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(54) **AIR-JET WEAVING MACHINE FOR PRODUCING LENO FABRICS**

(57) The invention relates to an air-jet weaving machine for producing leno fabrics comprising a beating-up mechanism (1) and a shedding mechanism (2), whereby the beating-up mechanism (1) comprises a weaving reed (11), mounted on a stringer (121) of a batten (12), and a batten (12) which is mounted on the frame (3) of the weaving machine by means of at least two flexible members (122) of the system of energy recuperation of the beating-up mechanism (1) arranged on two planar surfaces, between which there is a spacing in the direction of the movement of the stringer (121) of the batten (12) between its insertion position and beating-up position. The beating-up mechanism (1) is associated with an individual drive controlled in the electric cam mode and the shedding mechanism (2) is associated with an individual drive controlled in the electric cam mode, whereby the shedding mechanism (2) is associated with recuperative members (6) of the energy recuperation system of the shedding mechanism (2).

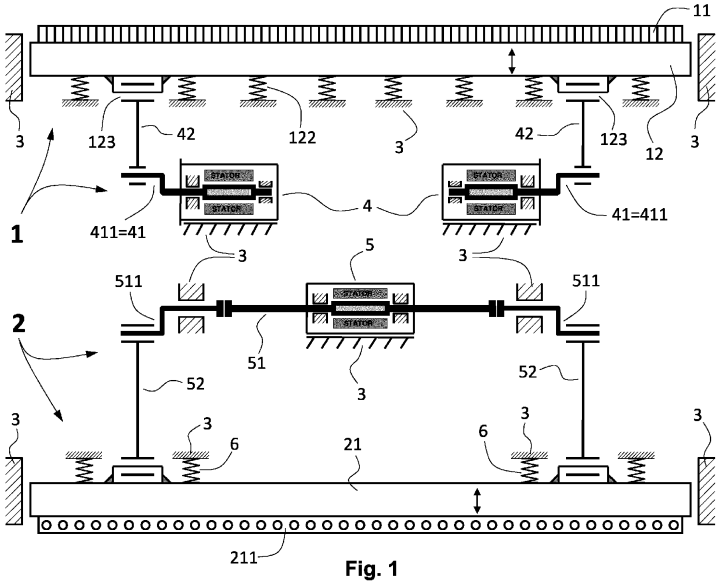

Fig. 1

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Description

Technical field

[0001] The invention relates to a weaving machine for producing leno fabrics, comprising a beating-up mechanism and a shedding mechanism, whereby the beating-up mechanism comprises a weaving reed mounted on a stringer of a batten and the batten which is mounted on the frame of the weaving machine by means of at least two flexible members arranged on two planar surfaces, between which there is a spacing in the direction of movement of the stringer of the batten between an insertion position and a beating-up position.

Background art

[0002] In known weaving machines for producing leno fabrics, a common motor is used to drive a batten of a beating-up mechanism of a weaving machine and a heald rod of a shedding mechanism of the weaving machine. If the batten is made with a reduced moment of inertia, lower stroke and the ability to recover energy, for example according to CZ 302391, the so-called electronic cam can be used to drive the batten, for example according to CZ 302391, i.e. a servomotor with a controllably variable angular speed during one revolution of the servomotor. A crankshaft of the beating-up mechanism of the weaving machine is coupled to this servomotor via toothed belt gears and countershafts, the crankshaft of the beating-up mechanism being coupled by means of connecting rods to the batten on which a weaving reed is mounted. The beating-up mechanism ensures a reciprocating rectilinear movement of the weaving reed in the horizontal direction. At the same time, a crankshaft of the shedding mechanism of the weaving machine is coupled to this servomotor via a toothed belt gear, the crankshaft of the shedding mechanism being coupled by means of connecting rods to the heald rod which is provided with guide elements of stationary warp threads. The shedding mechanism ensures a rectilinear reciprocating movement of the heald rod in the vertical direction.

