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(54) **TRANSFERRING GROUP IN A MOULDING LINE**

(57) A transferring group comprising a plurality of control units (U) is described, each provided with an actuator (M) controlling the opening / closing of a gripper (P) by means of a kinematic chain comprising at least a control rod (A) acting on said gripper (P), a rocking lever (3) engaged with said rod (A) and a control lever (8) transferring a control action from said actuator (M) to said rocking lever (3), said grippers (P) of the plurality of control units (U) being integral with first side transferring means

(T₁), wherein said actuator being composed of a tubular linear electric motor provided with a stator (100) and a slider (101) being reciprocally sliding, the slider (101) being provided with a front section (105) constrained in motion with said control lever (8), and wherein the position of said slider (101) in relation to a fixed terminal rod (103) integral with said stator (100) being detected by a position transducer (106).

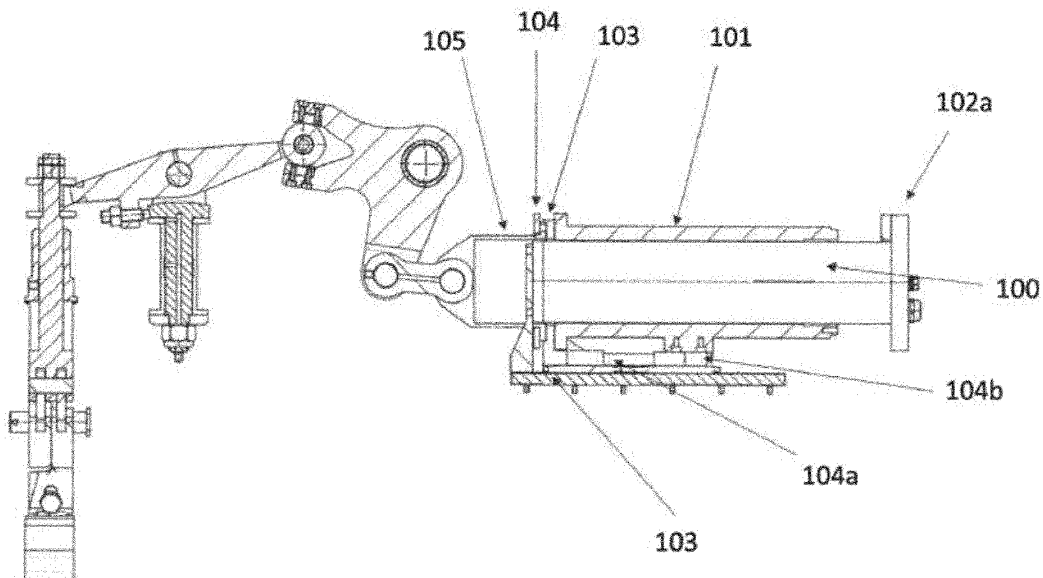


Fig. 4 section/ closed gripper, motor forward

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Description

Field of the invention

[0001] The present invention relates to a transferring group in a moulding line, especially it relates to a control system of the transferring group.

Prior art

[0002] As it is known, in multiple processing lines for pieces - especially in the moulding lines of metallic pieces by means of cold buckling (e.g. combined or progressive presses) - transferring groups advancing the pieces from a working position to the other are provided. Typically, when the pieces are to be transferred precisely, with a specific trim and at a predetermined rate, the transferring groups are provided with a plurality of openable and closable controlled grippers, which the mesh, the movement and the automatic release of the pieces are being achieved with.

[0003] Traditionally, grippers are controlled by a mechanical kinematic motion, provided with drive cams and a transmission rocking lever elastically pushed in a closing position of the gripper. This configuration turned out so far to be very stout and suitable to bear the working rhythm, even compatibly with the cross-transferring movement of the grippers.

[0004] In fig. 1 - representing a perspective view of a single control unit of a gripper of a prior art transferring group - the kinematic control chain of the gripper is being well represented. A first drive lever, provided with a yielding roller, receives the motion from a rotating cam profile and transfers it to a control end. The latter transfers a force directed on a vertical axis to a yielding end of a rocking lever, as opposed to a pneumatic cylinder loaded in the upward direction. A rocking lever fulcrum is being assembled on a first ledger, movable in an alternate motion in a cross direction to the kinematic chain, so to implement the advancing alternating movement of the transferring group. The grippers are being assembled on a second movable ledger, too, that moves with a parallel motion in relation to the first ledger.

