

Description

[0001] The present invention relates to the technical field concerning machines for bending threadlike metallic elements, in particular round deformed bars.

[0002] More precisely, the invention relates to bending metallic bars used to reinforce concrete beams or lintels and/or floors.

[0003] In fact, the reinforcements concerned often include a central core formed by a metallic round bar bent to form what is commonly known to those skilled in the art as "fret", with related pairs of straight bars welded at both sides of the lower and upper bends of the core, preferably in coplanar relation with each other.

[0004] Machines which traditionally bend metallic round bars, include a pair of floating pliers, which are situated downstream and upstream the bending point, which slide in corresponding horizontal guides defining a unique work line, on which the bar to be bent lies.

[0005] As it can be easily understood from Figure 1, which schematically shows the operation mode of a machine according to prior art, the reference numeral 90 indicates the downstream pliers, which are aimed at blocking at the "coil side" the round bar being bent, while upstream pliers are indicated with 91 and are aimed at blocking the bent bar near the last bend.

[0006] Third pliers 95, sliding on a related guide, which is substantially orthogonal to the work line, move between a rest position C, in which the third pliers 95 lie on the work line K, and a working position C', in which the third pliers 95 gets out of alignment with the work line K and push the bar upwards thus forming the upper turn of the bent bar.

[0007] The displacement of the third pliers 95 from the work line, to their working position C', determines the height of the bend and, in cooperation with the downstream pliers 90 and the upstream pliers 91, it defines also the pitch of the bar being bent.

[0008] While the third pliers 95 move from the rest position C to the working position C' in a direction K_C , the downstream pliers 90 and the upstream pliers 91 tend to move closer to each other.

[0009] The downstream pliers 90 move along the work line K in a direction K_A , until they reach, in an ideal operation way, a first position A, while the upstream pliers 91 move along the work line K, in a direction K_B , opposite to the direction K_A , until they reach, according to an ideal operation way, a second position B.

[0010] Theoretically, the first position A and the second position B should be symmetrical with respect to the working position C of the third pliers 95.

[0011] Due to different inertia of the metallic bar branches on which the upstream pliers 91 and the downstream pliers 90 respectively act, the positions reached in reality are respectively B' and A', generically indicated with an out of scale drawing in Figure 1.

[0012] Actually, while the downstream pliers 90 perform their action on the coil side of the bar to be bent, the upstream pliers perform their action on the already bent portion of the bar, whose inertia is much bigger with respect to the coil side.

[0013] Consequently, it is substantially impossible to figure out each time the actual first position A' and the actual second position B', which the downstream pliers 90 and the upstream pliers 91 will take after the third pliers 95 have moved from the rest position C to the working position C'.

[0014] After the round bar has been bent in a desired way, the third pliers 95 return to the rest position C and the upstream pliers 91 withdraws for the time strictly necessary to allow the bar bend to move and clear off the working area.

[0015] The movement of the bent bar, and consequently the positioning of a portion of the bar to be bent in the working area, are generally obtained by working pliers (not shown), situated between the feeding coil and the downstream pliers 90.

[0016] Obviously, the working pliers are made in such a way as not to hinder in the movement of the downstream pliers 90 in the direction K_A during bending of the bar in the working area.

[0017] The operation of the bar bending machines, according to prior art, as synthetically described, do not ensure the constant pitch of the already bent bars, thus preventing any precision of the geometrical features.

[0018] What above is worsened by the elastic features of the metallic bar, which tends to swing back due to elastic reaction, when the third pliers 95 move from the working position C' to the rest position C.

[0019] The non-constant pitch of the bent metallic bar creates big problems during the reinforcing preparation, particularly during automatic welding of the "fret" thus obtained with the pairs of straight bars placed on both sides of the lower and upper turns of the "fret". This is due to the difficulty in individuation of the points to be welded.

[0020] This disadvantage is particularly irksome in case small section bars, e.g. bars with diameters ranging from 10 to 14 millimeters, and in case of materials with high longitudinal elasticity modulus.

[0021] The above mentioned machines do not allow to obtain a wide range of bar pitch adjustment, due to the limited strokes of the downstream pliers 90 and upstream pliers 91.

[0022] The height of the bar bends is limited to the maximum stroke of the third pliers 95 moving from the rest position C to the working position C'.

[0023] This kind of machines for bending round bars work with particularly low speed, due to considerable inertia of

the "bent bar side" when the round bar is made to move during bending by the working pliers.

[0024] The final length of the already bent bars can range from four to six meters.

[0025] This causes slowing down of the production cycle and a consequent reduction of its performance.

[0026] A variable inertia of the "bar bent side" during the bending step, from an initial minimum value (with few bends) to a final maximum value (with the bar completely "fretted") increases considerably the variability of the pitch of the fretted bar produced by the machine.

