Feb. 9, 1960 M. FRESARD ET AL 2,924,107

CONTROL MECHANISM FOR THE DISPLACEMENTS OF A MACHINE PART

Filed Jan. 12, 1959 3 Sheets-Sheet 1

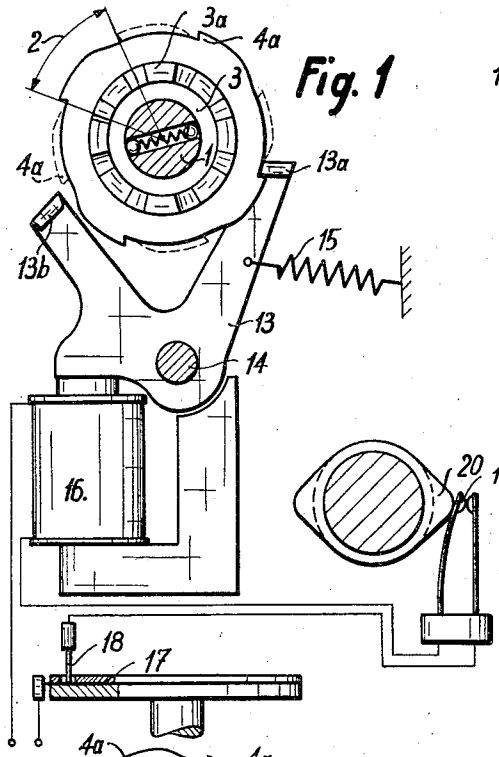

Fig. 1

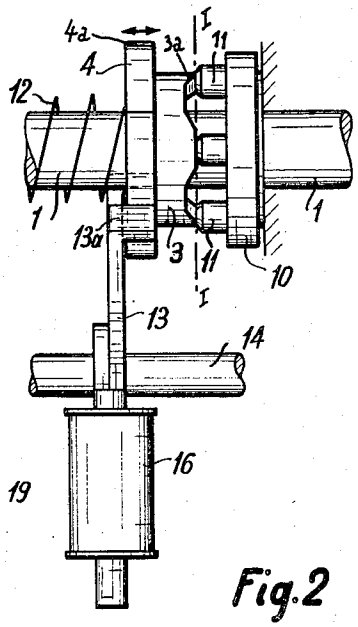

Fig. 2

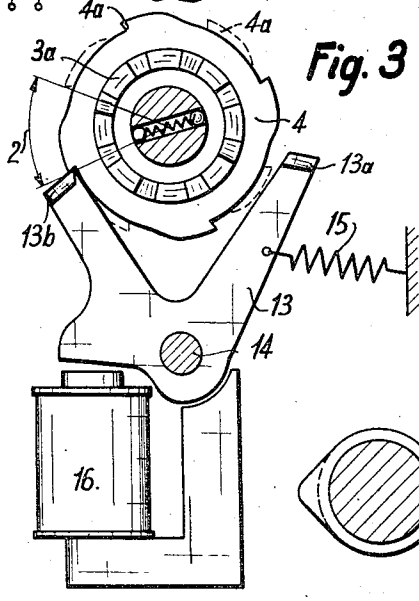

Fig. 3

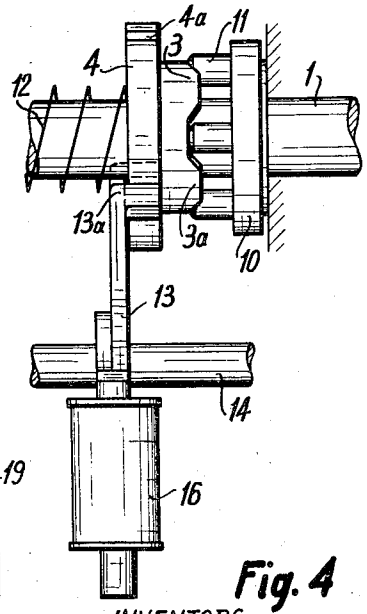

Fig. 4

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Fig. 5

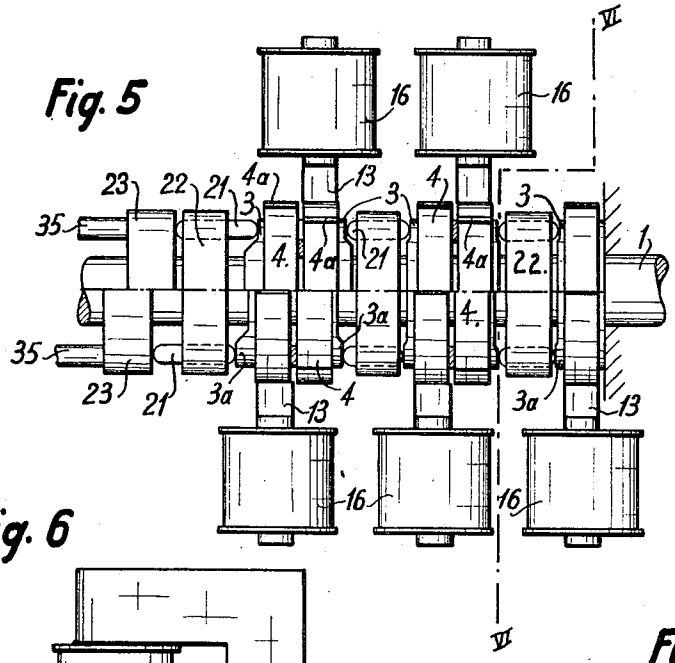