[0003] The disadvantage of this solution is the flexibility of the toothed belt gears and the countershafts, their high moment of inertia, higher number of rotary, statically indeterminate bearings and the resulting higher passive resistances, greater play and generated vibrations, increased requirements for maintenance and lubrication.

[0004] The object of the invention is, in addition to eliminating the disadvantages of the background art, to reduce the energy consumption of the drive of the weaving machine, or to increase the performance while maintaining the energy consumption of the weaving machine.

Principle of the invention

[0005] The object of the invention is achieved by an air-jet weaving machine for producing leno fabrics according to the invention, whose principle consists in that the beating-up mechanism is coupled to an individual drive comprising a servomotor with a controllably variable angular speed during one revolution of the servomotor and the shedding mechanism is coupled to an individual drive formed by a servomotor with a controllably variable angular speed during one revolution of the servomotor, whereby the shedding mechanism comprises a heald rod which is coupled to recuperative members of the energy recuperation system of the shedding mechanism.

[0006] The drive of the beating-up mechanism comprises two servomotors which are mounted on the machine frame and comprise crank rotors provided with eccentric pins which are coupled to a batten by means of connecting rods of the beating-up mechanism.

[0007] In a preferred embodiment, the connecting rods of the beating-up mechanism are mounted with one eye on the eccentric pins of the crank rotors and with the other eye are mounted on the pins of the connecting rods which are formed on the batten under the stringer of the batten.

[0008] In a specific embodiment, the servomotors with the crank rotors are arranged by eccentric pins with connecting rods oriented away from each other.

[0009] In order to enable to reduce the energy intensity of the drive of the weaving machine, or to increase performance while maintaining the energy intensity of the weaving machine, the servomotor of the shedding mechanism is mounted on the frame of the weaving machine under the middle part of the heald rod and is provided with a continuous shaft at whose ends are arranged crankshafts which are coupled to the vertically reversibly displaceable heald rod by means of connecting rods of the shedding mechanism.

[0010] To guide the stationary warp threads, a guide rail of the stationary warp threads with holes for the warp threads is mounted on the heald rod.

[0011] The heald rod of the shedding mechanism is associated with recuperative members of the energy recuperation system of the shedding mechanism.

[0012] The recuperative member of the shedding mechanism is preferably formed by a pair of leaf springs arranged one above the other. The ends of the leaf springs are on one side mounted in a static stirrup and on the other side in a movable stirrup to which is fixedly connected a resilient tow bar which is at its end provided with an eye to be mounted on the pin of the connecting rod of the shedding mechanism.

[0013] In a preferred embodiment, four recuperative members are arranged under the heald rod, whereby under the middle part of the heald rod, a central holder is fixedly mounted, to which static stirrups of inner recuperative members are connected. The movable stirrups of the inner recuperative members are coupled by means of resilient tow bars to the connecting rods of the shedding mechanism on which the resilient tow bars of the outer recuperative members are fixed outwards, the static stirrups of the outer recuperative members being fix-

edly mounted on the frame of the weaving machine.

[0014] The inner recuperative member and the outer recuperative member constitute a pair of recuperative members on either side of the machine.

Description of drawings

[0015] A basic scheme of a batten of a beating-up mechanism and a drive of a heald rod of a shedding mechanism of a weaving machine for producing leno fabrics is shown in Fig. 1, Fig. 2 shows a drive of a batten of a beating-up mechanism, Fig. 3 shows a drive of a heald rod of the shedding mechanism and Fig. 4 shows a recuperative member of the shedding mechanism.

Examples of embodiment

[0016] An air-jet weaving machine for producing leno fabrics comprises a beating-up mechanism **1** and a shedding mechanism **2**.