[0027] The object of the present invention is to outweigh the above mentioned disadvantages by a machine for bending metallic threadlike elements, in particular round bars, which ensures the production of bent threadlike metallic elements, with geometrical features particularly precise, as well as with a pitch strictly constant and adjustable within a wide range of values.

[0028] Another object of the present invention is to propose an extremely reliable and functional machine, which ensures high operation speed and production of bent threadlike metallic elements, whose geometrical features can vary within a wide range, according to the necessity of technical field concerned.

[0029] A further object of the present invention is to propose a machine, which ensures best precision during the bending of the threadlike metallic elements, in relation to different intrinsic and geometrical features thereof.

[0030] The characteristic features of the present invention will be pointed out in the following description of a preferred, but not unique embodiment, with reference to the enclosed drawings, using different scales for sake of clarity, in which:

- Figure 1 is a schematic out-of-scale view of an operation diagram of a machine for bending metallic round bars according to prior art;
- Figure 2 is a schematic partial lateral view of the proposed machine;
- Figures 2a, 2b are as many schematic plan views of particularly significant working elements of the proposed machine, shown in Figure 2;
- Figure 3 is a schematic front view of the station for collecting the metallic bars already bent by the proposed machine;
- Figure 4 is a schematic view of a metallic round bar bent according to a fret-like pattern;
- Figure 5 is a schematic view of a bending step of the metallic bar, whose developing trajectory changes according to the Archimedean spiral rule.

[0031] The proposed machine includes basically a station 1 for bending threadlike metallic elements 2, e.g. round bars. A bar feeding station and bar cross-rolling station, arranged in cascade, are situated at the inlet of the bending station 1.

[0032] The feeding and straightening or cross-rolling stations have not been illustrated deliberately, since their structure and operation way are known to those skilled in the art concerned.

[0033] The bending station 1 performs the shaping of the portion of the bar 2 which is located therein, according to the predetermined geometrical characteristics of the pitch p , height h and amplitude of the angle α .

[0034] The bending station 1 includes a first working group 4, which is substantially formed by a first slide 4b, guided slidably by respective first tracks 41 and supported by a relative second slide 40b, also guided slidably by respective second tracks 40, which are fastened substantially to the base 1a of the bending station 1.

[0035] The first slide 4b supports means 4a for hitting and pulling the bars 2, formed e.g. by a barrel and operated along a first axis Y and a second axis Z of an ideal Cartesian coordinate system, by corresponding motor means, which operate the respective first slide 4a and second slide 40b.

[0036] The motor means, of known type, include e.g. suitable stems, namely a first stem 4Y and second stem 4Z, which, together with corresponding actuators, which are not shown, operate the respective first slide 4b and second slide 40b.

[0037] The first slide 4b moves from a rest position N^* , in which the barrel 4a does not touch the above mentioned portion of the bar 2, which is parallel to the second axis Z, to a working position M, in which the barrel 4a hits the above portion of the bar 2 and starts the bending process thereof, until it takes a position defined by coordinates such to determine the selected height h (Figure 2).

[0038] The bending station 1 includes, in its outlet section, first pliers 5, which are motionless and fasten removably the above mentioned portion of the bar 2 in step relation with the movement of the first slide 4b.

[0039] The bending station 1 includes a second working group 3, which is located at its inlet section and is formed basically by a carriage 3b, substantially aligned with the first pliers 5 and slidably guided by relative guide 30 along a third axis X, which is substantially parallel to the second axis Z.

[0040] The carriage 3b supports second pliers 3a which fasten and/or release the above mentioned portion of the bar 2 in step relation with the movement of the first slide 4b.

[0041] The carriage 3b moves parallel to the third axis X, in step relation with the movement of the first slide 4b and

with fastening and/or releasing of the first pliers 5, from an initial configuration E, in which the carriage 3b is far from the first pliers 5 by a distance ΔL , to a final configuration F displaced of a distance $(\Delta L - p)$, in which the carriage 3b is far from the first pliers 5 by a distance p ; ΔL indicates the length of the bar 2 which is bent within a pitch p .

[0042] This way, when the first slide 4b is in the working position M, the desired characteristics of pitch p , height h and angle amplitude α are obtained.

[0043] The carriage 3b supports cutting means 3d, which cut the portion of bar 2 present in the bending station after a predetermined number of bends, i.e. in correspondence to a fretted bar 2 of a selected length.

[0044] A collecting station 10, situated near the bending station 1, receives the bent round bars 2 and conveys them to a magazine MS.

[0045] The collecting station 10 basically includes conveying means 20, e.g. an endless conveying belt, carrying the bent bars 2 along a fourth axis W, in step relation with the movement of the carriage 3b along the third axis X.

[0046] Support means 21, e.g. a plate hinged to the support structure 10a of the collecting station 10, support and guide the bent bars 2.