Fig. 6

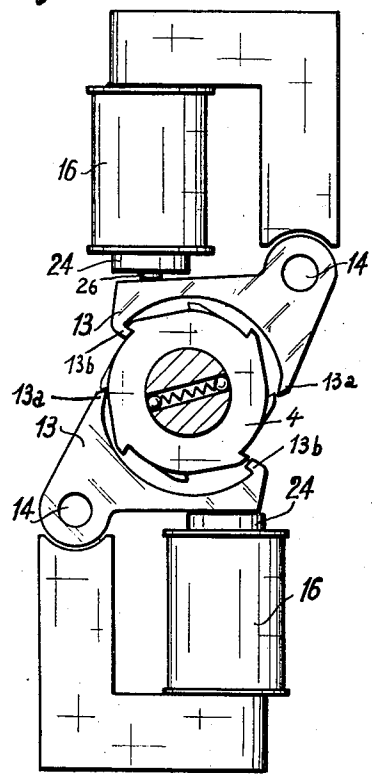


Fig. 7

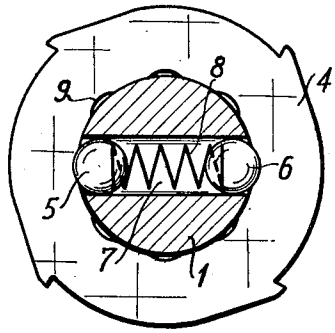
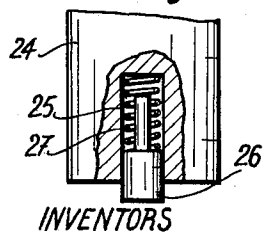


Fig. 8



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CONTROL MECHANISM FOR THE DISPLACEMENTS OF A MACHINE PART

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Fig. 9

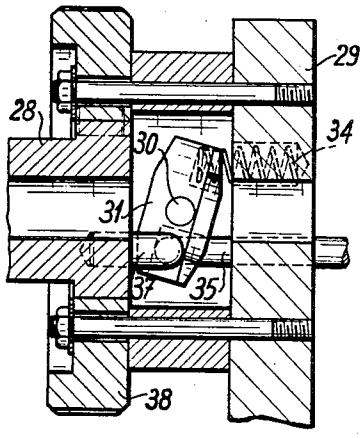
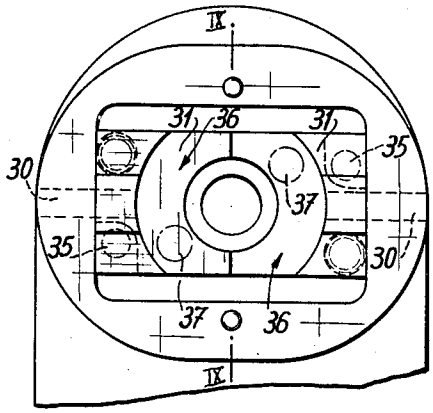