[0017] The beating-up mechanism **1** comprises a weaving reed **11** which is mounted on a stringer **121** of a batten **12.** The batten **12** is mounted in a known manner on the machine frame **3** by means of at least two flexible members **122** of the energy recuperation system of the beating-up mechanism **1**, as is schematically shown in in Fig. 1. In the exemplary embodiment according to Fig. 2, the flexible members **122** are arranged on two planar surfaces, between which there is a spacing in the direction of movement of the stringer **121** of the batten **12** between an insertion position and a beating-up position and the batten **12** is made according to patent CZ 302391 of a carbon-epoxy (CE) composite material or another suitable material. In the embodiment shown, the flexible members **122** consist of leaf springs **1221** which constitute in their upper part an integral part of the stringer **121**, whereby both the leaf springs **1221** and the stringer **121** are made of the same CE composite material and form an open profile in the shape of a parallelogram or a general quadrilateral. The beating-up mechanism **1** is provided with an individual drive which is in the illustrated embodiment formed by two servomotors **4** according to UV 29115 with crank rotors **41** which are at one end provided with eccentric pins **411** on which are mounted connecting rods **42** of the beating-up mechanism which are in the exemplary embodiment shown coupled to the batten **12** by means of connecting rod pins **123**, formed on the batten **12**. The two servomotors **4** with the crank rotors **41** are controlled synchronously in the electronic cam mode and therefore have a controllably variable angular speed during one revolution of the servomotors. The servomotors **4** with the crank rotors **41** are mounted on the frame **3** of the weaving machine and, in the embodiment shown, are spaced from each other by means of the eccentric pins **411** with the connecting rods **42.** The pins **123** of the connecting rods **42** are formed on the batten **12** under its stringer **121.** A weaving reed **11** and related accessories, for example main nozzles **124**, blowing nozzles **125**, etc., are mounted on the stringer **121** of the batten **12.** The servomotors **4** with the crank rotors **41** are coupled in a known unillustrated method to an unillustrated control system of the weaving machine.

[0018] The shedding mechanism **2** of the weaving machine comprises a vertically reversibly displaceable heald rod **21**, on which is mounted a guide rail **211** of stationary warp threads with holes to receive the stationary warp threads which further pass through the lamellae of the weaving reed **11** to a binding point, where they become part of the fabric. The heald rod **21** is coupled to the shedding mechanism with an individual drive with the aid of means which are situated below the weaving plane which is formed by a horizontal plane interspersed with the binding point.

[0019] The heald rod **21** of the shedding mechanism of the weaving machine is slidably mounted on the machine frame in guides (not shown) by means of gliders **23** which are fixedly connected to the heald rod **21.** The individual drive of the heald rod **21** is formed by a servomotor **5** controlled in the electronic cam mode. The servomotor **5** of the shedding mechanism is mounted on the frame **3** of the weaving machine and located under the middle part of the heald rod **21.** In the embodiment shown, the servomotor **5** of the shedding mechanism 2 is provided with a continuous shaft **51**, at the ends of which are arranged crankshafts **511**, which are coupled to the heald rod **21** in a known method by means of the connecting rods **52** of the shedding mechanism. In the embodiment shown, the heald rod **21** is made of CE composite material. The heald rod **21** of the shedding mechanism is associated with recuperative members **6** of the energy recuperation system of the shedding mechanism **2.**

[0020] The recuperative member **6** is shown in Fig. 4 and consists of a pair of leaf springs **66** arranged one above the other. The ends of the leaf strings **66** are on one side mounted in a static stirrup **661** and on the other side in a movable stirrup **662**, to which is fixedly attached a flexible tow bar **67**, which is at the end provided with an eye **671** to be mounted on a pin of a connecting rod **52** of the shedding mechanism. In the exemplary embodiment shown in Fig. 3, four recuperative members **6** are arranged under the heald rod **21.** Under the middle part of the heald rod **21,** a central holder **60** of the inner recuperative members **601** is fixedly mounted on the frame **3** of the weaving machine to which static stirrups **661** of the inner recuperative members **601** are connected. The movable stirrups **662** of the inner recuperative members **601** are coupled to the connecting rods **52** of the shedding mechanism **2** by means of resilient tow bars **67.** Outwards, resilient tow bars **67** of outer recuperation members **602** are mounted on the respective connecting rods **52** of the shedding mechanism **2,** whereby the static stirrups **661** of the outer recuperation members **602** are fixedly mounted on the frame **3** of the weaving machine in the extreme holders **61**, **62** of the outer recuperative members **6.** The inner recuperative member **601** and the

