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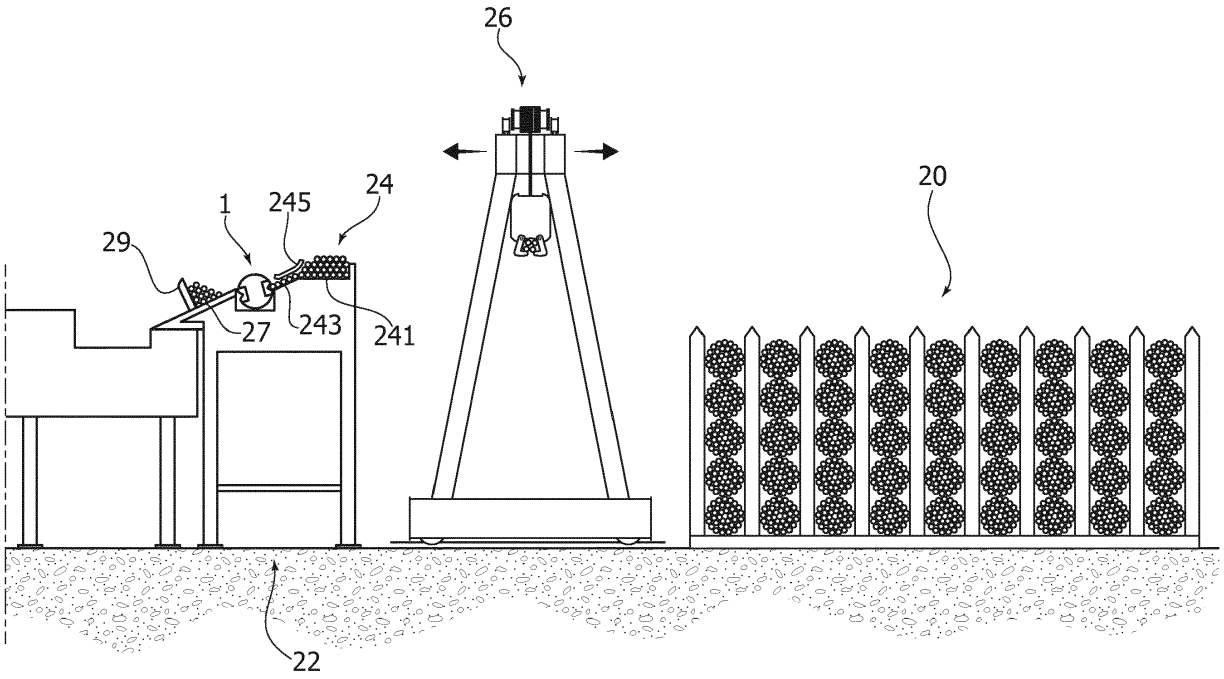
(54) **METHOD AND SYSTEM FOR FEEDING METAL BARS IN A CONTROLLED NUMBER TO AN OPERATING MACHINE**

(57) Described herein is a system for feeding metal bars in a given controlled number to an operating machine, which comprises, set between the magazine (20) and the machine (1) for handling and counting the bars, an intermediate compartment (24), accumulated in which is a number of bars that is equal to a multiple of the maximum number of bars that can be handled by the operating machine in a single cycle, with a multiplying factor comprised between 2 and 20.

FIG. 1



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Description

[0001] The present invention relates to systems for feeding metal bars in a controlled number to an operating unit.

[0002] The invention may be applied, for example, to systems for cutting and/or bending metal bars to be used for reinforcement of concrete. Some apparatuses make use, for example, of cutting benches in which bars of standard length are cut into desired lengths. Usually a cutting bench basically envisages a resting surface on which the bars are fed to undergo cutting, and cutting equipment, set at one end of the bench, for cutting the bars after they have been fed forward on the bench for a desired length. Usually provided upstream of the cutting equipment are means for feeding the bars on the bench. The Italian patent No. IT1360977 filed in the name of the present applicant describes a device for feeding in a completely automatic way a cutting bench of the type referred to above. The device described in this patent is able to feed the metal bars in a controlled number from a first, pick-up, position, in which the bars are grouped in a bundle, to a second position for delivery of the bars to the means for feeding the cutting bench.

[0003] In the technical field of interest here, systems for machining and treatment of the bars that require loading of the bars according to a feeding movement in a direction transverse to the longitudinal direction of the bars are increasingly widespread.

[0004] The above type of loading in fact affords advantages both from the standpoint of reduced use of space, an aspect that is very important for systems that already in themselves present very large overall dimensions, above all on account of the length of the bars that they have to treat, and from the standpoint of simplification that in this way it is possible to obtain in positioning the bars within the system. Consider, in this regard, a bending machine, for which feeding of the bars in the transverse direction makes possible, with relatively simple and far from costly means, a more precise and at the same time faster loading of the bars onto the bending unit of the machine.

[0005] In the above context, the object of the present invention is to provide a system for feeding metal bars in a controlled number to an operating machine that will be configured for providing transverse feeding of the bars and that will be able to operate in an efficient and reliable way.

[0006] The above object is achieved via an apparatus having the characteristics specified in Claim 1.

[0007] The claims form an integral part of the technical teaching provided herein in relation to the invention.

[0008] Further characteristics and advantages of the invention will emerge clearly from the ensuing description, with reference to the annexed drawings, which are provided purely by way of non-limiting example and in which:

- Figure 1 is a schematic illustration of a side view of the system described herein according to an embodiment thereof;
- Figures 2-5 are schematic cross-sectional views that illustrate different steps of operation of the system described herein;
- Figure 6 is a schematic front view of the handling and counting machine of the system of Figure 1;
- Figure 7 is a schematic illustration of an alternative embodiment of the handling and counting machine of the system described herein; and
- Figure 8 illustrates a further embodiment of the system described herein.

[0009] In the ensuing description, various specific details are illustrated aimed at enabling an in-depth understanding of the embodiments. The embodiments may be provided without one or more of the specific details, or with other methods, components, or materials, etc. In other cases, known structures, materials, or operations are not shown or described in detail so that the various aspects of the embodiment will not be obscured.

[0010] The references used herein are only provided for convenience and hence do not define the sphere of protection or the scope of the embodiments.

[0011] Figure 1 represents a system for feeding metal bars in a controlled number to an operating machine. The operating machine may be a bending machine, a cutting machine, a painting machine, a threading machine, or the like.

[0012] The system envisages a magazine 20 configured for storing a large number of bars that may be divided within the magazine, in respective compartments, by length, diameter, and/or material. The magazine may, for example, be obtained via a framework defining a series of compartments that present in the horizontal plane a prevalent extension oriented along which are the bars that are housed therein and that are set alongside one another in a direction transverse to the their longitudinal direction.