[0005] The opposite control end of the rocking lever acts with an alternate vertical force on a sliding rod, that controls the closing (downward) and the opening (upward) of a clamping gripper of the pieces being processed.

[0006] Schematically, the operation of this single unit of the transferring group is as follows:

- in static conditions (i.e. without the intervention of the cam profile) the pneumatic cylinder constantly pushes upward the end of the rocking lever, with a force being proportional to the pneumatic pressure;
- in this condition the rocking lever pushes downward the sliding rod, that therefore keeps the grippers pushed in a closed position;

- the grippers close in this way on the piece with a force depending on the pneumatic pressure being set by the operator for the pneumatic cylinder;
- in dynamic conditions, that is when the cam profile intervenes on the yielding roller of the lever, a pressure is being exerted on the rocking lever that wins the action of the pneumatic cylinder and moves the control rod upward, opening the grippers;
- the speed and the opening step of the grippers is a function of the cam profile.

[0007] On a transferring group there are different unities of this type, e.g. there are seven, assembled one next to the other, with rocking lever all constrained to the same cross alternating moving plate and the cam profiles being keyed on the same rotation shaft.

[0008] For the correct operation of this transferring group, for any piece type to transfer, the operator typically is being supplied with many cam profiles; depending on the opening or closing speed of the gripper that the production cycle requires, the operator must disassemble a cam profile (for each unity) and assemble another one.

[0009] Similarly, ad any article changes in production, normally it is even necessary to reset the timing of the cam profiles, therefore assembling the cams on the rotation shaft again with the angular desired position.

[0010] Apparently, these interventions on the cams, beside of being time consuming, they involve even operating difficulties and safety problems for the operators.

[0011] To partially solve this problem, it has already been proposed to assemble the cams on the rotation shaft by means of an adjusting system controlled by actuators. An example of such an adjusting device is being described in EP1958716 on behalf of the same Applicant.

[0012] Even if such system is effective, vast room of improvement to increase the use flexibility of the transferring group remains. Especially, the offer of a transferring group that reduces to a minimum the need of modifying the control chain of the transferring grippers with the substitution or the assembling/disassembling of the component is desired, so to solve the problems that affect the prior art at any article changes.

General description

[0013] Therefore, it is the object of the invention to propose a transferring group that does not require a substitution or a disassembling / reassembling of the components at article changes.

[0014] This object is being achieved by a transferring group as being essentially described in the main claim attached herein. Other aspects of the invention according to the invention are being described in the dependent claims attached herein.

Brief description of the drawings

[0015] Further characteristics and advantages of the

invention will be anyway clearer from the following detailed description of a preferred embodiment, given by way of an example and not limiting and illustrated in the attached drawings, in which:

Fig. 1, as mentioned, is a perspective view of a control unit of a transferring group of the prior art;
 Fig. 2 is a similar view to that of fig. 1, referred to a control unit according to the invention;
 Fig. 3 is a view in longitudinal section of the unit of fig. 2 with the gripper in an open position;
 Fig. 4 is a view in longitudinal section of the unit of fig. 2 with the gripper in a closed position;
 Fig. 5 is a perspective view of a transferring group according to the invention with grippers in an open position; and
 Fig. 6 is a perspective view of a transferring group according to the invention with grippers in a closed position.

Detailed description of an illustrative version

[0016] A transferring group comprises, in a known way per se, a plurality of control units U, that open and close transferring grippers P. The units U are assembled next to one another, and they each provide a kinematic chain transferring an opening/closing control from a respective controlled actuator M to the relevant gripper P.

[0017] Further, the grippers P are constrained to first side transferring means, typically a ledger T_1 movable with a reciprocating movement in a transferring direction.

[0018] Each gripper P presents two jaws being clamped or opened between each other by the drive of a movable control rod A in a control direction, usually an essentially vertical direction. Further details of the configuration of these grippers are not being provided in this context, because they are per se known in the field.

[0019] Each control rod A is guided in its motion from an appropriate pilot boss B. At the upper end of the control rod A, a double engaging flange 1 is fixed, in which a fork 2 of a transmission rocking lever 3 is engageable.

[0020] The transmission rocking lever 3 is assembled being rocking around a fulcrum axis 4 orthogonal to the control direction of the rod A.

