Abstract: The invention is a sewing machine (1) comprising a main motor (8) suited to axially rotate a main shaft (3) for moving the vertical needle-holding rod (4), an auxiliary motor (9) mechanically connected to the lower drive wheel (6) and to the roller (71) of the upper presser foot (7), an encoder (10) connected to a cam (43) for the oscillation of the needle-holding rod (4) and suited to detect the motion of said cam (43), that is, of said rod (4), an auxiliary electronic board (11) communicating with said encoder (10) and with said auxiliary motor (9), and wherein said auxiliary electronic board (11) activates said auxiliary motor (9) so as to modulate the speed and/or the rotation direction of said lower drive wheel (6) and of said upper roller (71) according to the motion of said needle-holding rod (4).
SEWING MACHINE WITH OPERATION CONTROL DEVICES

DESCRIPTION

The present patent concerns the sector of sewing machines and in particular it concerns a new sewing machine with new operation control devices.

Sewing machines are known which comprise at least one main shaft, an electric motor suited to rotate said main shaft axially, a vertical rod connected to said main shaft through transmission members, and wherein a needle suited to perforate the fabric to be sewn is constrained to the lower end of said vertical rod.

Said vertical rod, or needle-holding rod, performs an alternating movement from bottom to top and vice versa, which is transmitted by means of cams, and an oscillating motion in the direction of advance of the fabric, with variable period according to said advance speed, in order to prevent the tip of the needle from breaking or the fabric from getting damaged during the sewing operation.

The sewing machines of the known type also comprise at least one drive wheel, positioned under the sewing surface, suited to cause the fabric to advance, and wherein said drive wheel is also set rotating by said electric motor, being mechanically connected to said main shaft.

In order to guarantee that the fabric is correctly fed, the known sewing machines are also provided with a presser foot that is positioned over said sewing surface and is suited to press the fabric against said lower drive wheel.

Roller feet are also known, meaning feet comprising a roller positioned over the sewing surface and rotating in the advance direction of the fabric, in order to favour the forward feeding of the fabric.

In order to allow the reverse stitching to be performed, it is necessary that, at the end of the sewing operation, the fabric is driven backwards, so that some further final
stitches can be made. For this purpose, said drive wheel performs a driving movement in two directions, both forwards and backwards, and analogously said vertical needle-holding rod can reverse its oscillating motion in a way that corresponds to the rotation direction of said drive wheel.

Sewing machines are also known in which said roller foot is in turn connected to a rotation reversal device, so that said roller of the foot reverses the rotation direction in a way that corresponds to the reversal of the rotation of said lower drive wheel.

The oscillation and alternating translation period of said needle-holding rod is always determined according to the rotation speed of said lower wheel and of said roller, said components being all mechanically connected to the same motor.

A limitation of the sewing machines of the known type described above lies in that, with very thick fabrics or other thick and curved materials, said parameters regarding the speed of the lower wheel and of the upper roller and the oscillation and alternating translation period of the rod, on the other hand, should be able to be modulated in an independent manner, in such a way as to guarantee the correct sliding movement of the fabric without curling or deforming it in any way.

In order to overcome all the drawbacks described above, a new type of sewing machine with new operation control devices has been designed and manufactured.

The main object of the present invention is to provide a sewing machine in which it is possible to independently control all the operating parameters, such as the speed and rotation direction of the lower drive wheel and of the roller of the upper presser foot, as well as the oscillation period of the needle-holding rod, according to the kind of sewing operation to be carried out.

It is another object of the present invention to provide a sewing machine that allows said operating parameters to be modulated in a programmed and automatic way,
depending on the sewing operation to be carried out.

