazine portions, known as signatures. More particularly, it relates to an apparatus for drilling or sewing signatures. The term "books and magazines" means any volume, exercise book, block etc. having any dimension, which is to be sewn with a thread. The various signatures or book portions are sewn together to form a book by sewing.

[0002] Book or magazine sewing apparatus normally comprise a sheet feeder which partially opens the signatures in their middle and feeds the device carrying the signatures to the saddles, which receive them. The signatures are advanced, with a reforming system correctly arranging the signatures on the fixed saddle, and are then propelled towards a movable saddle pivoted about a shaft. Propulsion is effected between two wheels, one within the signature and the other beyond the signature spine. This propulsion is necessary to space apart the signatures, sliding on the fixed saddle, to enable the movable saddle to receive the signature, move into the sewing position, and return to receive the next signature. This propulsion step is particularly critical for signatures of large format and/or lightweight paper, in that the propulsion speed has to be adjusted (reduced) to prevent damage to the paper and/or problems in transferring the signatures from the fixed saddle to the movable saddle.

[0003] The movable saddle, which has two positions, takes the arriving signature, and positions it to enable the signature to be perforated and then sewn. Perforation is by perforators thrust forcibly against the signature, normally from the bottom upwards. The sewing head then sews the signature, the movable saddle moves and a prearranged rod then takes off the signature and is repositioned to receive the new signature to be perforated and sewn.

[0004] Such apparatus have a relatively low working speed particularly when delicate paper is used, so that the removal of the signatures does not ruin the paper.

[0005] Signature perforation requires considerable power, small tears often being caused about the hole, to be then amplified by the stitching thread during sewing.

[0006] IT 1,071,987 describes a book sewing machine comprising movable saddles pivotally mounted on a rotary member driven by a suitable motor. The rotary member positions the saddles in predetermined positions for the signature perforation and sewing operations.

[0007] IT 1,243,024 describes a sewing machine comprising several sewing saddles transported by an endless conveyor on which roller-guided carriages are pivoted, on which the saddles are positionably supported.

[0008] IT 1,036,478 describes a plant for producing sewn books which comprises signature transfer devices positioned between the exits of the sheet feeders and a main conveyor. The transfer devices comprise movable saddles pivotally mounted on rotatable rings.

[0009] An object of the present invention is to eliminate

the stated drawbacks of the known art.

[0010] Another object of the present invention is to increase the productivity of known apparatus.

[0011] A further object of the invention is to make the perforation step less critical.

[0012] These and further objects are attained according to the invention by an apparatus for drilling book or magazine portions each consisting of a plurality of sheets, comprising: means for feeding said book or magazine portions to drilling means; said apparatus comprising a first saddle which receives said book or magazine portions, characterised in that said drilling means comprise, positioned outside said first saddle, a drilling head including a plurality of spindles with relative drill bits for drilling said book or magazine portions from the top downwards.

[0013] Further characteristics of the invention are described in the dependent claims.

[0014] The characteristics and advantages of the present invention will be apparent from the ensuing detailed description of one embodiment thereof, illustrated by way of non-limiting example in the accompanying drawings, in which:

Figure 1 is a schematic front sectional view of an apparatus for drilling and sewing book or magazine portions in accordance with the present invention; Figure 2 is a schematic side section showing the drilling means including the saddle movement means;

Figures 3.1 and 3.2 are schematic detailed views of a saddle relative to the signature sewing head; Figures 4.1 and 4.2 are schematic detailed views of the saddle suction means;

Figures 5.1 and 5.2 are schematic detailed views of a saddle relative to signature alignment;

Figures 6.1, 6.2, 6.3, 6.4 are schematic views showing the drilling and reforming means.

[0015] With reference to the accompanying figures, an embodiment of a signature drilling and sewing apparatus of the present invention comprises a feeder 10 for feeding signatures 11 to a conveyor belt 12 comprising a drum 13 known as a sheet feeder. While the signatures 11 are conveyed by the conveyor belt 12 they are partially opened in half in known manner, not shown. On termination of their travel, each signature 11 is drawn over a saddle 14 appropriately positioned at the end of the conveyor belt 12.