[0021] The fulcrum axis 4 is provided at the upper end of a bearing column 5. The bearing columns 5 of all control units U are being constrained to the same second side transferring means, e.g. a second ledger T_2 movable with a alternating movement in the transferring direction.

[0022] The transmission rocking lever 3, at the opposite end of the fork 2 in relation to the fulcrum axis 4, presents a yielding end 6.

[0023] The yielding end 6 of the rocking lever 3 is engaged with a first end 7 of a control lever 8. In a way known per se the coupling means between the yielding end 6 of the rocking lever 3 and the first end 7 of the control lever 8 allow a maladjustment between the movement planes of the rocking lever and the lever, to support

the relevant cross movements between rocking lever (movable with the second ledger T_2) and lever. The lever 8 being generally L-shaped and tilting-assembled around a fulcrum axis 9 essentially centred-arranged in relation to the two arms of the L-shaped profile. On the opposite side to the first end 7, a second end 10 is provided being connected through an articulated rod 11 to a movable component of the actuator M.

[0024] According to a peculiar feature of the invention, the actuator M is a tubular linear motor.

[0025] Especially, the motor M comprises a stator 100, with the primary electric winding, and a slider 101, comprising permanent magnets, being designed to be reciprocally axially movable.

[0026] Preferably the stator being shaped as a core cylindrical body, while the slider 101 being composed of a series of permanent toroidal-shaped magnets, assembled parallelly among each other so to form a sleeve or a tubular coaxial body and longitudinally sliding on the stator 100.

[0027] In theory the tubular linear motor may indifferently provide configurations in which the primary or the secondary are fixed to a frame and may get the movement of the other one. According to the preferred embodiment, the illustrated configuration is being suitably selected, so to move the part with less inertia and/or that does not require a power supply with electric cables.

[0028] In the specific case, the cylindrical stator 100 shows a rear flange 102a, being suitably constrained to a fixed structure of a frame of the machine. On the opposite side, the cylindrical stator 100 is integral with a bearing column 102b integral to a terminal board 103 constrained to the same fixed structure of the frame of the machine.

[0029] The slider 101 shows a guide flange 104, from which, in a front direction, a front section 105 leans forward. The latter presents a longitudinal groove in which the bearing column 102b is being positioned.

[0030] Further, the guide flange 104 is integral to a saddle 104a being slidingly assembled on the terminal board 103. Further, the saddle 104a presents a connection bridge 104b to the slider body. The front section 105 of the slider 101 is constrained to the articulated rod 11: therefore, the linear movement of the slider 101 on the stator 100 is being transmitted to the control lever 8 rotating around its own fulcrum axis 9.

[0031] Further, the actuator unit M comprises a linear position transducer 106, detecting the position of the slider in relation to the stator. Especially, in the illustrated embodiment a transducer 106 detector is installed on the fixed terminal board 103 near the saddle 104a and it detects the position of a feedback element (e.g. a magnet) integral in the movement to the saddle 104a.

[0032] Further, a zero-setting thickness 107 is preferably provided, assembled on the rear flange 102a so to determine a bottom striking surface of the rear stroke for the slider. By means of the selection of the zero-setting thickness 107 it is possible to precisely define the striking

position or rear stroke bottom of the slider 101.

[0033] Effectively the tubular linear motor M, suitably controlled by a control logic, can cause the movable part to execute an alternating linear movement, that is the slider 101 in relation to the stator 100.

[0034] The motor being programmed to execute a prefixed active run, for example a 34 mm long run. The position of the slider 101 being detected and feedback-managed by means of a position signal coming from the linear position transducer 106.

[0035] At the ignition of the system the control logic is being set to bring the slider (or secondary) "striking" all backward on the zero-setting thickness 107, then it executes a little forward run, e.g. a 1 mm long one; this is the zero-position of the actuator M; from this zero-position the motor may perform its active run, e.g. a 34 mm long one.

[0036] The back-and-forth movement of the slider 101 and of its front section 105 determines the tilting movement of the rocking lever 3 and therefore it moves downward and upward, respectively, the control rod A determining the closing (fig. 4) and the opening (fig. 3) of the gripper P.

[0037] In the figures 5 and 6 an entire transferring system is being shown provided with seven neighbouring control units U, being joined one to the other by the ledgers T_1 and T_2 , synchronizing the side movement of the grippers P. In fig. 5 the system in condition of open grippers with the sliders of the actuators M in a back position is illustrated. In fig. 6 the system in a condition of closed grippers with the sliders of the actuators M in an advanced position is illustrated.