[0047] The lower part of the plate 21 is hinged to the operating stem of an actuator 23, e.g. hydraulic or pneumatic jack, which moves the plate from a receiving configuration Q, in which the bent bars 2 are placed on the conveyor 20 and moved therealong, to a release configuration R, in which the bent bars 2 are conveyed to the magazine MS.

[0048] When in the receiving configuration Q, the plate 21 is advantageously inclined with respect to the vertical, e.g. by an angle between 10 and 20 degrees, so as to facilitate the conveying of the bent bars 2 leaving the bending station 1.

[0049] While in the magazine MS, the bent bars 2 are supported by conveying means 24, operated stepwise, formed e.g. by a suitable number of chain compactors, in step relation with the movement of the plate 21.

[0050] With reference to a generic operation cycle of the proposed machine, operation of the machine will be described in the following.

[0051] The carriage 3b is in the initial configuration E, in which it is distant ΔL from the first pliers 5, with the second pliers 3a fastening the bar 2 being bent.

[0052] The first slide 4b is in the rest position N^* , with the barrel 4a situated at a lower level with respect to the portion of the bar 2 under bending, and with the first pliers 5 fastening the same portion of the bar 2 at a point separating the part of the bar 2 still straight and the part of the bar 2 already bent.

[0053] In order to obtain desired geometrical characteristics, i.e. pitch p , height h and aperture α , of the portion of the bar 2 currently under bending, the barrel 4a is suitably moved by moving the relative slides 4b, 40b along the corresponding Cartesian first axis Y and second axis Z. To do this, the corresponding actuators must be correctly operated.

[0054] When the first slide 4b moves from the rest position N^* to the working position M, the barrel 4a strikes the corresponding portion of the bar 2 clamped by first pliers 5 and second pliers 3a, thus causing bending of this portion, until the position of the first slide 4b reaches such coordinates of the Cartesian system to define the selected height h of the portion of the bar 2 to be bent.

[0055] In phase relation with the movement of the first slide 4b from the rest position N^* , the carriage 3b is moved from the initial position E to the terminal position F, and when the first slide 4b reaches the working position M, the selected pitch p for the portion of the bar 2 under bending is fixed..

[0056] Actually, in this case, the carriage 3b is placed at a distance p from the first pliers 5, so as to ensure a deflection between the first pliers 5 and the second pliers 3a, which corresponds exactly to the desired value of the pitch p .

[0057] Likewise, the barrel 4a supported by the first slide 4b in the working position M, defines the bending angle of the bar 2, thus its aperture α and height h .

[0058] The movement of the carriage 3b up to the above mentioned final configuration F draws a portion of the bar 2 from the feeding station situated upstream, which is equal to the distance covered by the carriage 3b, i.e. $(\Delta L - p)$ (Figure 2).

[0059] In phase relation with reaching of the final configuration F by the carriage 3b, the second pliers 3a release the portion of the bar 2 near the section the bar to be bent - the bar 2 already bent, and the carriage 3b withdraws moving far from the first pliers 5 by a distance equal to the predetermined pitch p , and assuming an intermediate position.

[0060] However, due to the elasticity of the material to be bent, the withdrawing can differ from the pitch value p , e.g. it can be bigger.

[0061] In phase relation with the reaching of the intermediate position, the first pliers 5 release the bar 2 by withdrawing axially (i.e. orthogonal to the figure plane); the second pliers 3a clamps again the bar 2 and the first slide 4b moves from the working position M to the rest position N^* , so that the barrel 4a is detached from the bar 2 bend due to the motion trajectory or to axial withdrawal of the same barrel 4a.

[0062] This allows to operate the carriage 3b which passes from the intermediate configuration to the final configuration F, thus pushing the bent bar 2 toward the outlet section of the bending station 1, without being hindered neither by the barrel 4a nor by the first pliers 5, and drawing a further portion p of the bar 2 from the feeding station situated

upstream.

[0063] Then, the bent bar 2 goes beyond the first pliers 5 by a distance equal to the pitch p , thus allowing the second pliers 5 to clamp again the bar 2 near the section separating the bar 2 to be bent from the bar 2 already bent, in suitable phase relation.

[0064] In phase relation with the clamping of the bar 2 by the first motionless pliers 5, the carriage 3b returns to the initial configuration E.

[0065] When the carriage 3b reaches the initial configuration E, the corresponding second pliers 3a clamps the bar 2.

[0066] It is easily understood that after the bar 2 has been bent as a consequence of the described movements of the carriage 3b: final configuration F - intermediate configuration (displacement p), intermediate configuration - final configuration F (displacement p), final configuration F - initial configuration E (displacement $\Delta L - p$), it is possible to draw from the feeding station upstream a portion of bar 2 equal to ΔL , i.e. equal to the length of the bent bar 2 included within the pitch p .