[0013] It should now be noted that, in the ensuing description, the transverse and longitudinal directions mentioned are defined with respect to the orientation of the bar within the system, and on the other hand also the directions themselves of the system are defined with respect to the orientation of the bars within the system. Consequently, also the simple indication of longitudinal direction or transverse direction already in itself indicates uniquely which direction is considered irrespective of whether it refers to the bars or to the device of the system that handles the bars.

[0014] Set at a distance from the magazine, the system envisages a station for handling the bars 22, which is equipped with a handling and counting machine 1 and has, right up against said machine, an intermediate compartment 24, unloaded into which are the bars that have been picked up from the magazine.

[0015] A pick-up and movement apparatus 26, for ex-

ample a gantry structure equipped with one or more gripper devices, performs the function of picking up the bars from the magazine 20 and unloading them into the intermediate compartment.

[0016] The handling and counting machine of the station in question basically performs the functions of picking up the bars from the intermediate compartment, counting them, and feeding them to the operating machine in a transverse direction. In various preferred embodiments, as in the ones illustrated, the handling and counting machine is of a type suited for being supplied by gravity, i.e., according to a modality where the bars access the machine as a result of the force of gravity acting on them.

[0017] The machine in question has one or more transfer members, which operate directly on the bars gathered by gravity up against the machine and which move the bars in a transverse direction. As will be seen in what follows, the above machine may be of different types. Moreover, as will be seen in what follows, the handling and counting machine in question is configured for picking up just one bar at a time, it being meant thereby that it is configured for engaging the individual bars in sequence. As a whole, the machine may in any case be operating also on a number of bars simultaneously.

[0018] The intermediate compartment 24 performs, in this arrangement, the function of feeding the bars to the aforesaid machine. It has a raised surface 241, preferably horizontal, which is in communication with the transfer members of the handling machine via an inclined plane 243. A containment plate 245 is associated to the above two surfaces, namely the raised surface 241 and the inclined plane 243. In particular, the aforesaid plate is set in an opposed position with respect to the inclined plane 243 and, with a portion thereof, extends as far as on top the horizontal surface 241 so as to define a wall designed to provide lateral containment of the bars supported by this surface.

[0019] At its portion opposed to the inclined plane 243, the above plate is set at a distance from the latter so as to define a restricted channel, the section of which is such as to enable passage of just one bar at a time, thus forcing the bars to arrange themselves in an orderly way in a row and advance in this condition towards the machine 1.

[0020] It should be noted that, in alternative embodiments, the inclined plane 243 could even not be present, in which case the bars gather directly against the transfer members of the machine.

[0021] Possibly, the bottom of the compartment 24 may form part of a vibrator device having the function of favouring both disentangling of the bars and displacement of the latter towards the machine 1.

[0022] In various preferred embodiments, as in the one illustrated, on the side opposite to the intermediate compartment 24, the station 22 has an inclined plane 27, unloaded onto which are the bars that have been picked up and counted by the machine 1. The inclined plane 27 is configured for transferring the above bars directly to the operating machine or else to conveyor means upstream thereof.

[0023] In various preferred embodiments, as in the one illustrated, a series of arms 29 are positioned flush with or underneath the inclined plane 27 and are hinged - for example to the same structure that supports the inclined plane 27 - about one and the same longitudinal axis, so as to be simultaneously brought into a position raised above the inclined plane 27 in order to stop the bars from sliding down the plane 27. In operation, the arms 29 may be activated for the purpose, for example, of accumulating along the plane 27 all the bars that the machine 1 has had to pick up from the intermediate compartment 24 so as to transfer them to the operating machine all together. This affords the advantage of enabling, in the meantime, the operating machine to carry out the previous working cycle so that, in effect, loading of the bars by the station 22 is made in masked times, and as soon as the operating machine has terminated the previous cycle the bars necessary for the next cycle have already gathered together and are ready for being supplied to the operating machine.

[0024] The station 22 described above may envisage different structural configurations. In various preferred embodiments, as in the one illustrated, it has a single metal framework, which defines the intermediate compartment 24 and the inclined plane 27 and carries the machine 1 and the arms 29 together with the respective actuation means.

[0025] With specific reference, now, to the handling and counting machine 1, this comprises a pick-up device including a rotary drum 6, which is made to rotate (via motor means not illustrated) about its own axis 6a and is set alongside the intermediate compartment.

[0026] As illustrated schematically in Figure 2, the rotary drum 6 has a magnetic element 10, which is set at the periphery of the drum and defines a housing 11 sized for receiving only one bar 2 inside it. It is also possible to envisage that the rotary member will present a number of magnetic elements 10 angularly spaced apart from one another, in which case at each revolution of the drum 6 a number of operations of picking-up of bars is performed that is equal to the number of the magnetic elements provided. Moreover, instead of the magnetic element or elements, the drum 6 could also envisage members of some other type, in particular mechanical members, for example a hook, a cam, etc.

[0027] As illustrated in Figure 3, at each revolution of the drum 6, a bar 2 is captured within the housing 11 of the magnetic element 10 and forced to rotate upwards together with the rotary drum 6 so as to be separated from the remaining bars present in the bundle.

[0028] As a rule, since the housing 11 is sized for receiving a pre-set number of bars at a time (for example, just one bar) each rotation of the rotary drum entails picking up a controlled number of bars (for example, of just one bar). On the other hand, it should be considered that a system usually envisages handling bars of different diameters. To overcome this drawback, there may, for ex-

ample, be provided on the rotary drum different magnetic elements each equipped with a housing of a different size, which are selectively activated according to the type of bars on which it is necessary to operate.

[0029] In any case, the system preferably envisages a counter (not illustrated), for example an optical counter or else a mechanical-lever counter, which is able to count the bars that pass in front of it, in a position prior to unloading of the bars. The means that control activation and the de-activation of the magnetic element (for example, the means that supply current to the electromagnet, in the case where the magnetic element is an electromagnet) temporarily de-activate the magnetic element in order to enable unloading of the bar that has been picked up. This may be obtained either by causing interruption of electrical supply to the electromagnet whenever this reaches a pre-set position or using the counter as de-activation sensor, possibly after a predetermined delay.

[0030] In a particularly simple embodiment, there may be envisaged, in association with the rotary drum 6, a sort of scraper element, which causes dropping of possible bars that have accidentally remained adherent to the magnetic element and are in excess with respect to the desired number to be picked up at each passage of the magnetic element on the bundle of bars.

[0031] Moreover, there may be provided a number of magnetic elements with respective housings sized according to different bar diameters, these magnetic elements being activated in a selective way according to the type of bars on which it is necessary to operate.