[0038] As it may be understood from the above-mentioned presentation the system according to the invention perfectly fulfils the objects set out in the introduction.

[0039] As a matter of fact, the complete substitution of the prior art cams with the tubular linear motors allows to achieve an excellent adjustment flexibility - without the need of substituting the pieces, just acting on the control logic programming - despite of a stout, reliable, and free from the risk of jamming configuration.

[0040] The significant advantages of this solution consist in the possibility to intervene on the operator's panel (where the control logic programming is being modified) to set with extreme ease and speed the opening or closing of the gripper, the closing force of the gripper, the out of phase angle of the operation among the different grippers.

[0041] Further, thanks to the position signal achieved by the transducer, with the power value absorbed by the motor, it is possible to fix in real time if the piece between the grippers is being correctly clamped or not (in any position of the run a certain power value is predictable indeed, due to the presence of the piece between the grippers or not): in this way it is possible to immediately stop the machine in case of defects, with clear advantages for the safety of the grippers.

Claims

1. A transferring group comprising a plurality of control units (U) each provided with

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an actuator (M) controlling the opening / the closing of a gripper (P) by means of a kinematic chain comprising at least a control rod (A) acting on said gripper (P), a rocking lever (3) engaged with said rod (A) and a control lever (8) transferring a control action from said actuator (M) to said rocking lever (3),

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said grippers (P) of the plurality of control units (U) being integral with first side transferring means (T_1), **characterized in that** said actuator is being composed of a tubular linear electric motor provided with a stator (100) and a slider (101) reciprocally sliding, the slider (101) being provided with a front section (105) constrained in the movement with said control lever (8), and **in that** the position of said slider (101) in relation to a fixed terminal board (103) integral with said stator (100) is being detected by a position transducer (106).

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2. A transferring group of claim 1, wherein furthermore a control logic of said control units (U) is provided, said tubular linear motor being controlled in a linear alternating movement from said control logic by means of a feedback with a position signal detected by said position transducer (106).

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3. A transferring group of claim 2, wherein said control logic determines the drive condition of said grippers (P) on the grounds of absorbed power signals from said tubular, linear electric motors and said position signals of relevant control units (U).

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4. A transferring group of claims 1, 2 or 3, wherein said tubular linear electric motor comprises a core cylindrical stator (100), a tubular slider (101) being linearly slidingly assembled thereon.

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5. A transferring group of claim 4, wherein said cylindrical stator (100) shows a rear flange (102a), a zero-setting thickness (107) being releasably assembled thereon, constituting the rear striking surface for said tubular slider (101).

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6. A transferring group of claim 5, wherein said tubular slider (101) shows a guide flange (104), a slider's front section (105) leaning forward therefrom, said guide flange (104) being integral with a saddle (104a) provided with a connecting bridge (104b) to said tubular slider (101).