[0067] This way, working conditions necessary to begin a new basic bending cycle are restored, i.e. the carriage 3b takes again the initial configuration E, in which it is distant from the first pliers 5 by ΔL , the second pliers 3a clamps the bar 2 to be bent; the first slide 4b is in the rest position N^* , and the first pliers 5 clamps the portion of the bar 2 in correspondence to the section separating the bar 2 to be bent from the bar 2 already bent.

[0068] In phase relation with the releasing of the bent bar 2 by the first pliers 5 and with corresponding movement of the bends toward the outlet section of the bending station 1, the belt conveyor means 20 are operated stepwise along the fourth axis W, in phase relation with the movement of the carriage 3b along the third axis X.

[0069] This way, the bends of the bar 2 can be supported at the outlet of the bending station 1 and moved along the fourth axis W.

[0070] The plate 21 of the collecting station 10, in the corresponding receiving configuration Q, receives and supports the bends of the bar 2, thus allowing the conveyor belt 20 to convey them stepwise along the axis W.

[0071] After a predetermined length of the bent bar 2 has been obtained at the outlet of the bending station 1 (usually ranging from four to six meters), shears 3d situated on the carriage 3b cut the finished bent bar 2 from the bar 2 coming from the feeding station.

[0072] In phase relation with the operation of the shears 3d and movement of at least one pitch p of the bent bar 2, the actuator 23 operates the plate 21 to move from the receiving configuration Q to the corresponding release configuration R, substantially orthogonal to the previous one, in which the bent bar 2 is conveyed to the magazine MS.

[0073] Suitable chain compactors 24, operated stepwise and situated in the magazine MS, support and store the bent bars 2 in phase relation with the movement of the plate 21.

[0074] According to an interesting embodiment, shears for cutting bent bars 2 can be situated also in correspondence to the first slide 4b, cooperating or not with the shears situated on the carriage 3b.

[0075] During the movement of the carriage 3b from the initial configuration E to the final configuration F, and during the movement of the first slide 4b from the working position M to the rest position N^* , the metallic bar 2 can bent in such a way as to describe an Archimedean spiral, i.e. a trajectory run by a point which moves uniformly over a straight line rotating on a point.

[0076] With reference to Figure 5, (x^*, y^*) indicates an additional Cartesian reference system, which has its origin on the center of the motionless barrel 50 of the first pliers 5 with the abscissas axis x^* parallel to the above mentioned third axis X.

[0077] Φ_f , Φ_p indicate the diameters of respectively, the metallic bar 2 and the barrel 50, which is geometrically identical with the barrel 4a.

[0078] With the first slide 4b in the rest position N^* , the reference $L/2$ indicates the distance between the center of the barrel 50 and the center of the barrel 4a along the Cartesian axis x^* .

[0079] The reference r indicates the straight line which joins the center of the motionless barrel 50 and the idle barrel 4a, the latter with the first slide 4b being in the rest position.

[0080] The reference β_1 indicates the angle between the straight liner and the axis of abscissas axis x^* , while the reference β_3 indicates the angle between the straight line r and the straight line r' , which joins the center of the motionless barrel 50 and the idle barrel 4a, the latter, (indicated with the reference number 400) with the first slide 4b being in the working position M.

[0081] The reference β_2 indicates the angle between the straight line r' and the abscissas axis x^* .

[0082] In the equations reported below, the reference β (not shown in Figure 5) indicates the angle between the straight line r and the line linking the center of the motionless barrel 50 and the idle barrel 4a, with the first slide 4b in any intermediate position between the rest position N^* and the working position M.

[0083] The reference β_p indicates the angle between with the abscissas axis x^* and the inclined stretch of the metallic bar 2 forming the angle α in its final configuration.

[0084] The references x , y indicate, in polar coordinates, the values of the abscissas x^* and of ordinates y^* of the center of the idle barrel 4a, while the first slide is in the generic position between the rest position N^* and the working

position M.

[0085] The following equations define the trajectory of the spiral on the basis of what above:

$$\beta p = 2 \cdot \arctan \frac{P \cdot \sqrt{P^2 - 4 \cdot [(2\Phi p + 3\Phi f - H) \cdot (H - \Phi f)]}}{2 \cdot [(2\Phi p + 3\Phi f - H)]}$$

$$L = 2 \cdot \left[(\Phi p + \Phi f) \cdot \beta p (\text{rad}) + \frac{P}{2 \cdot \cos \beta p} - (\Phi p + \Phi f) \cdot \tan \beta p \right]$$