[0032] Unloading of possible excess bars that have been picked up may also be obtained by de-activating the magnetic element following upon the signal received from sensor means for detecting the number of bars that have been picked up. Return of the excess bars into the bundle is obtained by de-activating the magnetic element 10 and possibly reversing rotation of the rotary member.

[0033] Finally, it may also be envisaged that the drum 6 is equipped with adjustment means, for example of a mask type, which enable adaptation of the housing associated to the magnetic element to different values of bar diameter.

[0034] It should be noted that the magnetic element does not necessarily have to be an electromagnet, but as an alternative there may also be envisaged permanent magnets associated to which is a respective mobile mask, which can be operated for covering the corresponding magnetic element so as to de-activate it. In general, then, the magnetic element or else the drum itself may be of a removable quick-mounting type in order to enable interchangeability with similar elements and render the system readily adaptable to the various applications, for example, for picking up bars of different diameters.

[0035] De-activation of the magnetic means may be performed either to facilitate release of the bars once they have been picked up to deliver them to the supply means set downstream or for unloading possible excess bars again into the bundle in the case where the number of desired bars has already been reached. Management of the possible excess bars will in any case depend upon the specific circumstances. In the case, for example, where the cycle subsequent to the one that has just terminated envisages supply of bars of the same type, the bars that have already been picked up can be withheld by the magnetic means until start of the next cycle without any need to unload them again into the bundle.

[0036] The means so far described operate for picking up the end portion of the bar (but the bar could be picked up, of course, in some other point, for example at the centre instead of at the end).

[0037] The handling machine moreover has purposely provided means for lifting completely and picking up also the remaining part of the bar so that it is then possible to move it in a transverse direction.

[0038] In various preferred embodiments, as in the one illustrated (Figure 6), the system described herein has one or more additional drums 6', which are also provided with respective magnetic elements 10' and are rotatable about respective axes of rotation substantially aligned with the axis of rotation of the drum 6. The number of additional drums may clearly vary according to the requirements of the specific applications. In particular, with bars of small diameter the additional drums may be in a number equal to or higher than four.

[0039] The drums 6' have the function of engaging corresponding portions of the bar that has already been picked up by the drum 6 and of raising these portions further as a result of the movement of rotation of the drums 6' themselves so that, at the end of the operation carried out by the entire set of drums 6 and 6', the bar is completely raised and separated from the other bars.

[0040] In particular, the drum 6' set immediately downstream the drum 6 has the function of engaging, via its element 10', the portion of the bar that has been picked up by the drum 6, which, as a result of the movement of rotation of the latter, is brought into its immediate vicinity, and of raising the aforesaid portion further via its own movement of rotation.

[0041] This causes also the remaining part of the bar to be brought into the immediate vicinity of the other additional drum 6'. At this point, also the second drum 6' engages via its magnetic element 10' the above portion in its immediate vicinity and raises it so that the bar will finally be completely lifted up and separated from the other bars.

[0042] To be able to carry out the operation referred to above, the drums 6 and 6' must clearly be synchronised so as to intervene on one and the same bar in sequence.

[0043] In particular, the first drum 6' must bring its respective magnetic element 10' up to the bar engaged by the drum 6 when this has already raised it sufficiently, and, likewise, the second drum 6' must bring its magnetic element 10' up to the bar when the first drum 6' has raised it sufficiently. It will moreover be noted that the movement

of rotation of the drums 6 and 6' brings about not only raising of the bar engaged but also lateral displacement thereof. Consequently, in operation, the various magnetic elements 10 must arrange themselves in given mutual angular positions that make it possible to follow the above angular displacement, also taking into account the deformations due to bending that the bar may undergo during this step.

[0044] In various preferred embodiments, the drums 6 and 6' are controlled by one and the same shaft driven by an electric motor, and are mutually oriented according to fixed angular positions, which are determined during a step of calibration of the system.

[0045] In alternative embodiments, the drums 6 and 6' may instead all have the same angular position, and not be staggered, with respect to their members for picking up the bars.

[0046] In various embodiments, in association with the drums 6 and 6', a corresponding series of lifting devices may operate, which are provided with grippers designed to receive the individual bars that have been picked up by the drums and feed them, either individually or all together, directly to the operating machine.

[0047] Use of the above lifting devices is not, however, at all necessary, but may be advantageous in some applications, such as in systems for supply of small cutting machines or else of bending machines. Possibly, the grippers may envisage a vertical adjustment so as to facilitate picking-up of the bars by the various drums 6 and 6' , and in a way such that the bars that have gathered can then be positioned according to a substantially horizontal arrangement.

[0048] In addition, instead of the grippers, the system may in any case also envisage members of some other type, for example mobile supports, which are preferably provided with appropriate grooves for ensuring an orderly arrangement of the bars thereon. In various preferred embodiments, the above supports may, for example, be constituted by a plurality of rotary screw members. As an alternative, roller tracks may also be envisaged, or else supports or brackets variously shaped in the form of a U, a V, an L, etc.

[0049] In the absence of the devices referred to above, the individual bars that have been picked up and separated from the bundle by the drums 6 and 6' are, instead, unloaded directly onto the inclined plane 27 (Figures 1 and 5).

[0050] In various alternative embodiments, instead of the additional drums 6', the system described herein may also envisage disentangling means proper. Figure 7 illustrates an embodiment equipped with the above means.

[0051] In various embodiments, as in the one illustrated, the disentangling means may be constituted by one or more supports 16', which are slidable in a direction substantially parallel to the longitudinal direction of the bars gathered in the bundle and act on the bar that is picked up by the drum 6 so as to raise it progressively and separate it completely from the other bars. The supports may have a fork-like structure so as to be able to constrain laterally the bars that have been engaged.

[0052] It should be noted that the drum 6 could also be set in a position corresponding to a central region of the bundle of bars, and in this case the disentangling means comprise slidable supports, which are arranged on both of the opposite sides with respect to the central drum and are mobile, in opposite directions, from the central drum to the corresponding ends of the bars. In any event, also in this case, the slidable supports in question perform the same function of lifting the bars progressively from the bundle so as to extract them completely therefrom.

[0053] In preferred embodiments, the slidable supports mentioned above have also the function of supporting the bars before these are then supplied to the operating machine. Consequently, the slidable supports in question will have to be in a number such as to make it possible to support the entire bar as this is lifted up from the bundle, preventing it from undergoing excessive bending. It is evident that only some of the supports will reach the end of the bar, whereas the others will stop their movement in respective positions along the bar, precisely in order to enable support thereof as described. Alternatively, it is possible to provide a lateral structure, for example a set of grippers or a series of V-shaped elements, onto which the bars are unloaded as the slidable supports lift them up and separate them from the other bars.