These and other direct and complementary objects are achieved by the new sewing machine with operation control devices, whose main parts comprise:

- a sewing surface, on which the fabric or material in general to be processed slides;
- at least one main driving shaft;
- at least one vertical rod, connected to said main shaft through at least one connecting rod, such that said vertical rod performs an alternating translational motion in the axial direction, and through at least one cam, such that said vertical rod performs also an oscillating motion in the advance direction of the fabric;
- at least one device suited to reverse said oscillating motion of said rod, said reversal device comprising, for example, at least one magnet;
- at least one needle positioned at the lower end of said vertical rod;
- at least one lower drive wheel, positioned under said sewing surface and suited to favour the feeding of the fabric;
- at least one presser foot with at least one drive roller, placed over said sewing surface and suited to favour the feeding of the fabric;
- at least one main motor connected to said main driving shaft that moves said vertical rod;
- at least one main electronic board equipped with control keyboard or buttons.

The new machine comprises also:

- at least one further auxiliary motor, preferably of the step-by-step type, mechanically connected, through transmission members, to said lower drive wheel and to said upper foot roller in order to set them rotating;
• at least one encoder, mechanically connected to said cam for the oscillation of
said needle-holding rod in order to detect the motion of said cam itself;
• at least one auxiliary electronic board communicating with said encoder and
with said auxiliary motor,

and wherein said auxiliary electronic board, once having acquired the data of said
encoders, activates said auxiliary motor and controls its number of steps according
to the motion of said cam of the rod, said number of steps being counted by the encoder
itself.

Therefore, said encoder detects the motion of said cam, which defines the oscillation
period of said rod, meaning the length of the sewing stitch to be made. According to
said data collected by said encoder, said auxiliary electronic board activates said
auxiliary motor by adjusting its number of steps, meaning the rotation speed of said
lower drive wheel and of said upper foot roller.

In this way it is possible to adjust the feeding speed of the fabric according to the
length of the sewing stitch to be carried out.

Therefore, said auxiliary electronic board, according to the data received from the
encoder, controls the operation of the step-by-step motor.

Furthermore, said auxiliary electronic board, following a signal sent by the main
electronic board of the machine, which controls the rod reversal magnet, can
correspondingly reverse also the rotation direction of said auxiliary motor and thus of
the lower wheel and of said upper roller, through said auxiliary motor, for the
automatic reverse stitching operation at the beginning and at the end of the sewing
cycle.

The characteristics of the new sewing machine will be highlighted in greater detail in
the following description, with reference to the attached drawing that is enclosed by
way of non-limiting example.

Figure 1 schematically shows the operation of the new sewing machine.

The figure shows a new sewing machine (1) comprising a sewing surface (2) on which the fabric or material in general to be processed slides. The new sewing machine (1) comprises a main driving shaft (3) and a vertical needle-holding rod (4), mechanically connected to said main shaft (3) and having at least one needle (5) installed at its lower free end (41).

Said main shaft (3) is in turn mechanically connected to a main motor (8) suited to rotate said main shaft (3) axially in order to provide for moving said vertical needle-holding rod (4).

Said vertical rod (4), in particular, is connected to said main shaft (3) through transmission members (42), like for example a connecting rod, such that said vertical rod (4) performs an alternating translational movement in the axial direction.

Furthermore, said vertical rod (4) is connected to said main shaft (3) through further transmission members, like for example at least one cam (43), so that said vertical rod (4) performs also an oscillating movement, and wherein said oscillating movement of said rod (4) can be reversed according to the advance direction of the fabric to be sewn, through a magnet (44), following the signal of a main electronic board (12) connected to the magnet (44) itself.

The new machine (1) also comprises at least one lower drive wheel (6), positioned under said sewing surface (2) and suited to favour the feeding of the fabric in one direction, in both senses.

The new machine (1) also comprises at least one presser foot (7) with at least one drive roller (71) positioned over said sewing surface (2) and suited to favour the feeding of the fabric, and wherein also said roller (71) rotates in both senses.
The new machine (1) also comprises at least one further auxiliary motor (9), preferably of the step-by-step type, mechanically connected, through transmission members (91), to said lower drive wheel (6) and to said roller (71) of the upper presser foot (7) in order to set them rotating and thus cause the fabric to be fed forwards.

The new machine (1) comprises also an encoder (10) mechanically connected to said cam (43) for the oscillation of said needle-holding rod (4), in order to detect the motion of said cam (43).

The new sewing machine (1) comprises also an auxiliary electronic board (11), in turn connected to said auxiliary motor (9).