[0016] The apparatus comprises a further three saddles 15, 16 and 17. When the saddle 14 is positioned at the end of the conveyor belt 12, the saddle 15 is positioned below a drilling and reforming head 18, the saddle 16 is positioned below a sewing head 19 comprising relative sewing thread spools 20, to the side of a sewn signature collection point 21, and the saddle 17 is positioned below the saddle 15.

[0017] Each saddle 14-17, of triangular prism form, is

connected to its own longitudinal shaft 22 such that it can rotate on a circular support structure 23. The circular support structure 23 rotates about its shaft 24.

[0018] The shaft 24 is connected to an intermitter 25 operated by a brushless motor 26. The intermitter 25 is arranged with 4 stations, to hence advance the circular support structure 23 through 90° steps.

[0019] The saddles 14-17 are fixed to their shaft 22, which is positioned in the lower portion of the saddles close to their base.

[0020] Each shaft 22 of the saddles 14-17, which is supported by the circular support via bearings, is connected to the shaft 24 via toothed belts 27 about pulleys with a 1:1 ratio. In this manner, those saddles having the tip of the prism orientated upwards, and in particular with a side of the prism positioned vertically (that facing in the same direction as the direction of rotation of the circular support structure 23) during rotation of the shaft 24 and of the circular structure 23, always maintain the same position.

[0021] In a variant of the invention, the toothed belts 27 are not connected directly to the shaft 24, but to further pulleys connected to the shaft 24 via bearings. These further pulleys are driven by a further motor (not shown).

[0022] To maintain the position of the saddles fixed during rotation of the support 23, as previously described, the advancement of the further motor is synchronized with the intermitter 25. If the position of the saddles is to be varied temporarily or systematically relative to their normal position, the further motor is operated asynchronously relative to the intermitter 25.

[0023] This can be useful when processing large-dimension signatures. When the saddle 14 has received a signature and moves into the drilling position, it could cross with the next signature arriving. At that moment it is preferable for the vertical advancement face of the saddle to incline slightly in the advancement direction to distance its tip from the drum 13.

[0024] The drilling and reforming head 18 comprises a motor 28 driving a belt 29 which operates a plurality of spindles 30 with drill bits 31 arranged to drill the signatures 11.

[0025] The drill bits, preferably diamond-set, are of suitable dimensions for their use, and are rotated at a speed of about 10,000 r.p.m.

[0026] An inverted V-shaped structure 32 is provided to reform and retain the signature edge during drilling, and comprises a series of holes in correspondence with the drill bits 31.

[0027] The structure 32 is provided with a guide and support bar 65, inclusive of springs, to be positioned with the required force on the signature.

[0028] The drilling and reforming head 18 is operated by a head lowering system operated by the arm 67, which acquires its movement and synchronism by suitable drives (not shown) connected to the intermitter 25. A pair of guide rods 66 maintain the head 18 aligned during its movement. The arm 67 lowers in succession both the V-

shaped reforming structure 32 and the plurality of spindles 30.

[0029] Each saddle 14-17 comprises in its interior a longitudinal rod 40 positioned in the vicinity of its tip. The rod 40 is connected to a wheel 41 which can slide within an appropriately shaped guide 42. The shuttles 43 co-operating with the needle 44 and crochet hook 45 are also connected to the rod.

[0030] The rod 40 is moved longitudinally by one or two motors 46 and 47, springs 48 being positioned to maintain the rod in its seat.

[0031] The apparatus comprises a suction system.

[0032] A vacuum or negative pressure generator (not shown) feeds a solenoid valve 50, to reach via a tube 51 an outer portion of the shaft 24. Via a rotary distributor 52 and tubes 53 the saddles 14-17 are reached, these presenting a plurality of holes 54 in their upper surface.