outer recuperative member **602** constitute on both sides of the machine a pair of recuperative members **6** which serves for energy recuperation of the shedding mechanism **2**.

[0021] As the heald rod **21** moves, the resilient tow bars **67** also move and carry the movable stirrups **662** of the respective pairs of recuperative members **6**, while the static stirrups **661** do not move, which leads to the deformation of the leaf springs **66** of the respective recuperative members. As the heald rod **21** moves backwards, the leaf springs **66** straighten and recover energy.

Industrial applicability

[0022] The invention can be used in weaving machines, especially at air-jet weaving machines for producing leno fabrics.

List of references

[0023]

1	beating-up mechanism
11	weaving reed
12	batten
121	stringer of the batten
122	flexible members of the energy recuperation system of the beating-up mechanism
1221	leaf springs of the batten
123	eyes of the batten
2	shedding mechanism
21	heald rod
211	guide rail of the stationary warp threads
23	sliders of the heald rod
3	frame of the weaving machine
4	servomotors with the crank rotors
41	crank rotors
411	eccentric pins
42	connecting rods of the beating-up mechanism
5	servomotor of the shedding mechanism
51	continuous shaft
511	crankshaft
52	connecting rods of the shedding mechanism
6	recuperative member
60	central holder of the inner recuperative members
601	inner recuperative member
602	outer recuperative member
61, 62	extreme holders of the outer recuperative members
66	leaf spring
661	static stirrup of the leaf springs of the recuperative member
662	movable stirrup of the leaf springs of the recuperative member
67	resilient tow bar of the recuperative member
671	eye of the resilient tow bar

Claims

1. An air-jet weaving machine for producing leno fabrics comprising a beating-up mechanism (1) and a shedding mechanism (2), whereby the beating-up mechanism (1) comprises a weaving reed (11), mounted on a stringer (121) of a batten (12), and a batten (12) which is mounted on the frame (3) of the weaving machine by means of at least two flexible members (122) of the energy recuperation system of the beating-up mechanism (1) arranged on two planar surfaces, between which there is a spacing in the direction of movement of the stringer (121) of the batten (12) between an insertion position and a beating-up position, **characterized in that** the beating-up mechanism (1) is coupled to an individual drive comprising a servomotor (4) with a controllably variable angular speed during one revolution of the servomotor and the shedding mechanism (2) is coupled to an individual drive formed by a servomotor (5) with a controllably variable angular speed during one revolution of the servomotor, whereby the shedding mechanism (2) comprises a heald rod (21) which is coupled to recuperative members (6) of the energy recuperation system of the shedding mechanism (2).

2. The air-jet weaving machine according to claim 1, **characterized in that** the drive of the beating-up mechanism (1) comprises two servomotors (4) which are mounted on the machine frame (3) and comprise crank rotors (41) provided with eccentric pins (411) which are coupled to the batten (12) by means of connecting rods (42) of the beating-up mechanism (1).

3. The air-jet weaving machine according to claim 2, **characterized in that** the connecting rods (42) of the beating-up mechanism (1) are mounted with one eye on the eccentric pins (411) of the crank rotors (41) and with the other eye the connecting rods (42) of the beating-up mechanism (1) are mounted on the connecting rod pins (123) formed on the batten under the stringer (121) of the batten (12).

4. The air-jet weaving machine according to claim 2 or 3, **characterized in that** the servomotors (4) with the crank rotors (41) are arranged by the eccentric pins (411) with the connecting rods (42) oriented away from each other.

