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(54) Method and device for starting a weaving machine

(57) The invention relates to a method for the starting of the weaving machine, in which the beating-up mechanism of the weaving reed proceeds from standstill to operating speed, whereby before dead centre, in the position of the weft insertion, the kinetic energy of the moving members of the beating.up mechanism is converted to the potential energy of a flexibly deforming means and after dead centre, in the position of the weft insertion, the potential energy of the means that is flexibly deformed is converted to the kinetic energy of the moving members of the beating-up mechanism of the weaving reed. From standstill in the first phase, the beating-up mechanism of the weaving reed is driven at a lower speed and and by a larger force, by which a flexibly deformable means is flexibly deformed before dead centre in the position of the weft insertion, and subsequently, in the second phase, the beating-up mechanism of the weaving reed is driven at a higher speed, being close to operating speed, and by a lesser force, whereby the flexibly deformable means returns to its original shape.

The invention also relates to a device for the starting of a weaving machine, whose beating-up mechanism of the weaving reed (3) comprises a batten (1) mounted on means which are flexibly deformable in a direction of the working movement of the batten (1) between its beat-up position and the position of the weft insertion, whereby the batten (1) is coupled by means of a connecting rod (4), a crank (51) and a crank shaft (52) with the electric drive (6). The electric drive (6) comprises a working drive electric motor (61) and a starting drive electric motor (62), wherein the output shafts of both electric motors (61, 62) are coupled with a switchable drive clutch (56), whose outlet portion is interconnectable with the output shaft of the starting drive electric motor (62) and/or the output shaft of the working drive electric motor (61).

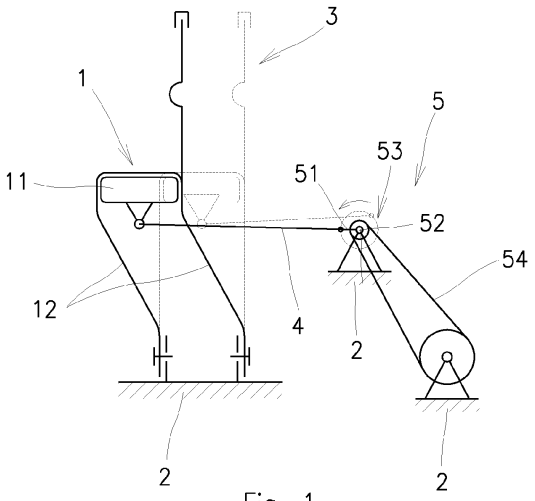

Fig. 1

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Description

Technical field

[0001] The invention relates to a method for the starting of a weaving machine, in which the beating-up mechanism of the weaving reed proceeds from standstill to operating speed, whereby before dead centre in the position of the weft insertion the kinetic energy of the moving members of the beating-up mechanism is converted to the potential energy of a flexibly deforming means and after dead centre in the position of the weft insertion the potential energy of the means which is flexibly deformed is converted to the kinetic energy of the moving members of the beating-up mechanism of the weaving reed.

[0002] The invention further relates to a device for the starting of a weaving machine, whose beating-up mechanism of the weaving reed comprises a batten arranged on means which are flexibly deformable in a direction of the working movement of the batten between its beat-up position and the position of the weft insertion, whereby the batten is coupled with electric drive by means of a connecting rod, a crank and a crank shaft.

Background art

[0003] Driving means of weaving machines drive working members which perform a cyclic movement, which is generally demanding wih respect to the requirements on the input of the drive motor. The movement of the heald shafts of the shedding mechanism and particularly the rectilineal reciprocating motion of the reed account for uneven energy input in the operating mode of the machine. Its negative influence on the energetic balance of the machine manifests itself especially in the starting operation of the machine which requires substantially greater driving forces, or more precisely, torques. Although this mode is only a fragment of the working time of the machine, it is necessary to adapt to this state by the performance of the electric drive motor.