[0033] This suction system can be used both to maintain the signature on the saddles during their movement, and to draw off the paper dust which forms as a residue of the signature drilling by the drill bits 31.

[0034] When the signature leaves the conveyor belt 12 and is drawn over the saddle 14, it may not be correctly aligned.

[0035] For this purpose each saddle is provided externally with a wheel 60 arranged to move along a guide 61 fixed to the structure 23. The wheel 60 is connected to a pin 62 movable relative to the saddle 14, including a spring 63 for its return to the rest position. The pin 62 suitably positions and aligns the signature while the wheel cooperates with the guide 61.

[0036] The operation of the device according to the invention is apparent from that described and illustrated, and is essentially the following.

[0037] The signature 11 originating from the feeder 10 is conveyed by the conveyor belt 12 while being partially opened to enable it to correctly lie on the saddle 14. When the signature is on the saddle 14, the circular structure 23 begins to move through 90°, the wheel 60 begins to cooperate with the guide 61 and the piston 62 aligns the signature 11. At this point, a control centre (not shown) activates the solenoid valve 50, the vacuum created on the saddle maintaining in position the signature 11 which in the meantime has moved below the drilling and reforming head 18. The rod 67 lowers the V-shaped reforming structure 32, which shapes and further fixes the signature edge, immediately after which the drill bits 31 reach their working position, operated by the motor 28, and drill the signature.

[0038] The circular structure 23 again moves through 90°, the signature now being below the sewing head 19; the motors 46 and 47 are operated so that the shuttle carrier shaft moves longitudinally. The shaping of the guide 42 enables the shuttle to take the thread from the needle 44 and accompany it onto the crocket hook 45.

[0039] If only normal stitch sewing is to be effected, only one motor is sufficient, whereas if alternating stitch sewing is required, then two motors are necessary.

[0040] When sewing is finished the circular structure 23 begins to move, the sewn signature being shifted, by holding blades (not shown but well known), to the side of previously sewn signatures at the collection point 21.

[0041] The present invention enables the signature to be received, drilled, sewn and removed, in parallel instead of in series as in the past, so considerably increasing the operation rate.

[0042] Advantageously, the saddles are positioned such that their advancement surface is always vertical during rotation of the circular structure 23. This facilitates separation of the signature from the saddle. Removal hence takes place without risk of signature breakage.

[0043] Only if necessary and if the apparatus is provided with a further motor, as aforesaid, is it possible to change the signature advancement angle, all effected by an electronic control system.

[0044] Paper perforation non longer takes place by needles with possible breakage of the hole edges, this operation being replaced by drilling using drill bits of high rotational speed, hence with a better result, to obtain a clean hole with no tendency for its subsequent breakage by the sewing thread.

[0045] The drilling head is positioned outside the saddles, hence a single head is sufficient for all the saddles present within the apparatus. Moreover, drilling is effected from the top downwards with the signatures fixed securely on the saddle of the inverted V-shaped saddle 32, there hence being a considerable improvement in signature drilling and hence sewing quality.

[0046] The noise due to signature removal from the saddle is also considerably reduced compared with previous machines.

[0047] Moreover, the extremely critical signature propulsion stage is eliminated.

[0048] The apparatus conceived in this manner is susceptible to numerous modifications and variants, all falling within the inventive concept; moreover all details can be replaced by technically equivalent elements.

[0049] In practice, the materials used and the dimensions can be chosen at will according to requirements and the state of the art.

Claims

1. An apparatus for drilling book or magazine portions (11) each consisting of a plurality of sheets, comprising:

means (10, 12, 13) for feeding said book or magazine portions (11) to drilling means (18);
said apparatus comprising a first saddle (15) which receives said book or magazine portions (11),

characterised in that said drilling means (18) comprise, positioned outside said first saddle (15), a drilling head (30, 31) including a plurality

of spindles (30) with relative drill bits (31) for drilling said book or magazine portions (11) from the top downwards.