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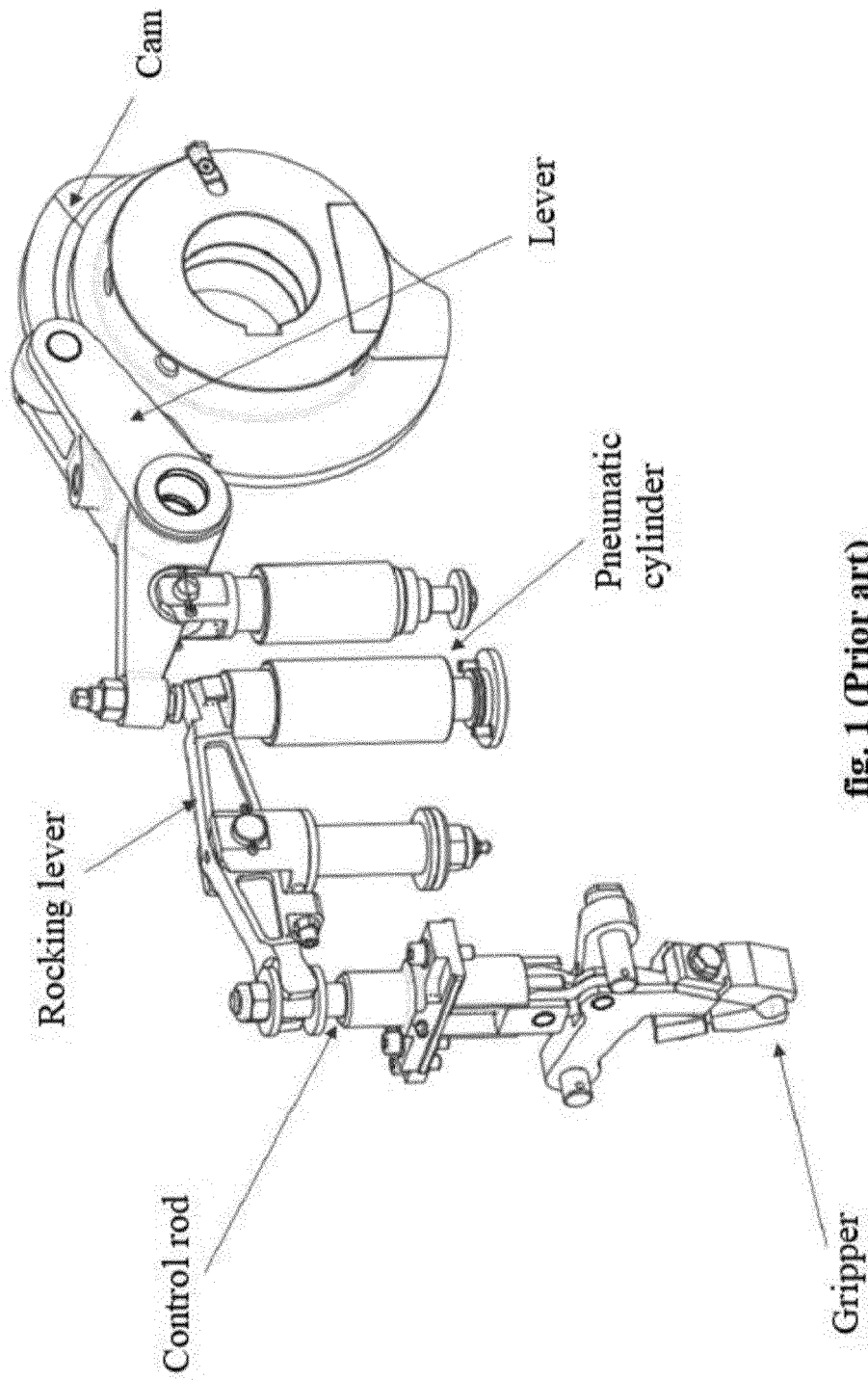


fig. 1 (Prior art)