[0054] The bar or bars that have been separated can then be carried to the operating machine directly by the slidable supports or else by the further elements onto which the bars are unloaded.

[0055] Finally, in any case, also in the embodiment of Figure 7, the handling and counting machine 1 operates by picking up a controlled number of bars and moving them in a transverse direction so as to feed them to the operating machine.

[0056] The system of Figure 8 differs from that of Figure 1 in that the handling and counting machine of this system comprises a rotary screw member 36 that is oriented in a direction transverse to the bars housed in the intermediate compartment, and in that it is set with its end facing the bars that positions itself directly at the end of the inclined plane 243. The outer thread portion of the member, as a result of rotation thereof, pushes the bars laterally, in a direction opposite to the position of the intermediate compartment, moving them in a transverse direction and separating them from one another.

[0057] In association with the above screw member there may be envisaged disentangling means of the same type as what has been described above, which, in particular, act on the bar that has been picked up by the screw member so as to separate it completely from the other bars.

[0058] It should be noted that the drums 6' and the grippers 12', like the disentangling means described above, may even find themselves carrying out a function

proper of disentangling of the bars, in the case where these are entangled, for example in the cases where the bars are of a very small diameter. This function may become important in the embodiments of the system where there is absence of any element, such as the plate 245, designed to convey the bars towards the machine 1 in an orderly way.

[0059] In operation of the system described herein, a preset number of bars, comprised within a given range, is accumulated within the intermediate compartment.

[0060] The above range has been selected on the basis of the maximum number of bars that can be handled by the operating machine in a single cycle. In particular, the lower limit of the range is defined by a number equal to a multiple of the aforesaid number of bars per cycle of the operating machine, with a multiplying factor of 2, and the upper limit is defined by a number equal to a multiple of the aforesaid number, with a multiplying factor of 20.

[0061] This means that, if the operating machine is a cutting machine that can cut in a single cycle a maximum number of ten bars, on the intermediate compartment in question there will be accumulated a number of bars comprised between 20 and 200. This number of bars will be picked up from the magazine by the pick-up and movement apparatus referred to above.

[0062] The bars accumulated in the intermediate compartment then gradually reach, by gravity, the transfer members of the handling machine 1.

[0063] It should now be noted that the above range has been selected in the perspective of meeting two requirements that in themselves are conflicting.

[0064] On the one hand, there is the need to feed the handling machine 1 in the absence of additional operating means designed to convey the bars from the compartment 24 to the machine. In this condition, with an excessively large number of bars, the bars themselves would be excessively entangled and would be unlikely to move by themselves in a more or less orderly way towards the handling machine 1, as schematically illustrated in Figures 1 and 8.

[0065] Also in the case where the machine 1, instead, directly faces the bars contained in the compartment 24, an excessively large number of bars would render it almost impracticable for the machine to extract and separate the individual bars from the other bars in the bundle.

[0066] It is hence clear that to enable the machine to operate smoothly and without any hitches, it is preferable to envisage a limited number of bars in the compartment 24.

[0067] On the other hand, the present applicant has set himself the aim of providing a condition where the handling machine 1 is able to operate at the service of the operating machine downstream for a number of cycles thereof in a continuous way and without any interruption for supply of new bars.

[0068] Now, thanks to the number of bars envisaged, the compartment 24 can operate as a temporary magazine for the bars. In fact, since it is located immediately adjacent to the operating machine, it is able to supply the operating machine with the bars immediately and moreover for a number of working cycles, thus preventing any need for the movement means of the system to perform displacements over long distances, at each cycle, from the main magazine 20 to the operating machine.

[0069] The range referred to above provides values that are able to meet both of the aforesaid requirements.

[0070] For some applications, the intermediate compartment is able to contain a number of bars sufficient to handle an entire batch of bars required by the operating machine. In other applications, to complete the batch it may, instead, be necessary to supply the compartment with new bars by picking them up from the main magazine.

[0071] Supply of the bars to the intermediate compartment may be performed at different moments according to the requirements of the specific applications. This step may in any case be carried out in masked times, for example during actual operation of the machine 1 for feeding the bars to the operating machine.

[0072] In various preferred embodiments, supply of new bars to the compartment takes place when the bars reach a number equal to or a little above the aforesaid maximum number of bars that can be handled in one cycle by the operating machine. In this way, it is guaranteed that the handling and counting machine will be always in a condition of being able to meet the requirement of the operating machine. To detect the amount of bars present in the compartment, the latter may be equipped with a device for measuring the weight or else with a sensor device, for example of an optical type, for measuring the level of the bars in the compartment 24.

[0073] The above operating mode is not, however, indispensable. Alternative embodiments may in fact envisage feeding bars to the intermediate compartment only when this is completely empty or else when the operator so requires.

[0074] As regards supply, it should moreover be noted that, preferably, the apparatus 26 of the system is provided with members that are able to grip and pick up from the magazine, all at the same time, a number of bars practically corresponding to the number to be accumulated in the intermediate compartment 24. These members may be gripper members, appropriately sized so as to be able to grip the number of bars envisaged, or else magnetic members configured for generating a magnetic force such as to cause the number of bars in question to adhere thereto. Preferably, the gripper members are configured for picking up the bars preferentially in a central region and moving away from one another so as to spread out over the length of the bundle of bars that is being picked up. The present applicant has found that this action by the gripper members affords the advantage of re-arranging the bars, disentangling them at least partially.

[0075] With reference to the main magazine, this will clearly be supplied with a number of bars greater than

the number envisaged for the intermediate compartment, in the perspective of ensuring a plurality of supplies to this compartment and more in general in order to set the system in a condition where it is able to operate autonomously for a very high total number of cycles of the operating machine.

[0076] In preferred embodiments, the magazine is supplied with a total number of bars that is at least a multiple equal to 40 of the aforesaid maximum number of bars that can be handled, in a single cycle, by the operating machine.

[0077] As mentioned above, the aforesaid magazine may contain also batches of bars of different diameters divided by compartments.

[0078] It is clear that, as the diameter increases, the number of bars that can be picked up by the aforesaid pick-up members of the movement apparatus of the system will decrease, and the number of bars that will be transferred to the intermediate compartment will hence be lower.

[0079] This, however, does not necessarily imply that the apparatus will have to carry out a number of operations of transfer of bars to reach the number of bars envisaged for the compartment, in so far as, with greater diameters, also the operating machine will be able to operate only with a small number of bars, and hence the number of bars that are picked up all at the same time from the magazine may in any case fall within in the range referred to above.