2. An apparatus for drilling book or magazine portions (11) as claimed in claim 1, **characterised in that** said apparatus comprises means (66, 67) for lowering said drilling means (18) onto said book or magazine portions (11).
3. An apparatus for drilling book or magazine portions (11) as claimed in claim 2, **characterised in that** said drilling means (18) comprise an inverted V-shaped structure (32) for reforming and holding said book or magazine portions (11) on said saddle (15).
4. An apparatus for drilling book or magazine portions (11) as claimed in claim 3, **characterised in that** said inverted V-shaped structure (32) comprises a series of holes in correspondence with said drill bits (31).
5. An apparatus for drilling book or magazine portions (11) as claimed in claim 1, **characterised by** comprising transport means (23) transporting four saddles (14, 15, 16, 17), said saddles being of triangular prism shape with its tip orientated upwards.
6. An apparatus for drilling book or magazine portions (11) as claimed in claim 5, **characterised in that** said transport means (23) comprise a circular support (23) operated by an intermitter (25), said circular support (23) advancing with 90° steps at each movement.
7. An apparatus for drilling book or magazine portions (11) as claimed in claim 6, **characterised in that** said saddles (14, 15, 16, 17) are fixed on said circular support (23), said saddles (14, 15, 16, 17) comprising a shaft (22) connected via bearings to said circular support (23), and maintaining their sides mutually parallel during their movement by belts (27) connected to their shaft (22) and to said transport means (23).
8. An apparatus for drilling book or magazine portions (11) as claimed in claim 7, **characterised in that** said saddles (14, 15, 16, 17) have their direction adjustable by belts (27) connected to their shaft (22) and to relative movement means.
9. An apparatus for drilling book or magazine portions (11) as claimed in claim 1, **characterised in that** said saddles (14, 15, 16, 17) comprise a plurality of holes (54) connected to suction means (50-54).
10. An apparatus for drilling book or magazine portions (11) as claimed in claim 1, **characterised in that**

said saddles (14, 15, 16, 17) comprise in their interior a longitudinally movable rod (40) on which shuttles (43) are fixed.

11. An apparatus for drilling book or magazine portions (11) as claimed in claim 1, **characterised in that** each of said saddles (14, 15, 16, 17) comprises, for aligning said book or magazine portions (11), means (60) cooperating with a guide (61) positioned on said movement means (23).

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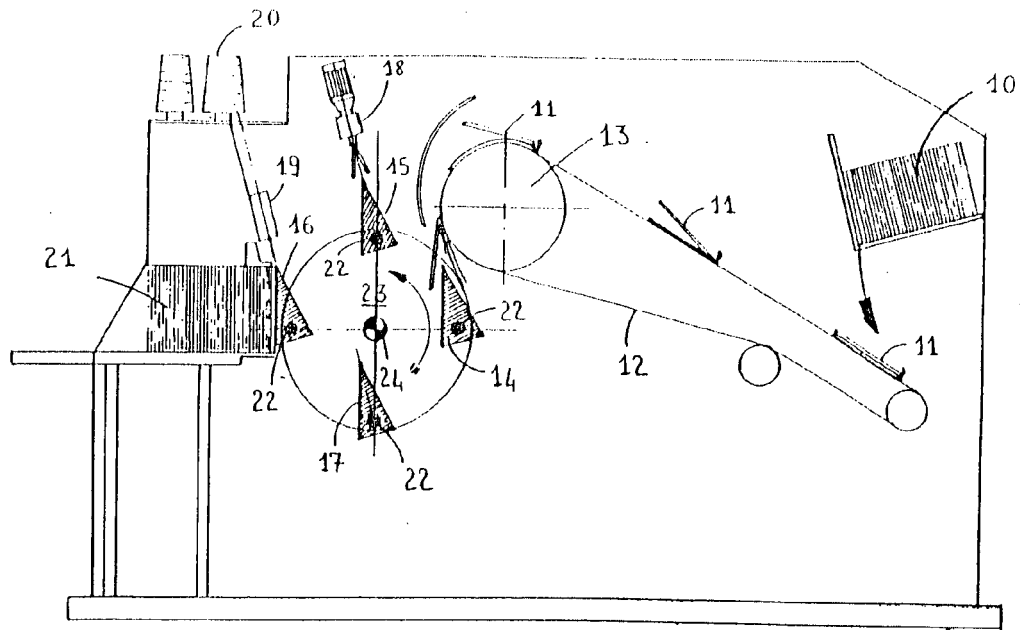