Fig. 10



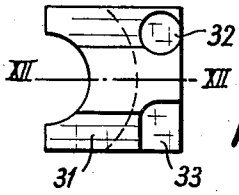
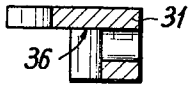


Fig. 11

Fig. 12



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United States Patent Office 2,924,107 Patented Feb. 9, 1960

2,924,107

CONTROL MECHANISM FOR THE DISPLACEMENTS OF A MACHINE PART

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Application January 12, 1959, Serial No. 786,319

Claims priority, application Switzerland January 14, 1958

10 Claims. (Cl. 74—99)

The present invention is concerned with a control mechanism for the displacements of a machine part, more particularly the needle carrier or work feed device of a sewing machine, transforming digital signals into similar shifting movements, with amplified power.

This mechanism is characterised by an oscillating shaft intended to be connected to a source of continuous energy by at least one bell-shaped cam fast with a ratchet wheel mounted with a close fit on the said shaft and adapted to be displaced axially thereon, by an axial abutment member co-operating with the working surface of the said cam, said abutment member being fast with the said shaft by at least one hingedly mounted lever in the form of an escapement lever co-operating with the said ratchet wheel to prevent the advance of the said cam, by at least one electromagnet controlled by the said digital signals and adapted to bring the said escapement lever into one or other of its two working positions, the arrangement being such that the angular position of the said cam relatively to the axial abutment, and consequently its axial position, is different depending on which of the two arms of the said escapement lever is concerned.

Two forms of embodiment of the subject of the invention have been illustrated by way of example in the accompanying drawings.

Fig. 1 is a sectional view taken on the line I—I of Fig. 2 of a control mechanism simplified so as to illustrate the principle of the invention.

Fig. 2 is an elevational view thereof.

Fig. 3 is a sectional view similar to that of Fig. 1, in another working position.

Fig. 4 is an elevational view of the mechanism in the same operational position as that of Fig. 3.

Fig. 5 is an elevational view of the second form of embodiment of the subject of the invention applied to the control of a displacement of the needle carrier or work feed device of a sewing machine, the cams being shown in different axial positions in the upper and lower parts of the figure respectively.

Fig. 6 is a sectional view taken on the line VI—VI of Fig. 5

Figs. 7 and 8 are sectional views of two details of Fig. 6 on an enlarged scale.

Fig. 9 is a sectional view taken on the line IX—IX of Fig. 10 through a reduction gear.

Fig. 10 is an end view thereof.

Fig. 11 is an elevational view of a detail of this device, and

Fig. 12 is a sectional view taken on the line XII—XII of Fig. 11.

The mechanism illustrated in Figures 1 to 4 comprises an oscillating shaft 1 connected to a continuous energy source which is not shown in the drawings. This shaft oscillates as indicated by the arrow 2, through one-eighth of a revolution. Mounted on the said shaft in such a manner as to be freely slidable thereon is a bell-shaped cam 3 fast with a ratchet wheel 4 comprising four teeth 4*a*.

Frictional connection between the shaft 1 and the cam 3 is ensured by a device which is shown in detail in Fig. 7, comprising two balls 5 and 6 arranged in a diametrally arranged hole 7 in the shaft 1 and subjected to the action of a coil spring 8 which is interposed between the said balls and which tends to cause them to penetrate partly into one or other of a series of eight longitudinal grooves 9 formed in the central bore of the cam 3 and ratchet wheel 4. Owing to this arrangement, the cam, as long as it is left free, oscillates with the shaft 1 whilst being capable of sliding axially along said shaft.