[0080] As regards applications in which the operating machine is a cutting machine or else a bending machine, the present applicant has been able to verify that the succession of steps of operation of the system remains basically the same irrespective of the diameter of the bars that are handled.

[0081] Finally, it should be noted that the operation of the system may be either completely automated or else may be governed by an operator through one or more control stations. In either case, the system will anyway comprise a control unit designed to manage the information coming from the counter means regarding the number of bars picked up by the handling machine 1 and/or the number of bars present inside the intermediate compartment 24.

[0082] Finally, it is clear that the system described herein will present appropriate control means designed to govern operation of the system in the way described above.

[0083] Of course, without prejudice to the principle of the invention, the details of construction and the embodiments may vary widely with respect to what has been described and illustrated herein, without thereby departing from the scope of the present invention.

[0084] In brief, the system described herein can have one or more of the following features.

1. A system for feeding metal bars in a controlled number to an operating machine,

said system comprising:

- a storage magazine (20) including a plurality of compartments;
- a machine (1) for handling and counting said bars, configured for picking up the bars and transferring them to said operating machine after counting them, in a direction transverse to said bars; and
- one or more apparatuses (26) for movement of the bars between the storage magazine and the handling and counting machine;

said system being characterized in that it comprises an intermediate storage compartment (24) set between said magazine (20) and said handling and counting machine (1), which is pre-arranged for receiving from said movement apparatus (26) the bars that have been picked up from said magazine and for feeding said bars to said machine.

2. The system according to point 1, having a station for handling the bars (22), which is equipped with said handling and counting machine (1) and has a raised surface (241), which is in communication with one or more transfer members of said handling and counting machine.

3. The system according to point 2, wherein said intermediate compartment is sized for receiving a number of bars that is a multiple of the maximum number of bars that can be handled by said operating machine in a single cycle, with a multiplying factor comprised between 2 and 20.

4. The system according to point 3, wherein said station for handling the bars (22) comprises an inclined plane (243), which connects said raised surface to said one or more transfer members of said machine (1).

5. The system according to any one of points 1 to 4, comprising an apparatus (26) for movement of the bars between the storage magazine and said intermediate compartment, which is equipped with one or more gripper members that are able to grip and pick up from said magazine a number of bars that is a multiple of the maximum number of bars that can be handled by said operating machine in a single cycle, with a multiplying factor comprised between 2 and 20.

6. The system according to any one of points 1 to 5, wherein said handling and counting machine comprises at least one rotary transfer member (6), set over or alongside said raised surface (241) and provided with pick-up means preferably of a magnetic-action type, set in a peripheral position with respect to its axis of rotation, for engaging the portion of a bar of the bundle of bars that is supported by said raised surface, and raising it into a higher position as a result of the movement of rotation of said rotary member.

7. The system according to point 6, wherein said handling and counting machine comprises at least one further mobile member (6'; 16'), which is operatively associated to said rotary member for engaging a raised portion of said bar corresponding or adjacent to the portion engaged by said rotary member and is pre-arranged for lifting from said bundle a remaining portion of said bar.
8. The system according to point 7, wherein said further member is a further rotary transfer member (6') provided with magnetic-action pick-up means set in a peripheral position with respect to its axis of rotation, which is designed to engage via said pick-up means a raised portion of said bar adjacent to the portion engaged by said first rotary member and to raise said adjacent portion of said bar into a higher position, as a result of its movement of rotation.
9. The system according to point 8, wherein said further rotary member (6') is mounted so that it can turn about an axis of rotation substantially aligned with the axis of rotation of said first rotary member.
10. The system according to point 9, wherein the axes of rotation of said rotary members are inclined upwards or downwards.
11. The system according to any one of points 8 to 10, wherein said rotary member and said additional rotary members (6, 6') have their respective magnetic-action pick-up means in angular positions mutually staggered between one member and another in such a way as to engage said bar in sequence.
12. The system according to point 7, wherein said further member is at least one supporting member (16'), which is designed to receive said adjacent or corresponding raised portion of said bar and is mobile in a direction that extends in the longitudinal direction of said bundle in such a way that the movement of sliding of said member will bring about lifting, from said bundle, of a remaining part of said bar.
13. The system according to any one of points 8 to 10, wherein said rotary member or members (6, 6') is/are in the form of a rotary drum and said magnetic-action pick-up means are constituted by at least one magnetic element (10), which is carried by the structure of the drum and defines a housing for receiving the bars that emerges on the peripheral surface of the drum.
14. The system according to point 1, wherein said handling and counting machine comprises at least one rotary screw-type transfer member, which is set underneath or alongside said raised surface (241) and faces with its own axis in a direction transverse to the longitudinal direction of said raised surface (241) in such a way that, as a result of rotation of said screw member, the thread portion of said member will push the bars arranged thereon in said transverse direction, away from said raised surface (241), keeping them separate from one another.
15. The system according to point 14, wherein said handling and counting machine comprises at least one further mobile member, which is operatively associated to said screw member so as to engage a portion of said bar corresponding or adjacent to the portion engaged by said screw member and is pre-arranged for separating from said bundle a remaining portion of said bar, in a transverse direction.
16. The system according to point 15, wherein said further member is at least one supporting member, which is designed to receive said adjacent or corresponding portion of said bar and is mobile in a direction that extends in the longitudinal direction of said bundle in such a way that the sliding movement of said member will bring about separation from said bundle of a remaining part of said bar.
17. The system according to any one of points 1 to 16, wherein sensor/counter means are envisaged, designed to count the bars that have been picked up.
18. The system according to point 17, wherein said sensor/counter means are designed to count at each passage, by said means, of one or more picked-up bars that are carried by said first rotary pick-up member.

Claims

1. A method for feeding metal bars in a given controlled number to an operating machine,
comprising the steps of:

- providing a storage magazine (20) equipped with a plurality of compartments and providing in said magazine a plurality of bars divided between said compartments;
- providing a machine (1) for handling and counting said bars configured for picking up the bars and transferring them towards said operating machine, after counting them, in a direction transverse to said bars; and
- providing one or more apparatuses (26) for movement of the bars between the storage magazine and the handling and counting machine;

said method being **characterized in that** it provides an intermediate storage compartment (24), set between said magazine (20) and said handling and counting machine (1), and a bundle of bars set in said intermediate compartment, which supplies the bars to said handling machine, and **in that** it includes accumulating in said intermediate compartment (24) a number of bars that is a multiple of the maximum number of bars that can be handled by said operating machine in a single cycle, with a multiplying factor comprised between 2 and 20.

2. The method according to Claim 1, wherein said movement apparatus (26) picks up from said mag-

azine (20), all at the same time, said multiple number of bars and unloads them into said compartment (24).