[0004] US5729114A solves the issue of starting a weaving machine by electronic controlling of asynchronous electric motor by means of a control unit upon receiving a signal from the detector of the main crank shaft revolutions of a loom. Arranged before the electric motor is a frequency converter, which controls the drive of the machine during the first moments of the start-up. This device is able to ensure that the desired technology requirements are met, nevertheless the electric motor must be dimensioned with respect to the necessity of accelerating large inertial masses during the starting operation of the machine, especially heald shafts during the start of beating-up weft.

[0005] The driving system of the weaving machine according to WO97033024A1 discloses the starting operation of the machine by electric motor coupled with capacity resistance, which has the role of intermediate storage of potential electric energy, which is consumed during the acceleration of inertial masses moving reciprocatingly.

[0006] The device according to EP1048769B1 describes a solution in which a disconnectable fly-wheel is arranged between the drive electric motor, which is during the starting operation controlled by means of a frequency converter, and the inertial masses, the fly-wheel being connected with the main shaft of the machine only after reaching the required start-up speed. In order to start the fly-wheel by means of the working electric motor, the electric motor must be appropriately dimensioned.

[0007] The device according to EP2004895B1 discloses the start-up of a machine, whose driving mechanism comprises additional rotational inertial masses running in the operating mode of the machine. The start-up of these masses and simoultaneous start-up of the working mechanisms is energy demanding, costly and unsuitable with respect to possible utilization of the fabric produced during the starting operation. The device solves mutual controlled connection of the drive motor to the main shaft of the machine and the additional rotational masses. That enables to start the machine without additional inertial rotational masses being connected and connect them only after the operating speed is achieved.

[0008] From the document CZ302391B6 there is known a weaving machine, whose reed is mounted on the stringer of the batten, which is by means of two parallel vertical leaf springs seated on the frame of the weaving machine. The stringer, which is with the aid of means connected with the drive motor alternately deflected towards the picking position and back to the beat-up position, forms in principle a parallelogram with the springs and the machine frame, and, furthermore, the springs accumulate energy when moving to dead centre position and transfer the energy to the drive mechanism when moving from dead centre position. However, the device again requires overdimensioned output power of the motor drive to maintain a stable operating mode.

[0009] Devices according to the prior art either do not solve increased dimension of the drive motor at all, or basically solve the situation by regulation means coupled with the electric motor, yet more or less with regard to disposal of losses of fabric produced during the starting mode of the machine. In addition, these are complicated solutions, wherein the need for stable operating mode of the overdimensioned drive means remains unsolved.

[0010] The goal of the invention is to remedy the drawbacks of the background art, particularly avoid utilization of an economically unfavourable overdimensioned electric motor.

Principle of the invention

[0011] The goal of the invention is achieved by a method of starting a weaving machine, whose principle consists in that the beating-up mechanism of the weaving reed from standstill in the first phase is driven at a lower speed and by a larger force, by which a flexibly deform-

able means is flexibly deformed before dead centre in the position of weft insertion, and subsequently, in the second phase, the beating-up mechanism of the weaving reed is driven at a higher speed, being close to the operating speed, and by a lesser force, whereby the flexibly deformable means returns to its original shape.

[0012] The principle of the device for starting a weaving machine consists in that the electric drive comprises a working drive electric motor and a starting drive electric motor, whereby the output shafts of both electric motors are coupled with a switchable drive clutch, whose outlet portion is interconnectable with the output shaft of the starting drive electric motor and/or with the output shaft of the working drive electric motor.

Description of drawings

[0013] Examples of embodiment according to the invention are schematically shown in the drawing, where Fig. 1 represents a diagram of the movement of the batten connected with leaf springs and Fig. 2 a part of the drive mechanism controlling the movement of the batten.