5. The air-jet weaving machine according to claim 1, **characterized in that** the servomotor (5) of the shedding mechanism (2) is arranged on the frame (3) of the weaving machine under the middle part of the heald rod (21) and provided with a continuous shaft (51), at whose ends are arranged crankshafts (511), which are coupled by means of connecting rods (52) of the shedding mechanism (2) to a verti-

cally reversibly displaceable heald rod (21).

6. The air-jet weaving machine according to claim 5, **characterized in that** a guide rail (211) of stationary warp threads with holes for the stationary warp threads is mounted on the heald rod (21).

7. The air-jet weaving machine according to claims 1 to 6, **characterized in that** the recuperative member (6) of the energy recuperation system of the shedding mechanism (2) consists of a pair of leaf springs (66) arranged one above the other, whose ends are on one side mounted in a static stirrup (661) and on the other side in a movable stirrup to which is fixedly attached a resilient tow bar (67), provided at its end with an eye (671) to be mounted on the pin of the connecting rods (52) of the shedding mechanism (2).

8. The air-jet weaving machine according to claim 7, **characterized in that** four recuperative members (6) are arranged under the heald rod (21), whereby under the middle part of the heald rod (21), a central holder (60) is fixedly mounted on the frame (3) of the weaving machine, whereby to the central holder (60) are connected static stirrups (661) of inner recuperative members (601), whose movable stirrups (662) are by means of resilient tow bars (67) coupled to the connecting rods (52) of the shedding mechanism (2) on which are mounted outwards resilient tow bars (67) of outer recuperative members (602), whose static stirrups (661) are fixedly mounted on the frame (3) of the weaving machine.

9. The air-jet weaving machine according to claim 8, **characterized in that** the inner recuperative member (601) and the outer recuperative member (602) constitute a pair of recuperative members (6) on both sides of the machine.

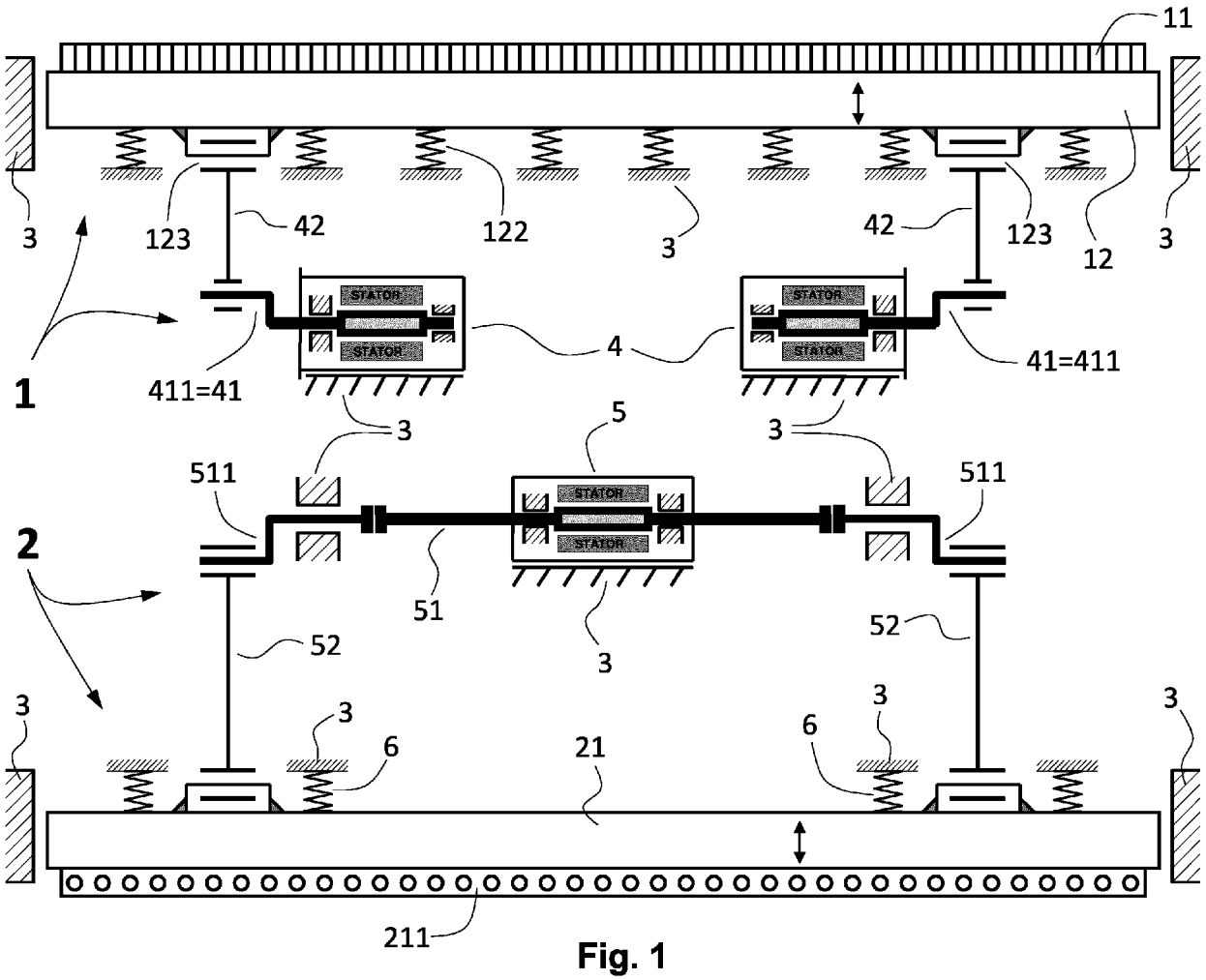
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Fig. 1