3. The method according to Claim 1 or Claim 2, which, starting from an instant when said intermediate compartment is completely empty, it includes the steps of:

- via said movement apparatus (26), picking up from said magazine said multiple number of bars;
- unloading said number of bars that have been picked up into said intermediate compartment (24), where said number of bars is gathered in the form of said bundle of bars;
- via said handling machine (1), picking up from said bundle of bars just one bar at a time and counting the bars that have been picked up; and
- repeating the operation of picking up a single bar from said bundle until a number of bars equal to the number of bars envisaged for the required working cycle of the operating machine is reached.

4. The method according to Claim 3, which includes gathering the bars that have been picked up and counted by said handling and counting machine (1) in a position along an inclined plane (27), by means of arms (29) that can be lifted above said plane, until a number of bars equal to said number of bars envisaged for the required working cycle of the operating machine is reached, and which envisages releasing the bars gathered on said plane (27) when the operating machine is ready to receive new bars.

5. The method according to any one of the preceding claims, which envisages picking up again said multiple number of bars from said magazine (20) and unloading them into said intermediate compartment (24), according to one or more of the following conditions:

- before the number of bars previously unloaded into said intermediate compartment runs out;
- to complete the number of bars envisaged for a working cycle of the operating machine;
- after the number of bars previously unloaded into said intermediate compartment has run out;
- when the number of bars present in said intermediate compartment reaches a value below a given number;
- until the number of bars envisaged in a batch of bars to be machined that has been assigned to the system is reached,

or in any case when the operator so requires.

6. The method according to any one of the preceding claims, which, at the end of production of a batch of bars, includes, via said movement apparatus, picking up the residual bars present in the intermediate compartment and bringing them back into the respective compartment of said magazine.

7. The method according to any one of the preceding claims, wherein said bundle of bars present in said intermediate compartment supplies said handling and counting machine by gravity.

8. A system for feeding metal bars in a controlled number to an operating machine,
said system comprising:

- a storage magazine (20) including a plurality of compartments;
- a machine (1) for handling and counting said bars, configured for picking up the bars and transferring them to said operating machine after counting them, in a direction transverse to said bars; and
- one or more apparatuses (26) for movement of the bars between the storage magazine and the handling and counting machine;

said system being **characterized in that** it comprises an intermediate storage compartment (24) set between said magazine (20) and said handling and counting machine (1), which is pre-arranged for receiving from said movement apparatus (26) the bars that have been picked up from said magazine and for feeding said bars to said machine.

9. The system according to Claim 8, having a station for handling the bars (22), which is equipped with said handling and counting machine (1) and has a raised surface (241), which is in communication with one or more transfer members of said handling and counting machine.

10. The system according to Claim 9, wherein said intermediate compartment is sized for receiving a number of bars that is a multiple of the maximum number of bars that can be handled by said operating machine in a single cycle, with a multiplying factor comprised between 2 and 20.

11. The system according to Claim 10, wherein said station for handling the bars (22) comprises an inclined plane (243), which connects said raised surface to said one or more transfer members of said machine (1).

12. The system according to any one of Claims 8 to 11, comprising an apparatus (26) for movement of the bars between the storage magazine and said inter-

mediate compartment, which is equipped with one or more gripper members that are able to grip and pick up from said magazine a number of bars that is a multiple of the maximum number of bars that can be handled by said operating machine in a single cycle, with a multiplying factor comprised between 2 and 20.

13. The system according to any one of Claims 8 to 12, wherein said handling and counting machine comprises at least one rotary transfer member (6), set over or alongside said raised surface (241) and provided with pick-up means preferably of a magnetic-action type, set in a peripheral position with respect to its axis of rotation, for engaging the portion of a bar of the bundle of bars that is supported by said raised surface, and raising it into a higher position as a result of the movement of rotation of said rotary member.

14. The system according to Claim 13, wherein said handling and counting machine comprises at least one further mobile member (6'; 16'), which is operatively associated to said rotary member for engaging a raised portion of said bar corresponding or adjacent to the portion engaged by said rotary member and is pre-arranged for lifting from said bundle a remaining portion of said bar.

15. The system according to Claim 8, wherein said handling and counting machine comprises at least one rotary screw-type transfer member, which is set underneath or alongside said raised surface (241) and faces with its own axis in a direction transverse to the longitudinal direction of said raised surface (241) in such a way that, as a result of rotation of said screw member, the thread portion of said member will push the bars arranged thereon in said transverse direction, away from said raised surface (241), keeping them separate from one another.