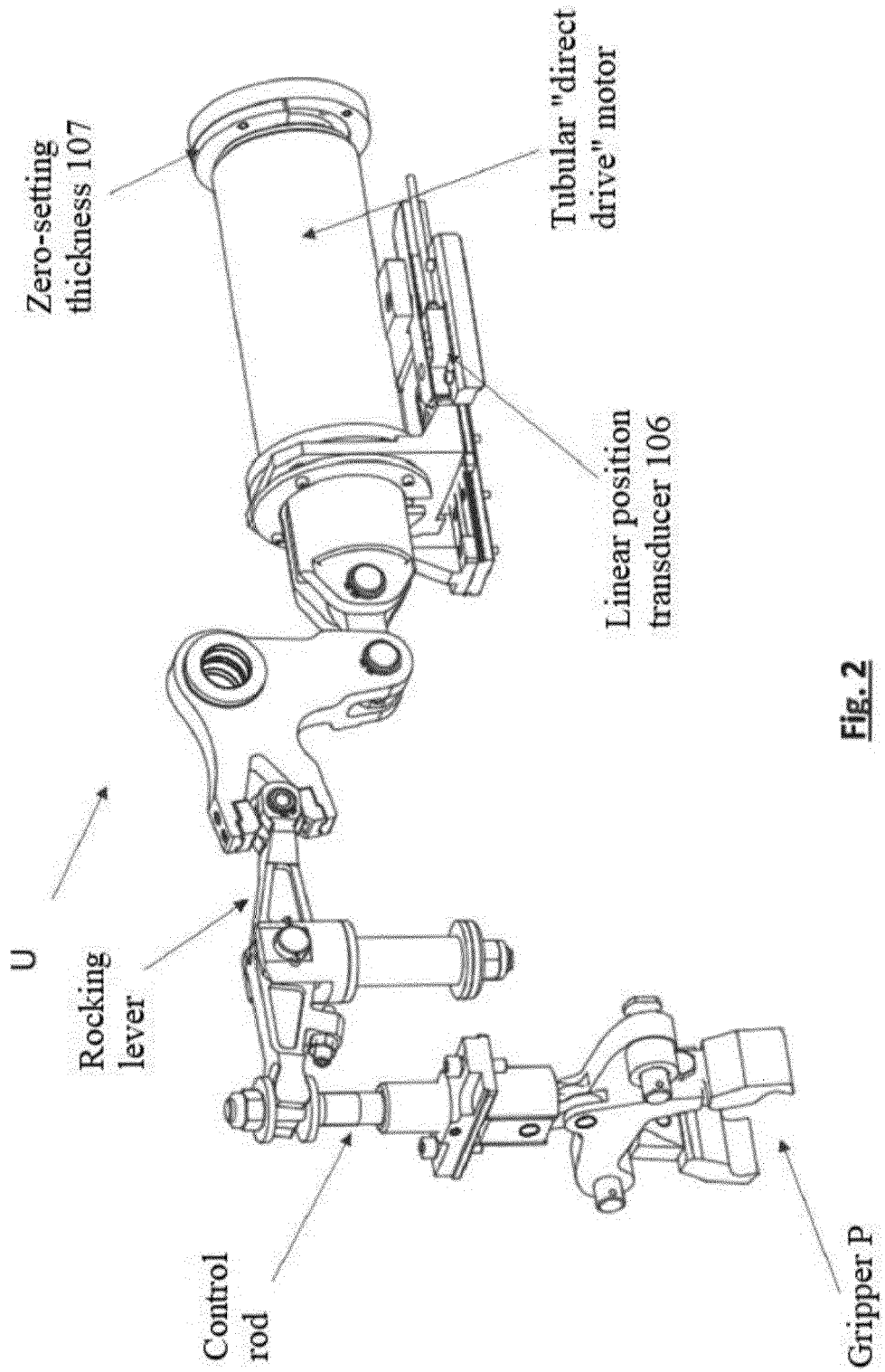


Fig. 2

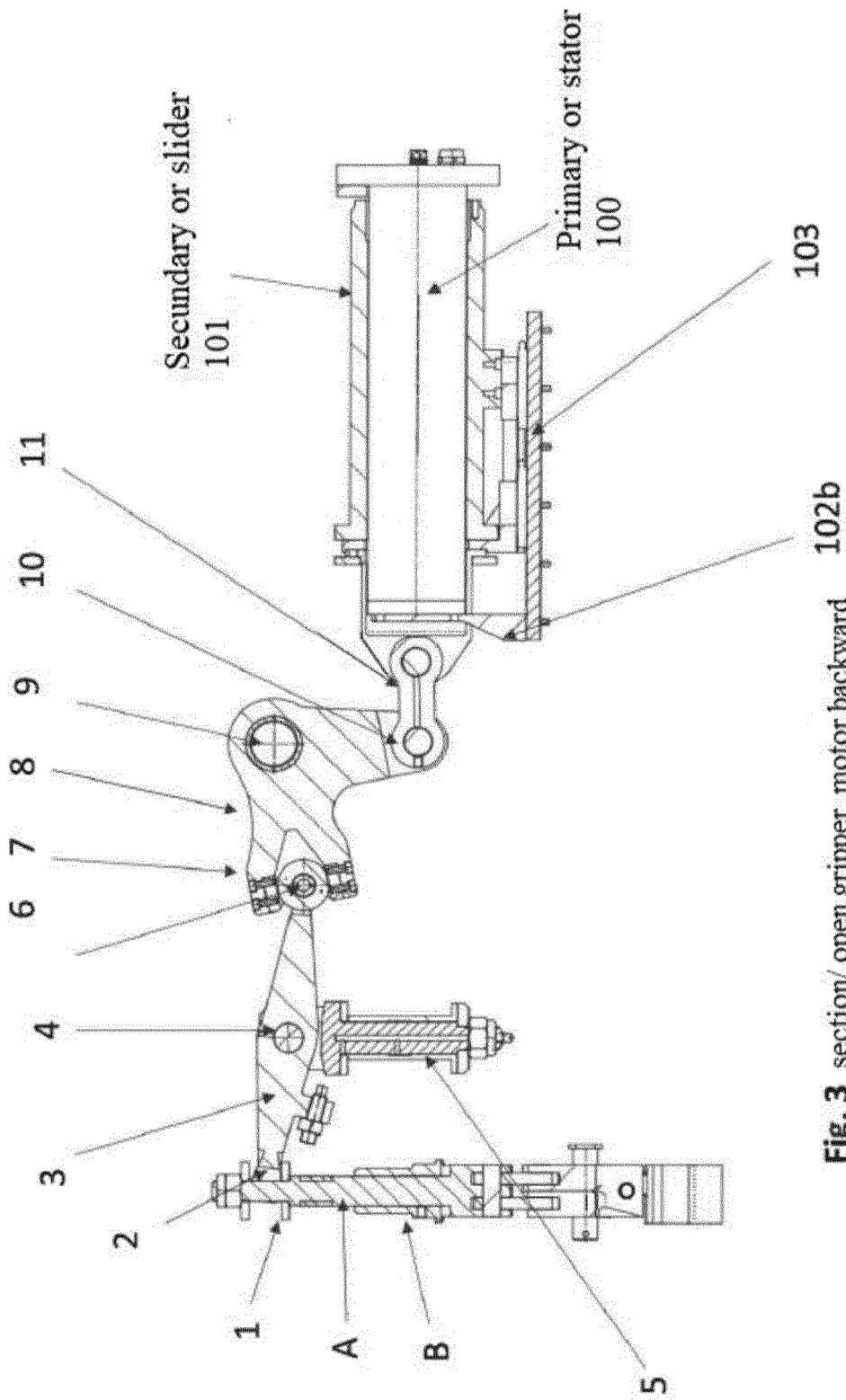