A drum 10 carrying four pins 11 arranged at 90° from one another, three of which pins are visible in the drawings, is fixed on the shaft 1. A spring 12, which is partly illustrated, keeps the cam 3 bearing against the pins 11.

The mechanism also comprises a lever 13 having two arms which is in the form of an escapement lever hingedly mounted on a fixed pin 14 and subjected to the action of a restoring spring 15 on the one hand and an electromagnet 16 on the other hand. The two arms of the lever 13 terminate respectively in two noses 13*a* and 13*b* co-operating with the teeth 4*a* of the ratchet wheel 4 so as to prevent the latter, and consequently the cam 3, from rotating with the shaft 1 in one direction whilst leaving it free to rotate with the shaft 1 in the opposite direction.

When the lever 13 does not come into action and the cam 3 is left free to follow the shaft 1 in both directions of rotation, said cam remains in a specific relative angular position with respect to the said shaft, either having its elevations 3*a* applied against the pins 11 which also oscillate with the shaft 1 (Figs. 1 and 2) or on the contrary having the recesses situated between the said elevations bearing against the said pins (Figs. 3 and 4). The axial position of the cam differs in each of these cases. The position of the cam is determined by the escapement lever 13; depending on whether one or other of the lever arms has previously stopped the ratchet wheel, the cam occupies one or other of the two positions mentioned hereinbefore. In effect, as long as the nose of the escapement lever which has just stopped the cam remains in contact with the ratchet wheel or comes intermittently into contact with the said wheel without the other nose coming into action in the interim periods, no change in the angular position of the cam relatively to that of the shaft takes place. On the contrary, as soon as the other nose comes into action, it engages in passing with one of the ratchet wheel teeth and stops the cam. The shaft then carries out its oscillatory movement and is thus displaced angularly with respect to the cam until the balls 5 and 6 penetrate into the two following grooves 9 of the cam 3.

The impulses are sent to the electromagnet 16 by a digital programme control means constituted by a perforated disc 17 driven step by step by a mechanism not shown in the drawings. Depending on whether a brush 18 is opposite a perforation or opposite a non-perforated part of the disc 17, contact is open or closed and the electromagnet 16 is energised or not. In order to prevent the production of sparks at the contacts of the programme control means, the machine also comprises a circuit-breaker 19 arranged in series with the programme control means and controlled by a cam 20 rotating at such a speed that this circuit breaker closes the circuit for an instant during which the contact of the programme control means is itself closed.

It should be noted that, whereas the nose 13*b* can remain in permanent contact with the ratchet wheel 4 under the action of the restoring spring 15, permitting the cam to be maintained in the axial position illustrated in Fig. 4, the nose 13*a* cannot remain permanently applied against the ratchet wheel since this would imply that the electromagnet is to be capable of attracting during

a period of a certain duration, whereas in reality it operates only by impulses. Consequently, if it is desired that the cam should remain in the axial position shown in Fig. 2, it is necessary at each oscillation of the shaft 1 to supply a fresh impulse to the electromagnet, thus putting the nose 13*a* again in contact with the ratchet wheel.

This mechanism will be applied advantageously to the control of the needle carrier or work feed device of a sewing machine for carrying out stitches forming various patterns, more particularly stitches of the kind known as "embroidery" stitches. However, in the example mentioned hereinbefore, the mechanism has been simplified so as to illustrate the basic principle of the invention.