FIG. 1

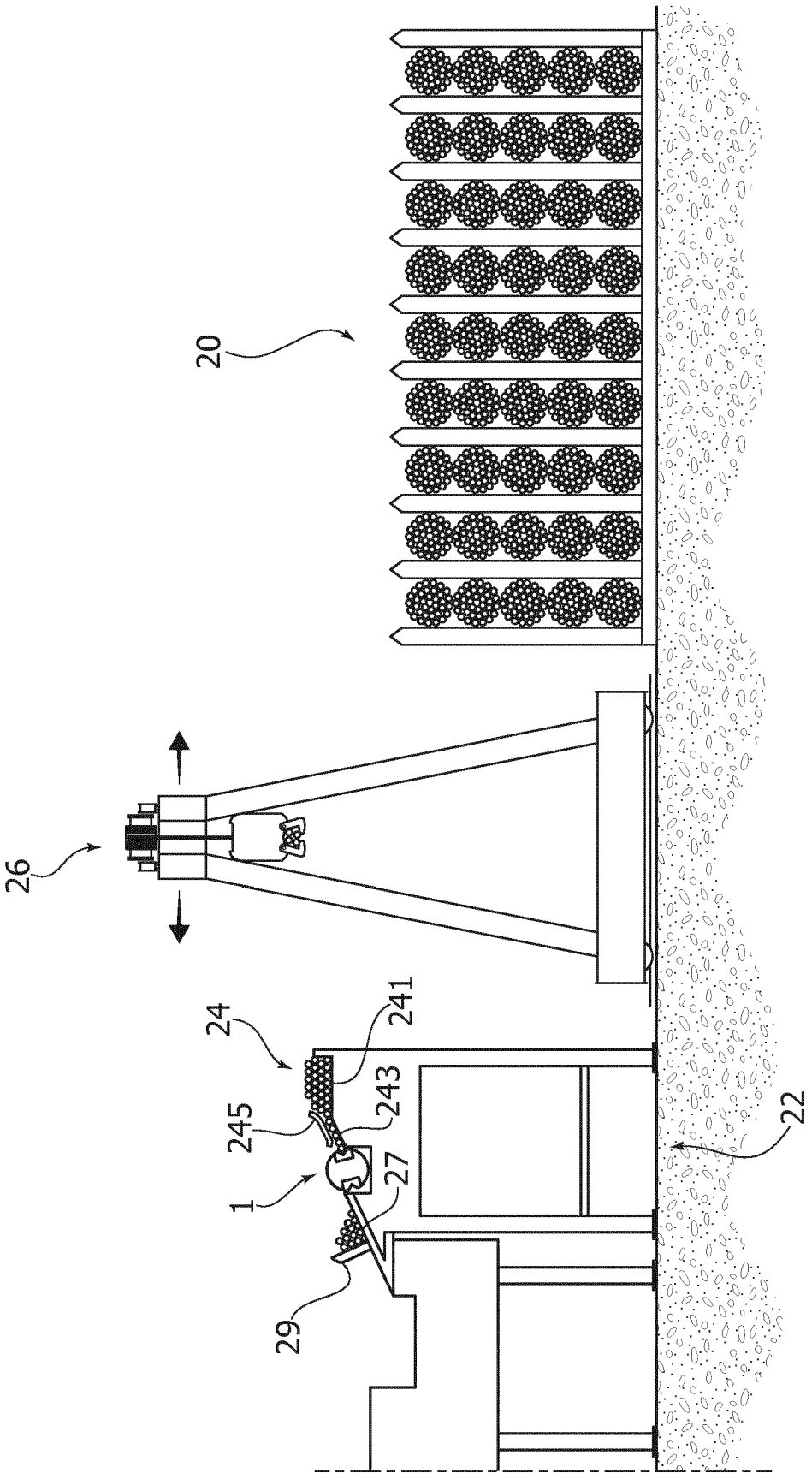


FIG. 3

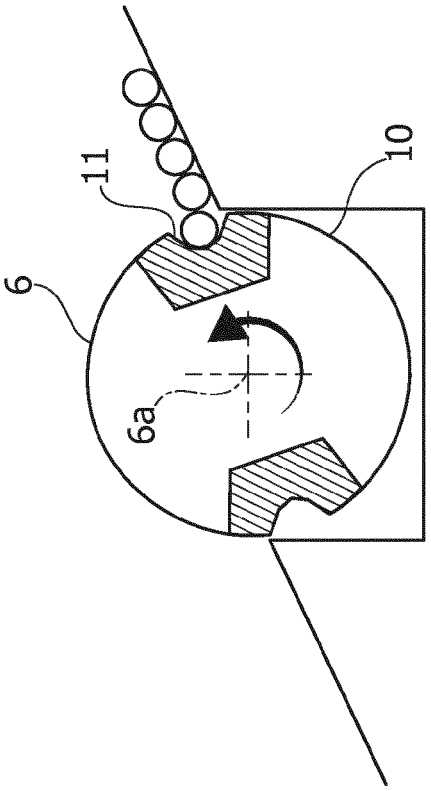


FIG. 5

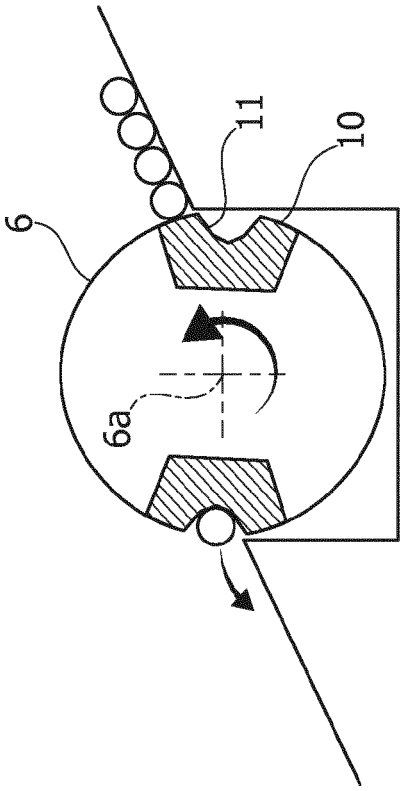


FIG. 2

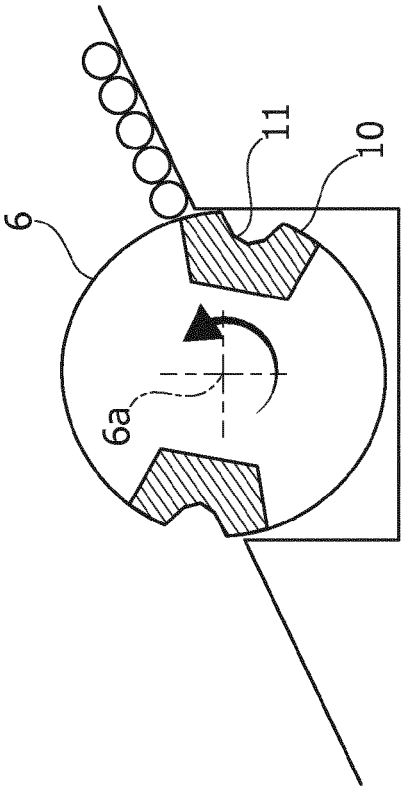


FIG. 4

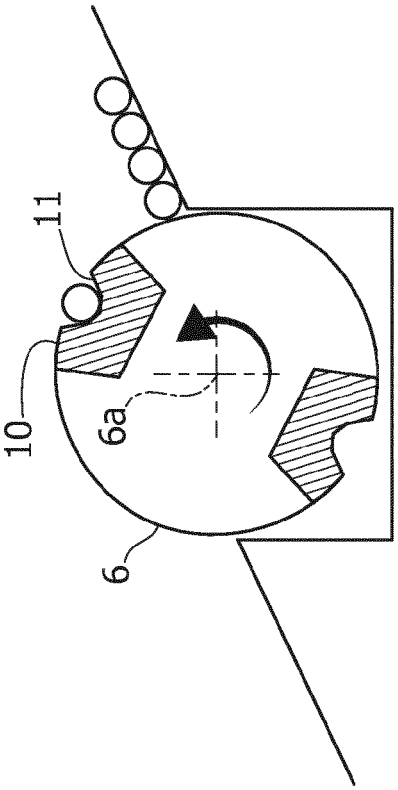


FIG. 6

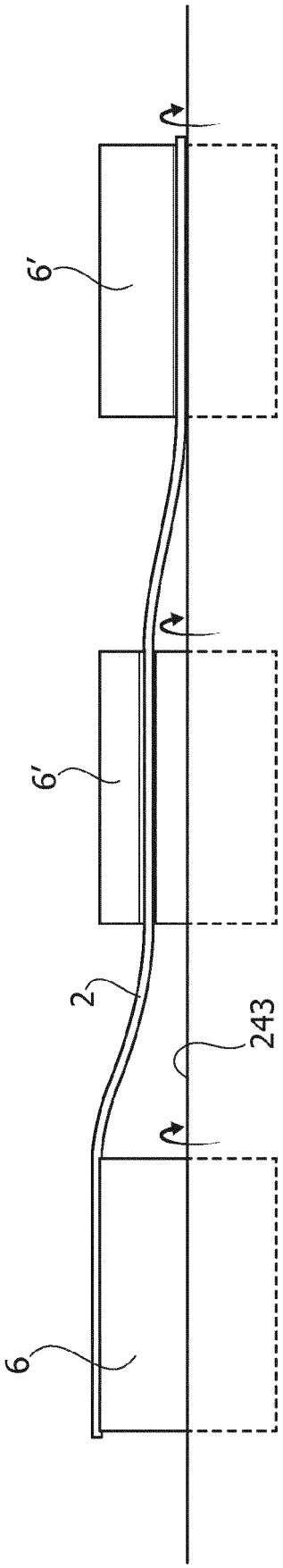


FIG. 7

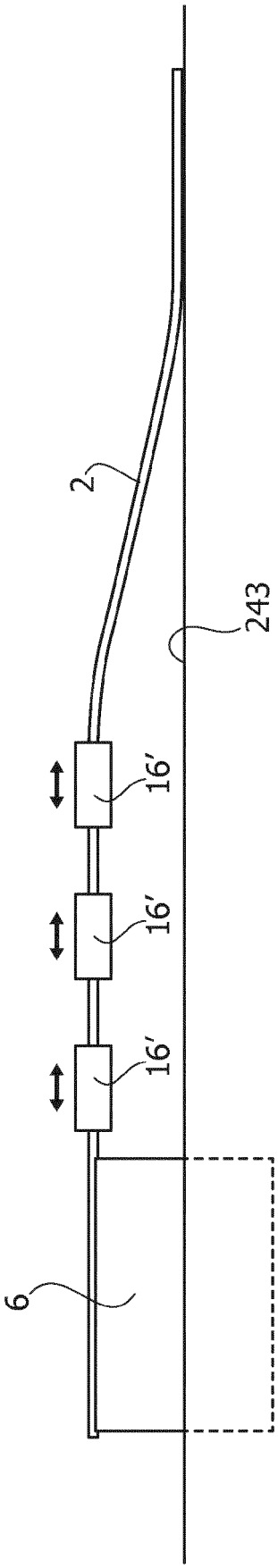