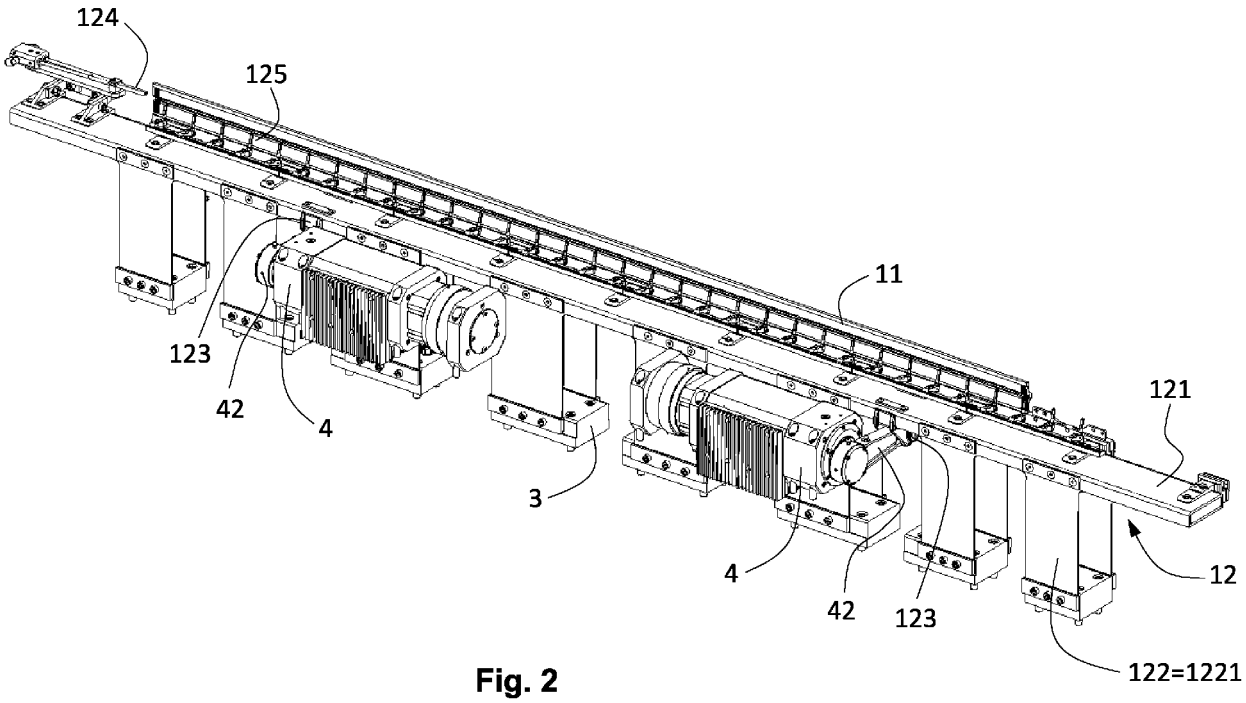

Fig. 2

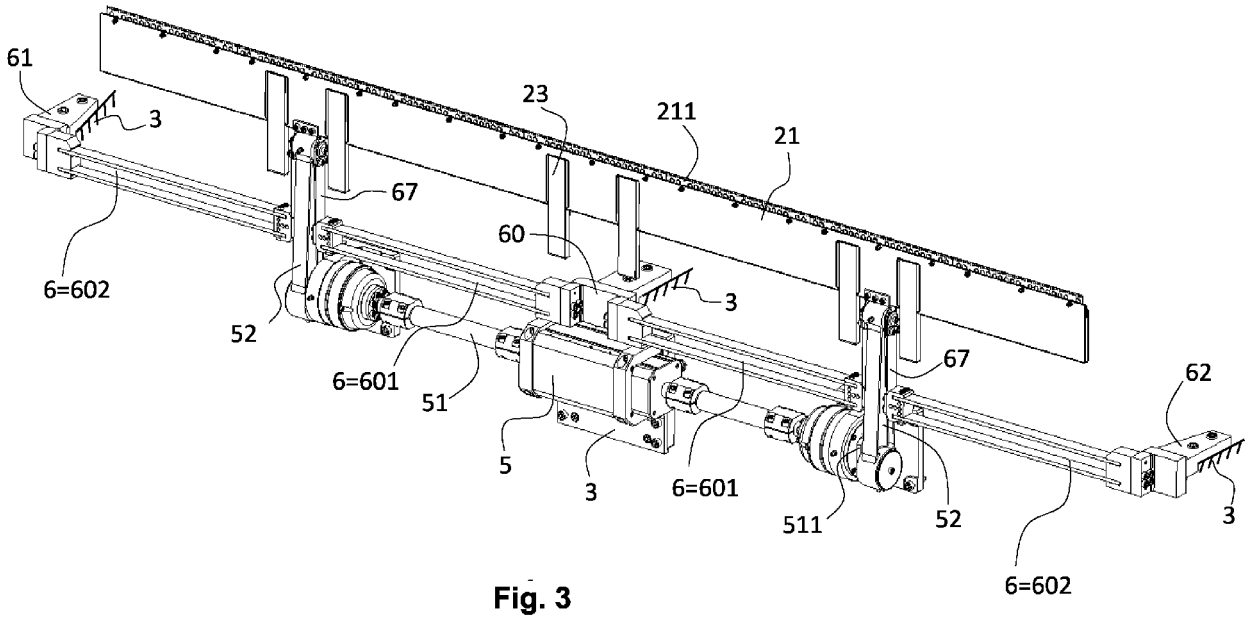

Fig. 3

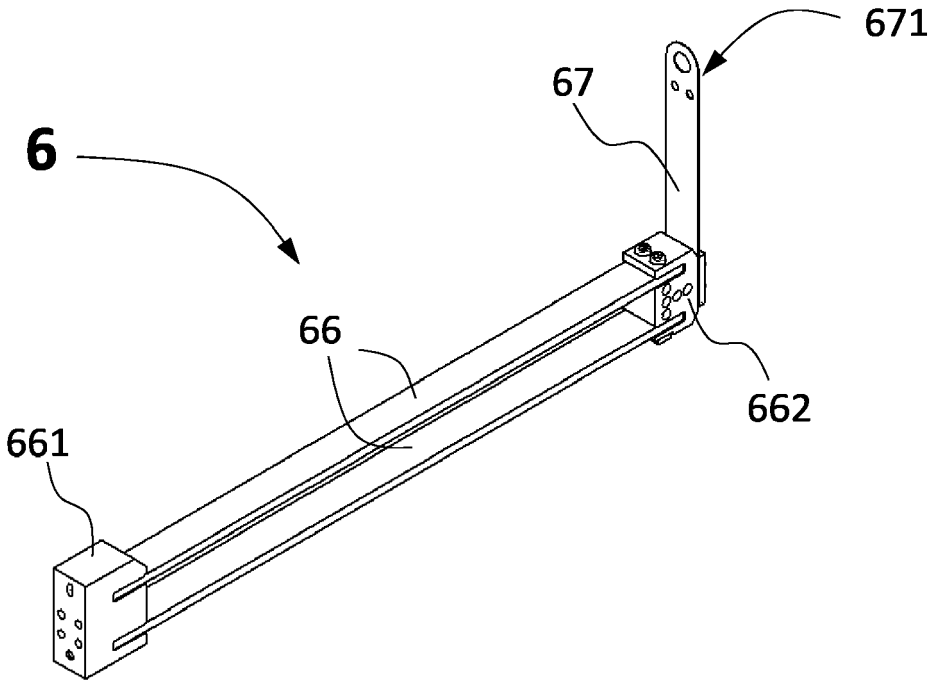

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 20 17 9257

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 1 675 983 A1 (VYZK USTAV TEXTILNICH STROJU L [CZ]) 5 July 2006 (2006-07-05) * abstract; figures 1-4 * * paragraphs [0010], [0012] *	1-9	INV. D03D51/02 D03D49/64
A	US 2008/135122 A1 (DONNER ALBRECHT [DE]) 12 June 2008 (2008-06-12) * abstract; figures 1-3,6 * * paragraphs [0003] - [0012], [0021] - [0028]; claims 6-17 *	1-9	