Fig. 3 section/ open gripper, motor backward

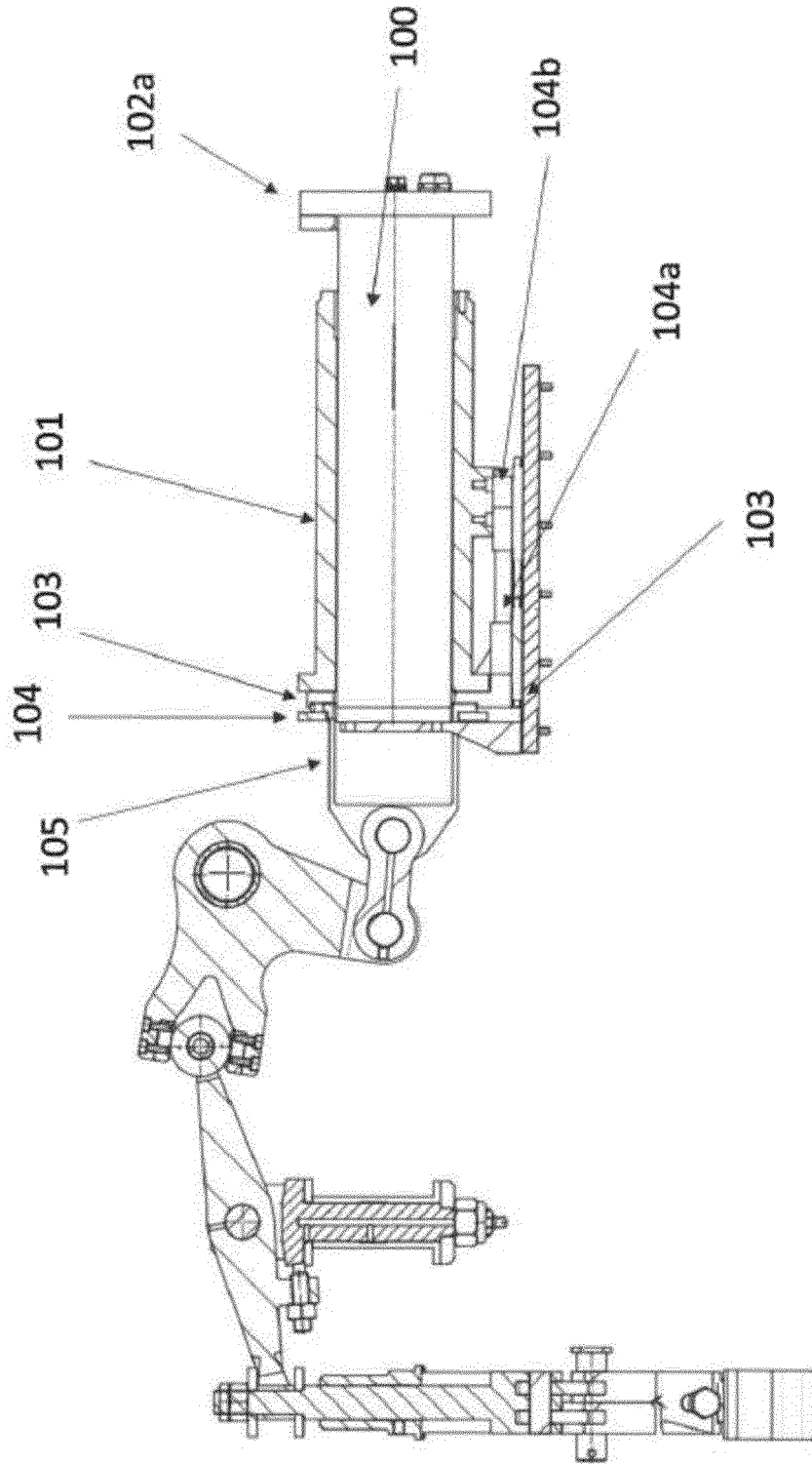