In actual fact, the possibilities provided by a single cam are insufficient, and the second form of embodiment shown in Figures 5 to 8 has also been conceived, wherein the mechanism comprises a row of cams 3 mounted on a common shaft 1 in the same way as the cam 3 in the first form of embodiment. Each of these cams is fast with a ratchet wheel 4. They are placed back to back in pairs and between their working faces directed towards one another there are arranged spacers 21 mounted in such a manner as to be capable of sliding axially in drums 22 fast with the shaft 1. Owing to this arrangement, the axial displacements of the various cams are added together and finally transmitted to a sleeve 23 slidable axially on the shaft 1. The height of the elevations 3*a* differs at each cam in such a manner as to permit, by appropriate combinations, obtaining a larger number of different possible displacements of the sleeve 23 for a small number of cams. In the upper part of Fig. 5, the cams have all been illustrated in their "down" position i.e. in the position wherein the spacers 21 are opposite recesses situated between the elevations 3*a*, whereas in the lower part of this figure the cams have all been illustrated in their "up" position i.e. the position in which the spacers 21 are situated opposite the elevations 3*a*. The difference in axial positions between the upper and lower parts of the sleeve 23 (Fig. 5) indicates the maximum amplitude of the displacements of the said sleeve.

In order to reduce bulk, the electromagnets 16 have been distributed above and below the shaft 1, but each of them controls a different escapement lever 13, the latter also being subjected to the action of restoring springs. The core 24 of each electromagnet 16 carries, slidable axially in a hole 25 in the said core, a buffer 26 which is made of plastic material and is subjected to the action of a shock-absorbing spring 27 (Fig. 8). These buffers absorb the shocks of the escapement levers on the electromagnets and constitute moreover restoring springs operating like springs 15 of the first embodiment.

Finally, the mechanism according to the invention comprises a reduction gear having adjustable speed ratios, interposed between the sleeve 23 and the output element of the mechanism, designated as 28. This output element, constituted by a sleeve, is itself connected to the controlled part, which is not shown in the drawings. This reduction gear comprises a frame 29 wherein are mounted, in such a manner as to be oscillatable about a pin 30, two oscillatable elements 31 each comprising on one of their faces two recesses 32 and 33 adapted to receive respectively the end of a restoring spring 34 and the end of a push member 35 which is also fast with the sleeve 23. The axial movements of the latter are thus transmitted as oscillating movements of the elements 31. The latter each have at their face opposite to the face comprising the recesses 32 and 33, a circular cavity 36 against which bears the end of a push member 37 fixed to the axially slidable sleeve 28. The movements of the oscillatable elements are thus transmitted to the sleeve 28 with a reduction ratio which varies with the position of the push members 37 on the surface 36 of the oscillatable elements. In fact, the sleeve 28 can be rotated on itself by means of a serrated wheel 38 keyed on the said shaft, so that the push members 37 can be brought nearer to or moved away from the pivot pins 30 of the oscillatable elements. In the example shown in Figures 9 and 10, the ratio is 1/1, the axes of the push members 37 being situated at the same distance from the pivot pin 30 as the axes of the push members 35 are. The closer the push members 37 are moved towards the pin 30, the more does the amplitude of the axial movements of the sleeve 28 diminish. When the pin 30 is passed, a reversal takes place and the sleeve 28 will then be displaced in the opposite direction to the sleeve 23. The restoring springs 34 then serve to keep the oscillatable elements bearing against their respective push members 35.

What we claim is:

1. In a control mechanism for the displacements of a machine part, more particularly the needle carrier or work feed device of a sewing machine, transforming digital signals into similar shifting movements, with amplified power; an oscillating shaft intended to be connected to a source of continuous energy at least one ratchet wheel mounted with a close fit on the said shaft and adapted to be displaced axially thereon, at least one bell-shaped cam having axially facing cam surfaces fast with said ratchet wheel, an axial abutment member co-operating with the working surface of the said cam, said abutment member being fast with the said shaft, at least one hingedly mounted two arms detent lever each arm of which engages alternately with the said ratchet wheel to prevent the advance of the said cam, and actuating means controlled by the said digital signals and operatively connected to said detent lever so as to produce rocking movements thereof, the arrangement being such that the angular position of the said cam relatively to the axial abutment, and consequently its axial position, is different depending on which of the two arms of the said detent lever engages the ratchet wheel.