Fig. 1

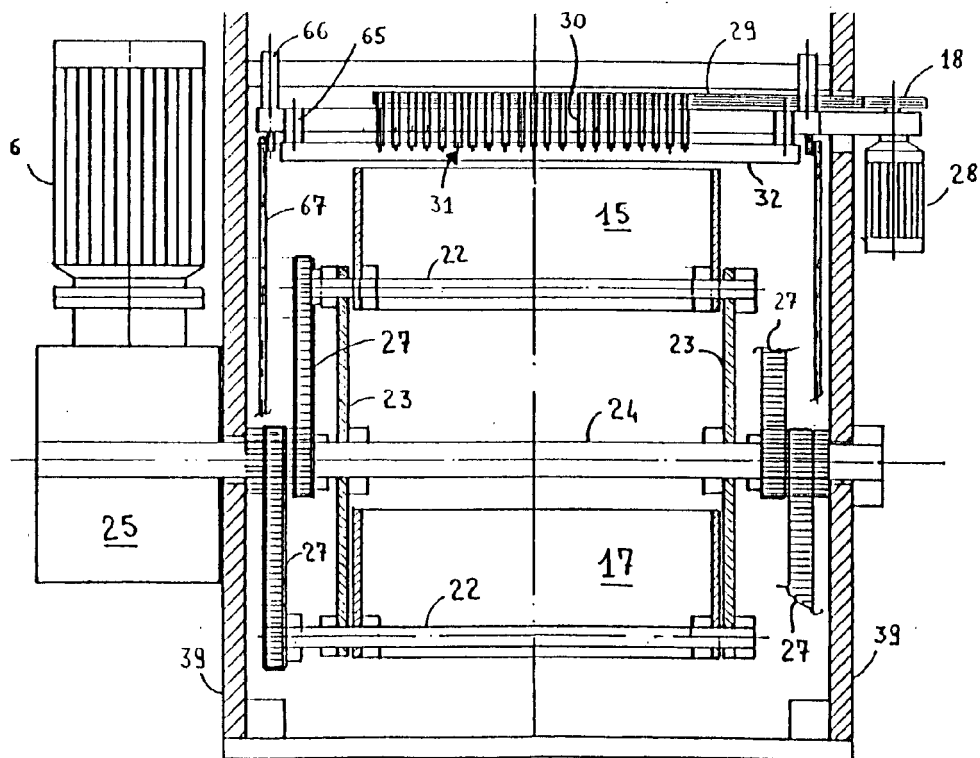


Fig. 2

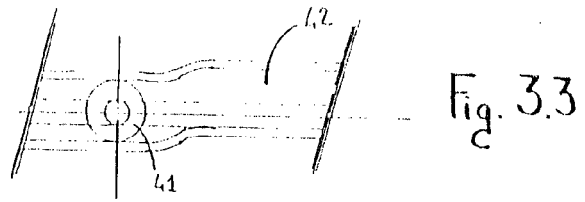


Fig. 3.3