Specific description

[0014] Fig. 1 shows a side view of a part of a weaving machine in the area of the batten **1** which is in the position of weft insertion (continuous line), i.e. the weaving reed **3** is in a position remote from the beating up point and a shed is opening for inserting weft into the shed to be followed subsequently by beating up by the weaving reed **3** to the face of the formed fabric. In an example of embodiment the stringer **11** of the batten **1** is arranged in a well-known manner between two vertically arranged leaf springs **12** at their upper end, the lower ends of the leaf springs **12** being firmly attached to the frame **2** of the weaving machine. Mounted on the stringer **11** of the batten **1** is the weaving reed **3.** The batten **1** is coupled by a connecting rod **4** with a drive mechanism **5.** The beating- up position of the batten **1** is indicated by continuous line, when the leaf springs **12** are not pre-loaded and when the batten **1** beats up the weft, which has already been inserted into the shed, into the face of the formed fabric.

[0015] Fig.1 further illustrates some parts of the drive mechanism **5.** The connecting rod **4** is hinge-coupled with a crank **51,** pivotably mounted on the frame **2** of the machine. The rotation axis of the crank **51** is the axis of the crank shaft **52** mounted pivotably in the frame **2** of the machine, the driven pulley **53** of the toothed belt drive of the drive mechanism **5** is fixed on the crank shaft.

[0016] Fig. 2 shows a drive pulley **55**, which is mounted pivotably in the frame **2** of the machine, whereby it is connected with an unillustrated outlet member of the switchable drive clutch **56**, coupled with the electric drive **6** mounted on the frame **2** of the machine.

[0017] The electric drive **6** comprises a working drive electric motor **61** and a starting drive electric motor **62.** The output shafts of the electric motors **61, 62** are mutually coaxial, the electric motors 61, **62** being arranged in position with the shafts facing each other. The shafts of the electric motors **61, 62** are connected to the hubs in the body of the switchable drive clutch **56.** The switchable drive clutch **56** enables to engage the drive pulley 55 into contact with the output shaft of the starting drive electric motor **62,** or with the output shaft of the working drive electric motor **61,** or engage the drive pulley **55** in interposition into synchronous mutual contact with the output shafts of both electric motors **61, 62.**

[0018] Control of the switchable drive clutch **56** and electric motors **61, 62** is coupled with the control unit **7** of the weaving machine.

[0019] Before the start of the weaving machine the switchable drive clutch **56** is connected with the output shaft of the starting drive electric motor **62.** After its start during the first half-turn of the driven pulley **53** the batten **1** is moved by the crank **4** to the position of the weft insertion. Since the starting drive electric motor **62** is low-speed, it has a high torque, even though its performance is relatively low, and during this shifting its kinetic energy is converted into potential energy of the flexibly deformed leaf springs **12.** Theoretically, as early as at this point, the control unit **7** may give an impulse to the switchable drive clutch **56** to connect the output shaft of the working drive electric motor **61** to the drive pulley **55** and to start the working drive electric motor **61.**

[0020] In the following half-turn of the driven pulley **53** the potential energy of the flexibly deformed leaf springs **12** returning from the position of the weft insertion to the beat-up position is converted to kinetic energy, which together with the kinetic energy generated by the working drive electric motor **61,** which was started in the meanwhile, being connected by means of the switchable drive clutch **56,** acts to overcome the inertial forces caused by the weight of parts of the machine that are running up.

[0021] For a short time the output shafts of both electric motors **61, 62** can be connected to the drive pulley **55** by means of the switchable drive clutch **56,** whereupon after the impulse from the control unit **7** the switchable drive clutch **56** disconnects the drive pulley **55** from the output shaft of the starting drive electric motor **61** and the starting drive electric motor **62** switches off.