$$\beta 1 = \arctan \left[\frac{(2\Phi p + 2\Phi f)}{L} \right]$$

$$\beta 2 = \arctan \left[\frac{2 \cdot (H - \Phi p - \Phi f)}{P} \right]$$

$$\beta 3 = \beta 1 + \beta 2$$

$$Ro = \overline{oa} = \sqrt{\left(\frac{L}{2}\right)^2 + (\Phi p + \Phi f)^2}$$

$$R1 = \overline{oa'} = \sqrt{\left(\frac{P}{2}\right)^2 + (H - \Phi p - 2\Phi f)^2}$$

$$K = \frac{R1 - Ro}{\beta 3}$$

$$R = K \cdot \beta + Ro$$

$$X^x = R \cdot \cos(\beta - \beta 1)$$

$$Y^x = R \cdot \sin(\beta - \beta 1)$$

[0086] The proposed machine for bending threadlike metallic elements 2, in particular round bars, allows to obtain highly precise bars 2 varying within a wide range of selected geometrical features i.e. pitch p and height h.

[0087] The obtained precision does not depend on the desired geometrical features (diameter, pitch, etc.) nor on the intrinsic features of the treated material (elasticity, etc.).

[0088] It is to be noted that the bending station 1 operates in particular proper way with varying driving torque. A varying torque allows the first slide 4b as well as the second slide 40b to adapt the actual displacement along the corresponding axes, first Y and second Z, in relation to the geometrical and intrinsic features of the bar 2 to be obtained.

[0089] This way, it is possible to foresee, e.g. in relation to the diameter and elasticity modulus of the bar 2, the effective values of the pitch p and height h that this portion of the bar 2 being bent will have after having been disengaged from the barrel 4a carried by the first slide 4b and being released by the second pliers 3a supported by the carriage 3b.

[0090] Thus, it is possible to adjust and/or change the actual displacement of the slides, first 4b and second 40b, in relation to different diameters and to non-homogeneity of the bar 2 to be bent, so as to define the selected values of the displacement and to obtain bars with the desired geometrical features of pitch p and height h.

[0091] This object can be obtained beforehand or during bending after having measured the elastic reactions of the portion of the bar 2 in the regions of the slides, first 4b and second 40b, and to the carriage 3b, by comparison of the measured values with respect to the selected ones.

[0092] The machine allows to obtain extremely variable shapes of the bars or of bends of the same bar; for instance, it is possible to obtain also a sawtooth fret as shown in Figure 4.

[0093] The possibility of obtaining bars 2 with constant pitch p prevents all the problems which can occur during manufacturing of the corresponding reinforcements, first of all during welding of the fret thus obtained to the pairs of straight bars situated on both sides in the region of the lower and upper bends of the fret.

[0094] This allows to easily manufacture reinforcements with frets of relatively limited diameters, e.g. from ten to fourteen millimeters, and with materials of high longitudinal elasticity modulus.

[0095] The particularly simple and shrewd operation ensures especially rapid and fast production processes of high performance.

[0096] The above advantages are obtained by a simple, extremely reliable and functional technical solution, which ensures high working speed and obtaining of bent threadlike metallic elements, whose geometrical features vary within a wide range, according to the necessity of the technical field concerned.

Claims

1. Machine for bending threadlike metallic elements, in particular round bars, cooperating with at least one station for feeding said threadlike metallic elements (2), **characterized in that** it includes a bending station (1), situated downstream of said feeding station and aimed at shaping a portion of a threadlike metallic element (2) located therein, according to selected geometrical characteristics defining the pitch (p) and height (h), said bending station (1) including: at least one first working group (4), moving along related Cartesian axes, namely a first axis (Y) and a second axis (Z), and equipped with means (4a) for striking said portion of said threadlike metallic element (2), said first working group (4) moving between a rest position (N^*), in which said striking means (4a) do not touch said portion of the threadlike metallic elements (2) which is substantially parallel to said second axis (Z), and a working position (M), in which said striking means (4a) strike said portion of the threadlike metallic elements (2) thus performing the bending process thereof, until it is arranged according to Cartesian coordinates defining a selected geometrical feature of the height (h); at least one first gripping means (5), motionless, situated near the outlet section of said bending station (1), which clamp and/or release said portion of the threadlike metallic elements (2) in phase relation with the movement of said first working group (4); at least one second working group (3), substantially aligned with the first gripping means (5) and situated near the inlet section of said bending station (1); said second working group being equipped with second gripping means (3a), which clamp and/or release said portion of threadlike metallic elements (2) in phase relation with the movement of said first working group (4), said second working group (3) moving along a third axis (X), substantially parallel to the second axis (Z), in phase relation with the movement of said first working group (4) and with the clamping and/or releasing of said first gripping means (5), so as to define said geometrical feature of the pitch (p) when it reaches said working position (M) of said first working group (4).
2. Machine, according to claim 1, **characterized in that** said second working group (3), moving along said third axis (X) with respect to corresponding guides (30), includes a carriage (3b) carrying said second gripping means (3a), which are substantially pliers.
3. Machine, according to claim 1, **characterized in that** said second working group (4) includes a first slide (4b) guided slidably by respective first tracks (41) with respect to said first axis (Y), said first slide (4b) being supported by a relative second slide (40b), also guided slidably by respective second tracks (40), with respect to said second axis (Z), with said first slide (4b) carrying said striking means (4a), which include at least one barrel.
4. Machine, according to claim 1 or 2, **characterized in that** it includes cutting means (3d), situated in correspondence to said second working group (3) and aimed at cutting said threadlike metallic element (2).
5. Machine, according to claim 1 or 3, **characterized in that** it includes cutting means, situated in correspondence to said first working group (4) and aimed at cutting said threadlike metallic element (2).
6. Machine, according to claim 1, **characterized in that** said first gripping means (5), motionless, can withdraw in direction orthogonal with respect to said third axis (X).