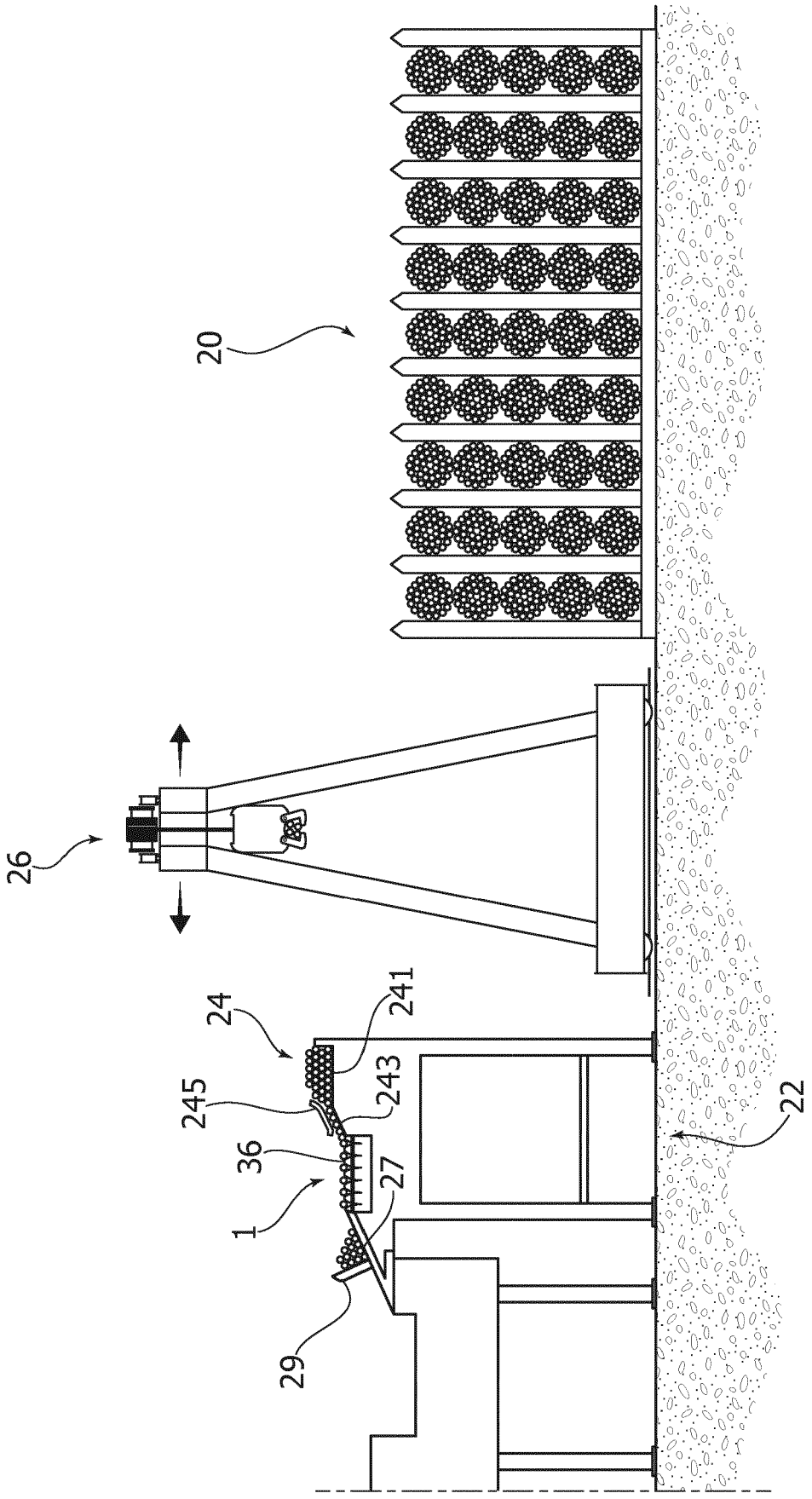


FIG. 8



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EUROPEAN SEARCH REPORT

Application Number
EP 18 15 1606

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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	9 May 2018	Augé, Marc

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