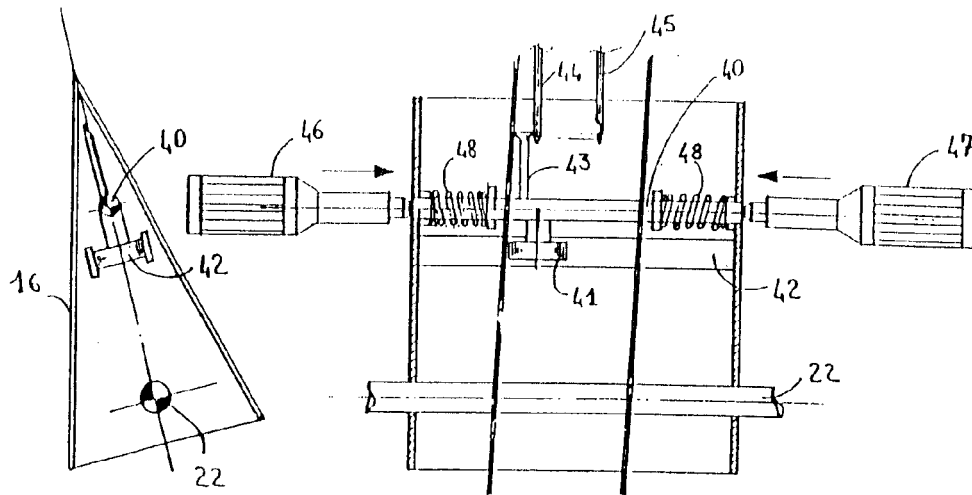


Fig. 3.1

Fig. 3.2

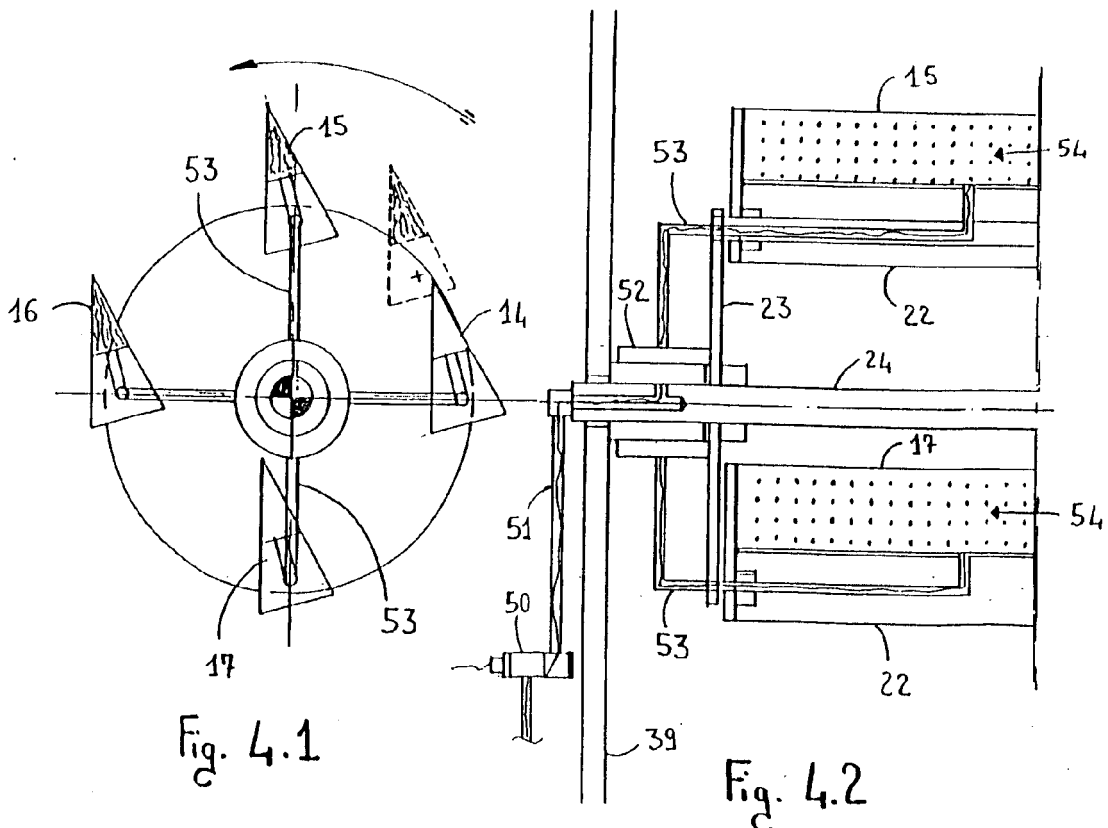


Fig. 4.1