7. Machine, according to claim 1 or 6, **characterized in that** said first gripping means (5) substantially include pliers means.
8. Machine, according to claim 1 or 6 or 7, **characterized in that** said first gripping means (5) works in the area, in which the threadlike metallic elements (2) already bent are separated from threadlike metallic elements (2) still to be bent.
9. Machine, according to any of previous claims, **characterized in that** it includes a collecting station (10), situated in outlet area of said bending station (1) and aimed at receiving said bent threadlike metallic elements and conveying them to a magazine (MS).
10. Machine, according to claim 9, **characterized in that** said collecting station (10) includes: conveying means (20) supporting threadlike metallic elements (2) and conveying them along a fourth axis (W), in phase relation with the movement of said first working group (3) of said bending station along said third axis (X); support means (21) aimed at receiving and guiding said threadlike metallic elements (2) and operated by an actuator (23) to move from a receiving configuration (Q), in which said bent threadlike metallic elements (2) are supported and moved by said conveying means (20), to a release configuration (R), in which said bent threadlike metallic elements (2) are conveyed to said magazine (MS) and supported by relative conveying means (24) operated stepwise in phase relation with the movement of said support means (21).
11. Machine, according to claim 9 or 10, **characterized in that** said support means (21) situated in said collecting station (10) are substantially inclined with respect to the vertical.
12. Machine, according to claim 3, **characterized in that** said slides, first (4b) and second (40b) are operated along said related Cartesian axes, first axis (Y) and second axis (Z), by corresponding motor means including relative motor shafts, first (4Y) and second (4Z), which cooperate with corresponding actuators.