[0022] In another example of embodiment the starting drive electric motor **62** assists the working drive electric motor **61** in the stretching of the leaf springs **12** into the position of the weft insertion, which is in principle the back dead centre of the movement of the batten **1,** where both electric motors **61, 62** stop running. Subsequently the starting drive electric motor **62** is disconnected, the movement of the batten **1** to the beat-up position is started and in this manner the potential energy stored in the leaf springs **12** is converted, whereupon the connected working drive electric motor **61** starts up and reaches operating speed. That means that the starting drive electric motor **62** is only interconnected with the working drive electric motor **61** in the phase of "stretching" of the ma-

chine - of the batten **1.**

[0023] In another example of embodiment the starting drive electric motor **62** isused for "manual" operations with the batten or positioning with the batten **1,** which are performed at a low speed and during which the decreased performance of the working drive electric motor **61** would not be sufficient. In this case, i.e. for low speeds, either both electric motors **61, 62** work simultaneously, or the "manual" operations or positioning are carried out only by the starting drive electric motor **62,** while the working drive electric motor **61** is connected just as a passive load.

[0024] It is apparent that the invention includes various modifications that can be made to the embodiments of the means described herein as come within the scope of the appended patent claims.

[0025] The device according to the invention relating to a weaving machine enables to employ the working drive electric motor **61** with significantly lower performance, than it would certainly have if the starting drive electric motor **62** had not been used, and so it is possible to use the working drive electric motor **61,** which is considerably cheaper. This is achieved by virtue of connecting the low-speed starting drive electric motor **62,** which within a short time period of the starting operation of the machine makes it possible by its high torque to overcome the initial flexible deformation of the flexible means (here the leaf springs **12** of the batten **1**) while "stretching" the leaf springs **12** to the position of the weft insertion of the batten.

List of references

[0026]

1	batten
11	stringer of batten
12	leaf spring
2	frame of weaving machine
3	reed
4	connecting rod
5	drive mechanism
51	crank
52	crank shaft
53	driven pulley
54	toothed belt
55	drive pulley
56	switchable drive clutch
6	electric drive
61	working drive electric motor
62	starting drive electric motor
7	control unit

Claims

1. A method for the starting of a weaving machine, in which the beating-up mechanism of the weaving reed proceeds from standstill to operating speed, whereby before dead centre, in the position of the weft insertion, the kinetic energy of the moving members of the beating-up mechanism is converted to the potential energy of a flexibly deforming means and after dead centre, in the position of the weft insertion, the potential energy of the means that is flexibly deformed is converted to the kinetic energy of the moving members of the beating-up mechanism of the weaving reed, **characterized by that** the beating-up mechanism of the weaving reed from standstill in the first phase is driven at a lower speed and and by a larger force, by which a flexibly deformable means is flexibly deformed before dead centre in the position of weft insertion, and subsequently, in the second phase, the beating-up mechanism of the weaving reed is driven at a higher speed, being close to operating speed, and by a lesser force, whereby the flexibly deformable means returns to its original shape.

2. A method for the starting of a weaving machine according to Claim 1, **characterized by that** in the first phase the beating-up mechanism is driven mainly by a low-speed electric motor with a high torque, while in the second phase the beating-up mechanism is driven mainly by a high-speed electric motor with a low torque, whereby at the latest after reaching operating speed the slow-speed electric motor is disconnected.

3. A device for the starting of a weaving machine, whose beating-up mechanism of the weaving reed (3) comprises a batten (1) mounted on the means which are flexibly deformable in a direction of the working movement of the batten (1) between its beat-up position and the position of the weft insertion, whereby the batten (1) is coupled by means of a connecting rod (4), a crank (51) and a crank shaft with the electrical drive, **characterized by that** the electric drive (6) comprises a working drive electric motor (61) and a starting drive electric motor (62), wherein the output shafts of both electric motors (61, 62) are coupled with a switchable drive clutch (56), whose outlet portion is interconnectable with the output shaft of the starting drive electric motor (62) and/or to the output shaft of the working drive electric motor (61).

4. A device for the starting of a weaving machine according to Claim 3, **characterized by that** the outlet portion of the switchable drive clutch (56) is connected with the drive pulley (55) of the toothed belt (54) drive, the driven pulley (53) being connected with the crank shaft (52).