2. In a control mechanism for the displacements of a machine part, more particularly the needle carrier or work feed device of a sewing machine, transforming digital signals into similar shifting movements, with amplified power; an oscillating shaft intended to be connected to a source of continuous energy, a series of ratchet wheels each mounted with a close fit on the said shaft and adapted to be displaced axially thereon, a series of bell-shaped cams having each axially facing cam surfaces each fast with one of said ratchet wheels, an axial abutment member co-operating with the working surface of one of the ending cams of the series, said abutment member being fast with the said shaft, spacers, which are axially movable but fast in the angular sense with the said shaft, interposed between the said cams, a series of hingedly mounted two arms detent levers, the arms of each of which engage alternatively one of the said ratchet wheels to prevent the advance of the corresponding cam, and a series of actuating means controlled by the said digital signals and each operatively connected to one of said detent levers so as to produce rocking movements thereof, the arrangement being such that the angular position of the said cams relatively to each other, and consequently their axial position, is different depending on which of the two arms of the said detent levers engage the ratchet wheels.

3. A control mechanism as claimed in claim 2, in which the height of the elevations differs at each cam so as to increase the different possibilities of displacement for the output element of the mechanism with a given number of cams.

4. In a control mechanism for the displacements of a machine part, more particularly the needle carrier or work feed device of a sewing machine, transforming digital signals into similar shifting movements, with amplified power; an oscillating shaft intended to be con-

nected to a source of continuous energy, at least one ratchet wheel mounted with a close fit on the said shaft and adapted to be displaced axially thereon, at least one bell-shaped cam having axially facing cam surfaces, fast with said ratchet wheel, an axial abutment member co-operating with the working surface of the said cam, said abutment member being fast with the said shaft at least one hingedly mounted two arms detent lever each arm of which engages alternatively the said ratchet wheel to prevent the advance of the said cam, a restoring spring urging the said detent lever in one of its two working positions, and at least one electro-magnet controlled by the said digital signals and adapted to bring the said detent lever into the other of its two working positions against the action of said restoring spring, the arrangement being such that the angular position of the said cam relatively to the axial abutment, and consequently its axial position, is different depending on which of the two arms of the said detent lever engages the ratchet wheel.

5. In a control mechanism for the displacements of a machine part, more particularly the needle carrier or work feed device of a sewing machine, transforming digital signals into similar shifting movements, with amplified power; an oscillating shaft intended to be connected to a source of continuous energy, at least one ratchet wheel mounted with a close fit on the said shaft and adapted to be displaced axially thereon, at least one bell-shaped cam having axially facing cam surfaces, fast with said ratchet wheel, an axial abutment member co-operating with the working surface of the said cam, said abutment member being fast with the said shaft, at least one hingedly mounted two arms detent lever each arm of which engages alternatively the said ratchet wheel to prevent the advance of the said cam, at least one electromagnet provided with a core controlled by the said digital signals and adapted to bring the said detent lever into one of its two working positions, a buffer carried by the said core, and a spring acting on said buffer whereby this latter is adapted to damp the shocks of the detent lever on the said core when said lever is attracted by the electromagnet, the arrangement being such that the angular position of the said cam relatively to the axial abutment, and consequently its axial position, is different depending on which of the two arms of the said detent lever engages the ratchet wheel.

6. A control mechanism as claimed in claim 4, in which the said buffer is made of plastic material.

7. In a control mechanism for the displacements of a machine part, more particularly the needle carrier or work feed device of a sewing machine, transforming digital signals into similar shifting movements, with amplified power; an oscillating shaft intended to be connected to a source of continuous energy, at least one ratchet wheel mounted with a close fit on the said shaft and adapted to be displaced axially thereon, at least one bell-shaped cam having axially facing cam surfaces fast with said ratchet wheel, a series of longitudinal grooves formed in the central hole of the cam, a radial hole formed in the said oscillating shaft, at least one ball lodged in said radial hole, a spring likely lodged in said radial hole and tending to cause the said ball to penetrate partly in one or other of said longitudinal grooves, whereby the stability of a certain number of angular positions of the cam on the shaft is guaranteed, whilst said cam is permitted to jump from one position to the other and also to be displaceable freely along the said shaft, an axial abutment member co-operating with the working surface of the said cam, said abutment member being fast with the said shaft, at least one hingedly mounted two arms detent lever each arm of which engages alternatively the said ratchet wheel to prevent the advance of the said cam, and actuating means controlled by the said digital signals and operatively connected to said detent lever so as to produce rocking movements thereof, the arrangement being such that the angular position of the said cam relatively to the axial abutment, and consequently its axial position, is different depending on which of the two arms of the said detent lever engages the ratchet wheel.