FIG.1

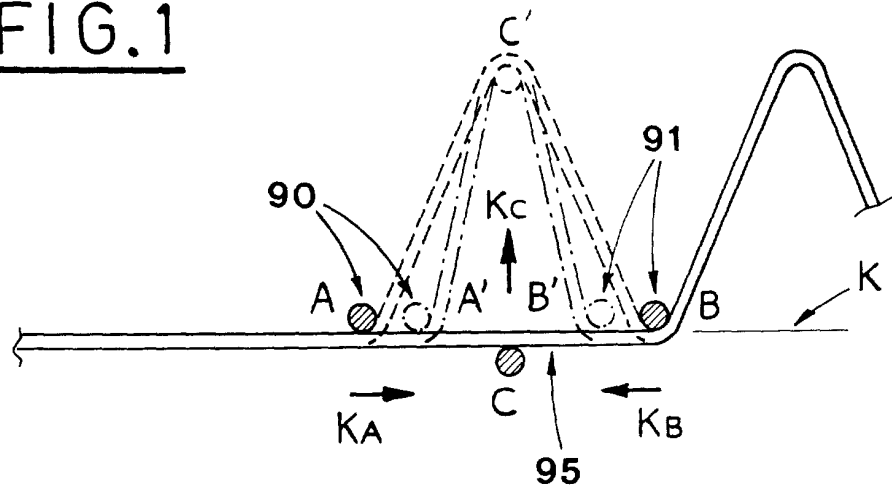


FIG.4

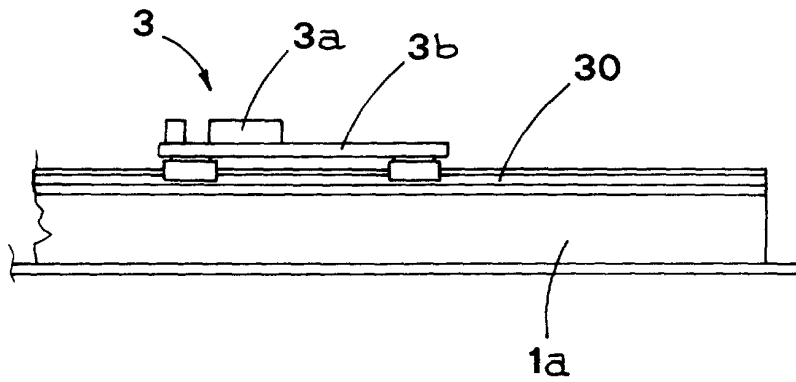
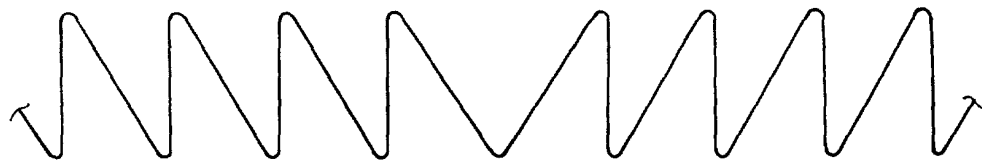
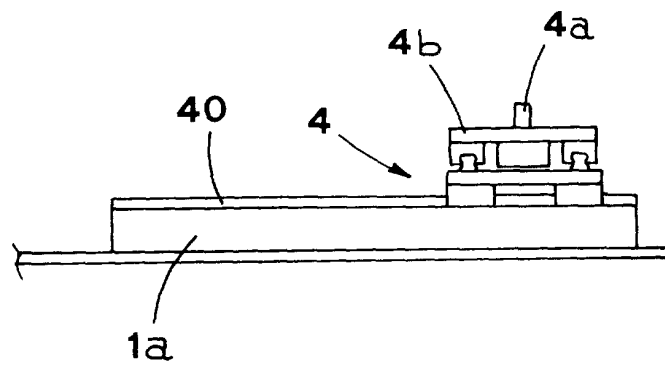
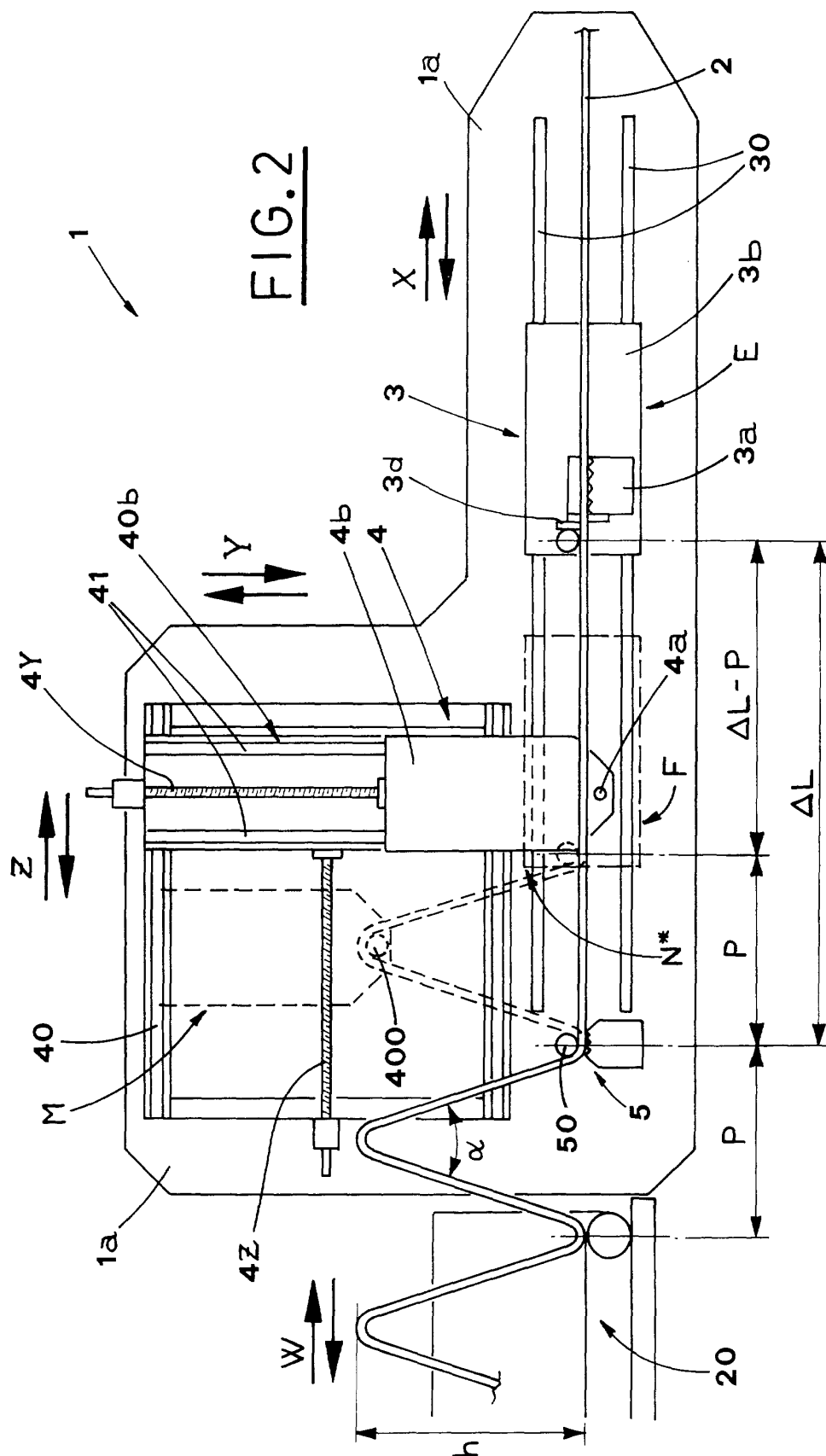