Said auxiliary electronic board (11) is also connected to said encoder (10), in order to process the collected data, wherein, according to said data of the encoder (10), said auxiliary electronic board (11) is suited to activate said auxiliary motor (9) controlling its number of steps according to the motion of said cam (43), in turn connected to said encoder (10).

Said auxiliary electronic board (11) can also reverse the rotation direction of said auxiliary motor (9) and thus of said lower wheel (6) and of said upper roller (71).

Therefore, with reference to the above description and to the attached drawing, the following claims are expressed.
CLAIMS

1. Sewing machine (1) comprising a sewing surface (2) on which the fabric or material in general to be processed slides, at least one main driving shaft (3), at least one vertical needle-holding rod (4), mechanically connected to said main shaft (3) through mechanical members (42, 43) for the transmission of an alternating axial translational motion and of an oscillating motion, at least one needle (5) mounted at the lower free end (41) of said vertical needle-holding rod (4), at least one main motor (8) suited to rotate said main shaft (3) axially in order to move said vertical rod (4), at least one lower drive wheel (6) positioned under said sewing surface (2) and suited to favour the feeding of the fabric, at least one presser foot (7) with at least one drive roller (71) placed over said sewing surface (2) and suited to favour the feeding of the fabric, characterized in that it also comprises:
   • at least one further auxiliary motor (9) mechanically connected to said lower drive wheel (6) and to said roller (71) of the upper presser foot (7) to set them rotating;
   • at least one encoder (10) mechanically connected to at least one cam (43) for the oscillation of said needle-holding rod (4), said encoder (10) being suited to detect the motion of said cam (43), that is, of said rod (4);
   • at least one auxiliary electronic board (11) communicating with said encoder (10), suited to process the data received from the encoder (10) and connected at least to said auxiliary motor (9),
and wherein said auxiliary electronic board (11) activates said auxiliary motor (9) to modulate the speed and/or the rotation direction of said drive wheel (6) and of said upper roller (71) according to the motion of said needle-holding rod (4).
2. Sewing machine (1) according to claim 1, characterized in that said vertical rod (4) is connected to said main shaft (3) through mechanical members (42) in such a way that said vertical rod (4) performs an alternating translational motion in the axial direction, and through mechanical members or said cam (43), in such a way that said vertical rod (4) performs also an oscillating motion in the advance direction of the fabric, and wherein said encoder (10) is connected to said cam (43) for the oscillation of the rod (4).

3. Sewing machine (1) according to claims 1, 2, characterized in that said auxiliary motor (9) is a step-by-step motor, and wherein said encoder (10) detects the motion of said mechanical members (43) for the oscillation of the rod (4) and, according to said data, said auxiliary electronic board (11) activates said auxiliary motor (9) adjusting its number of steps, meaning the rotation speed of said lower drive wheel (6) and of said roller (71) of the upper presser foot (7).

4. Sewing machine (1) according to claims 1, 2, 3, characterized in that said auxiliary electronic board (11), through said auxiliary motor (9), can reverse the rotation direction of said lower drive wheel (6) and of said upper roller (71) according to the direction of the oscillating motion of said rod.

5. Sewing machine (1) according to claims 1, 2, 3, 4, characterized in that it comprises at least one main electronic board (12) connected to a device or magnet (44) for the reversal of the oscillating motion of the rod, and wherein said main board (12) sends said magnet (44) the reversal signal for the rod (4) and said auxiliary electronic board (11) the reversal signal for said lower drive wheel (6) and said upper roller (71).
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

INV. D05B19/12 D05B69/14

ADD.

According to International Patent Classification (IPC) or both national classification and IPC.

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

D05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>A</td>
<td>US 5 660 129 A (MURATA KUNIHISO [JP] ET AL) 26 August 1997 (1997-08-26) column 4, line 65 - column 9, line 57; figures 1-3</td>
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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search: 16 July 2013

Date of mailing of the international search report: 23/07/2013

Name and mailing address of the ISA:

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Authorized officer: Herry-Marti n, D
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