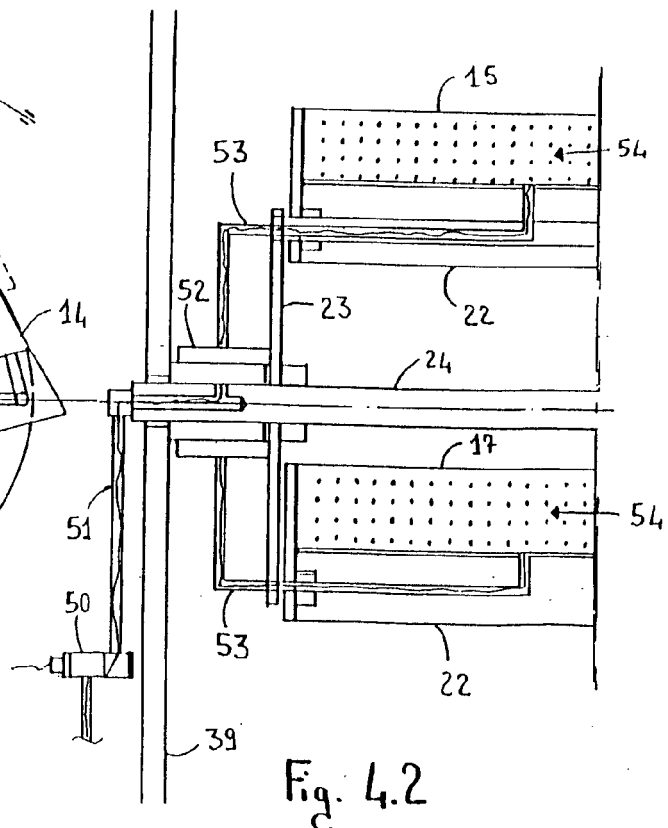
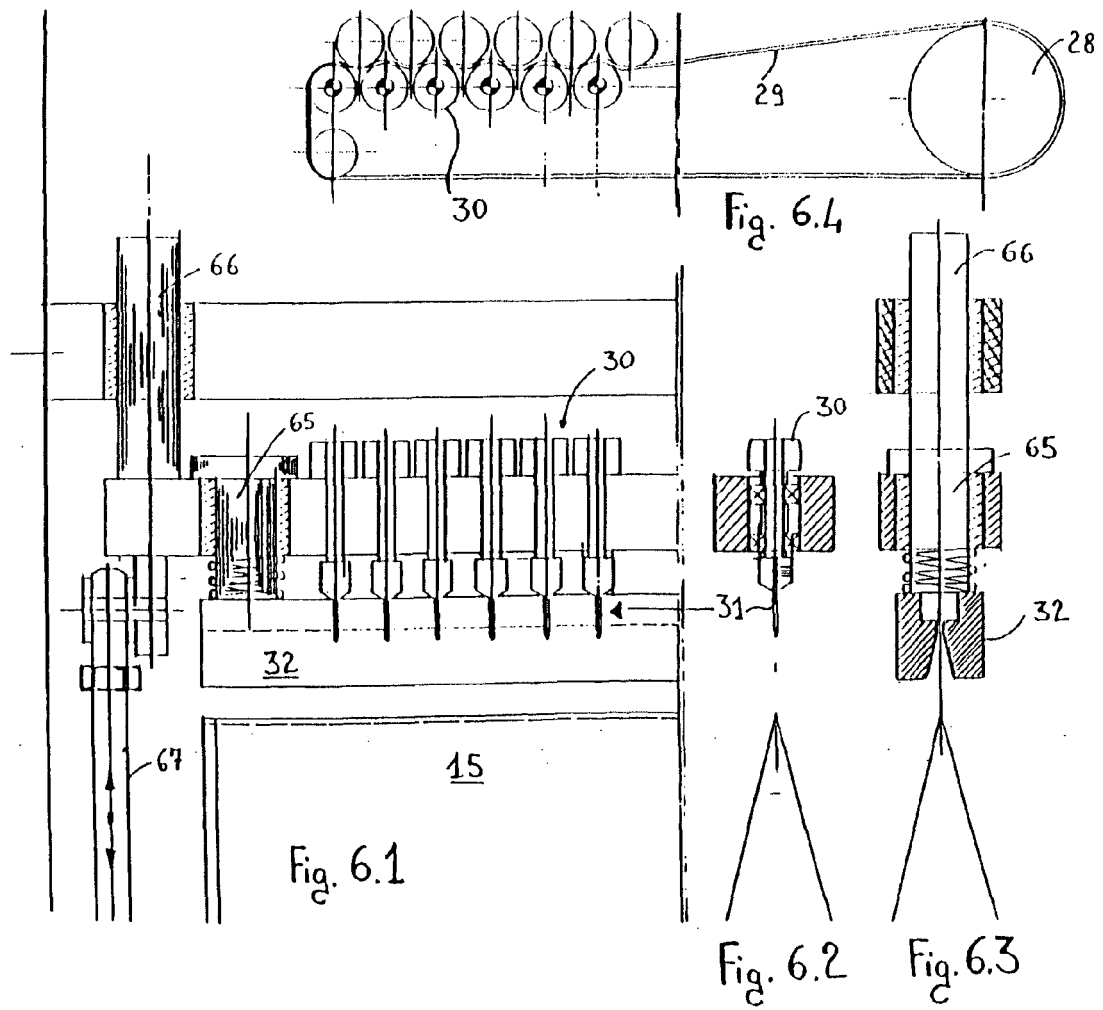
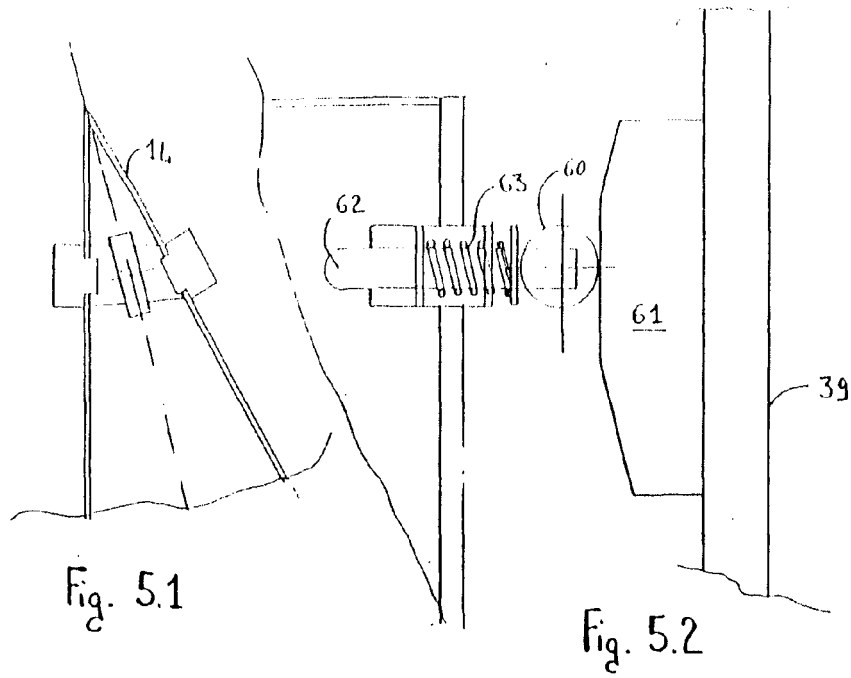


Fig. 4.2



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- IT 1071987 [0006]
- IT 1243024 [0007]
- IT 1036478 [0008]