FIG.2a

FIG.2b





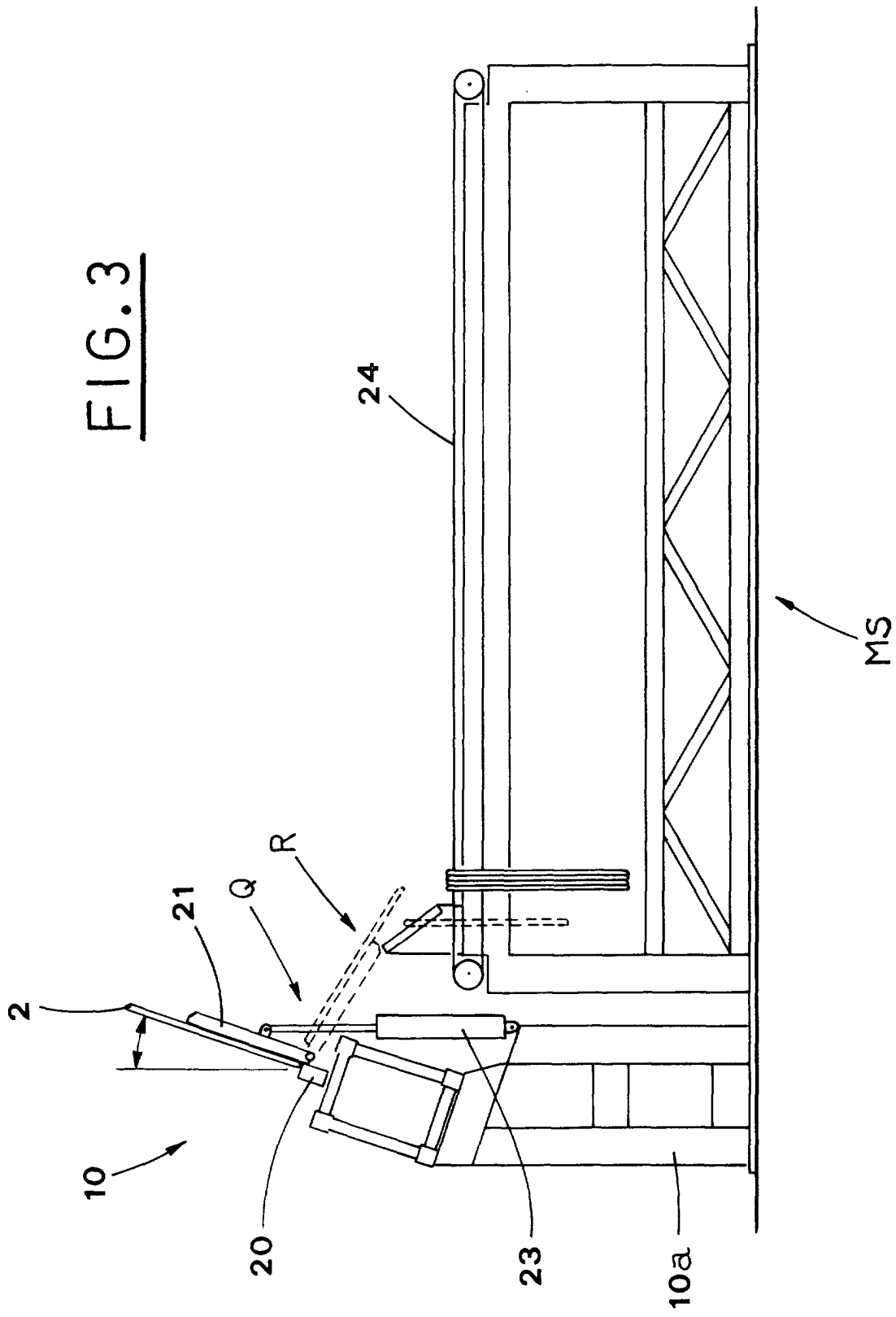


FIG. 5