A	WO 97/33024 A1 (PALMER RAYMOND LESLIE [GB]) 12 September 1997 (1997-09-12) * abstract; figures 1-8 * * page 1, paragraph 1 - page 3, paragraph 3 *	1-9	
A	DE 10 2005 039738 A1 (SCHAEFFLER KG [DE]) 1 March 2007 (2007-03-01) * abstract; figures 2,3 * * paragraphs [0006], [0007], [0012], [0020] *	1-9	
			TECHNICAL FIELDS SEARCHED (IPC) D03D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	12 October 2020	Louter, Petrus

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1675983 A1	05-07-2006	CZ 20032887 A3	17-08-2005
		EP 1675983 A1	05-07-2006
		WO 2005038110 A1	28-04-2005
US 2008135122 A1	12-06-2008	CN 101103151 A	09-01-2008
		DE 102004045208 A1	06-04-2006
		DE 112005002161 A5	23-08-2007
		US 2008135122 A1	12-06-2008
		WO 2006029993 A1	23-03-2006
WO 9733024 A1	12-09-1997	EP 0885319 A1	23-12-1998
		JP 2001502761 A	27-02-2001
		KR 19990087647 A	27-12-1999
		WO 9733024 A1	12-09-1997
DE 102005039738 A1	01-03-2007	DE 102005039738 A1	01-03-2007
		WO 2007022856 A1	01-03-2007

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Patent documents cited in the description

- CZ 302391 **[0002] [0017]**