5. A device for the starting of a weaving machine according to Claim 3 or 4, **characterized by that** the

working drive electric motor (61), the starting drive electric motor (62) and the switchable drive clutch (56) are coupled with the control unit (7) of the weaving machine.

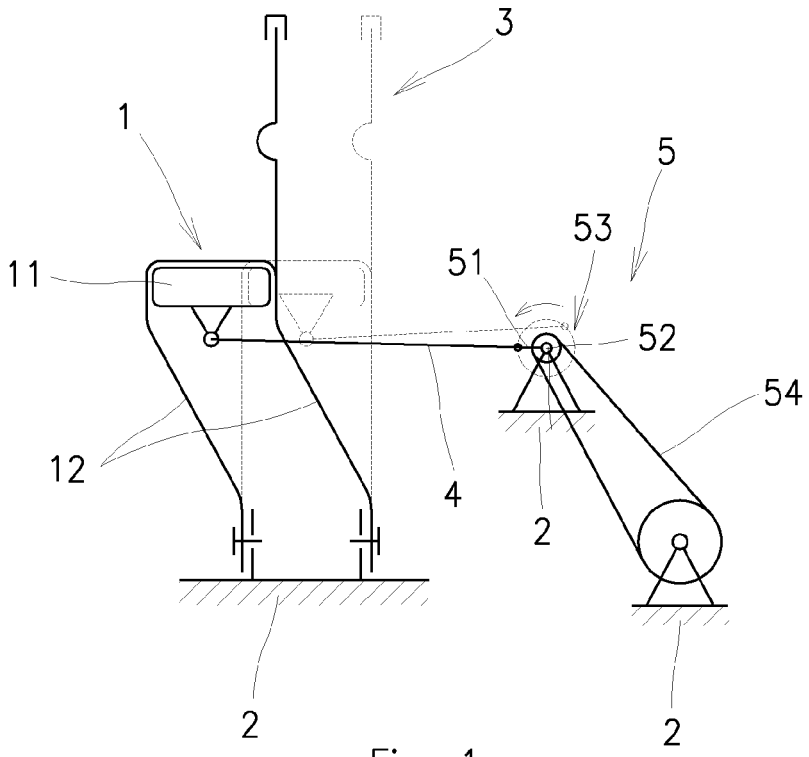

Fig. 1

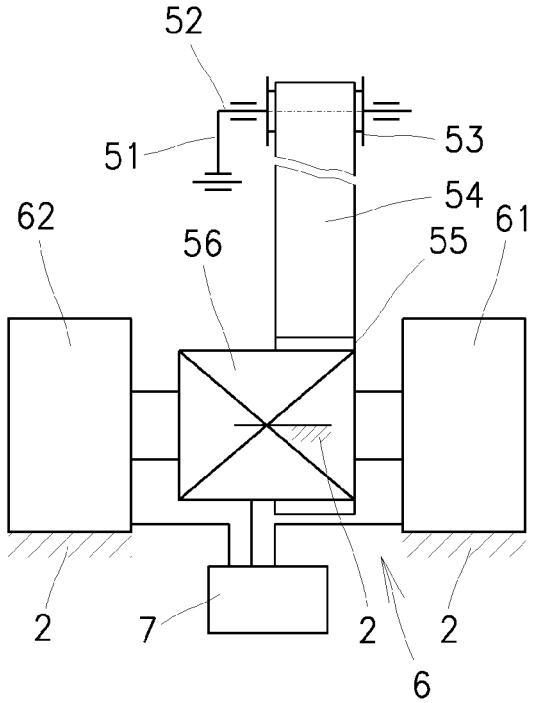

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 13 18 1011

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	DE 28 08 202 A1 (JEANDAUD JEAN CLAUDE) 6 September 1979 (1979-09-06) * page 13, line 15 - page 18, line 4 * * page 23, line 13 - page 28, line 16 * * figures 1, 2, 5, 6 *	1-5	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	5 November 2013	Hausding, Jan

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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