8. In a control mechanism for the displacements of a machine part, more particularly the needle carrier or work feed device of a sewing machine, transforming digital signals into similar shifting movements, with amplified power; an oscillating shaft intended to be connected to a source of continuous energy, a ratchet wheel mounted with a close fit on the said shaft and adapted to be displaced axially thereon, at least one bell-shaped cam having axially facing cam surfaces, fast with said ratchet wheel and comprising a number of elevations equal to the number of teeth in the ratchet wheel, an axial abutment member cooperating with the working surface of the said cam, said abutment member being fast with the said shaft, at least one hingedly mounted two arms detent lever each arm of which engages alternatively the said ratchet wheel to prevent the advance of the said cam, and actuating means controlled by the said digital signals and operatively connected to said detent lever so as to produce rocking movements thereof, the arrangement being such that the angular position of the said cam relatively to the axial abutment, and consequently its axial position, is different depending on which of the two arms of the said detent lever engages the ratchet wheel.

9. In a control mechanism for the displacements of a machine part, more particularly the needle carrier or work feed device of a sewing machine, transforming digital signals into similar shifting movements, with amplified power; an oscillating shaft intended to be connected to a source of continuous energy, at least one ratchet wheel mounted with a close fit on the said shaft and adapted to be displaced axially thereon, at least one bell-shaped cam having axially facing cam surfaces fast with said ratchet wheel, an axial abutment member co-operating with the working surface of the said cam, said abutment member being fast with the said shaft, at least one hingedly mounted two arms detent lever each arm of which engages alternatively the said ratchet wheel to prevent the advance of the said cam, actuating means controlled by the said digital signals and operatively connected to said detent lever so as to produce rocking movements thereof, the arrangement being such that the angular position of the said cam relatively to the axial abutment, and consequently its axial position, is different depending on which of the two arms of the said detent lever engages the ratchet wheel, an output element, and a variable reduction gear interposed between the cam and the said output element in such a manner that displacements of variable amplitude on the part of the said ouput element correspond to given axial displacements of the last cam.

10. In a control mechanism for the displacements of a machine part, more particularly the needle carrier or work feed device of a sewing machine, transforming digital signals into similar shifting movements, with amplified power; an oscillating shaft intended to be connected to a source of continuous energy, at least one ratchet wheel mounted with a close fit on the said shaft and adapted to be displaced axially thereon, at least one bell-shaped cam having axially facing cam surfaces fast with said ratchet wheel, an axial abutment member co-operating with the working surface of the said cam, said abutment member being fast with the said shaft, at least one hingedly mounted two arms detent lever each arm of which engages alternatively the said ratchet wheel to prevent the advance of the said cam, actuating means controlled by the said digital signals and operatively connected to said detent lever so as to produce rocking move-

ments thereof, the arangement being such that the angular position of the said cam relatively to the axial abutment, and consequently its axial position, is different depending on which of the two arms of the said detent lever engages the ratchet wheel, an output element, and a variable reduction gear, interposed between the cam and the said output element in such a manner that displacements of variable amplitude on the part of said output element correspond to given axial displacements of the last cam, said reduction gear comprising at least one oscillatable element whose displacements are controlled by the said cam and a push member by means of which said oscillatable element controls the output element and whose position relatively to the axis of oscillation of the oscillatable element is variable in such a manner as to make it

possible to vary and even to reverse the transmission ratio.

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