Fig. 4 section/ closed gripper, motor forward

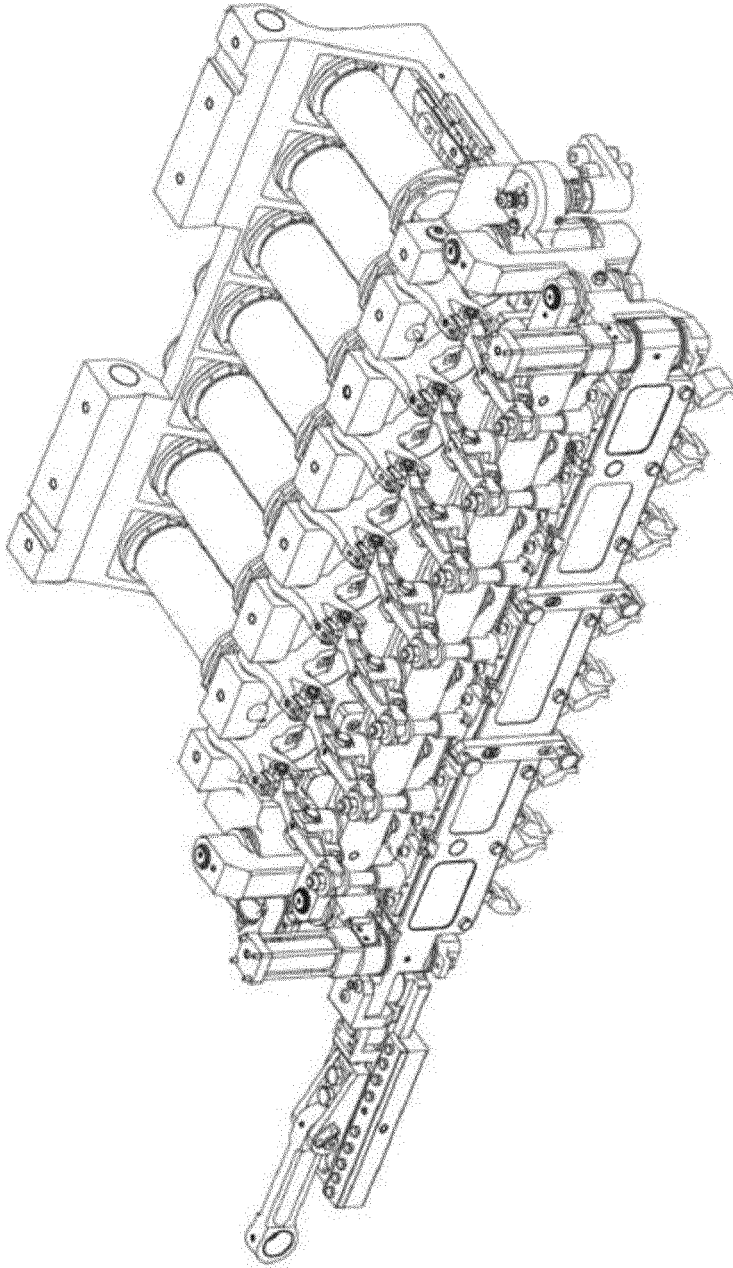


Fig. 5

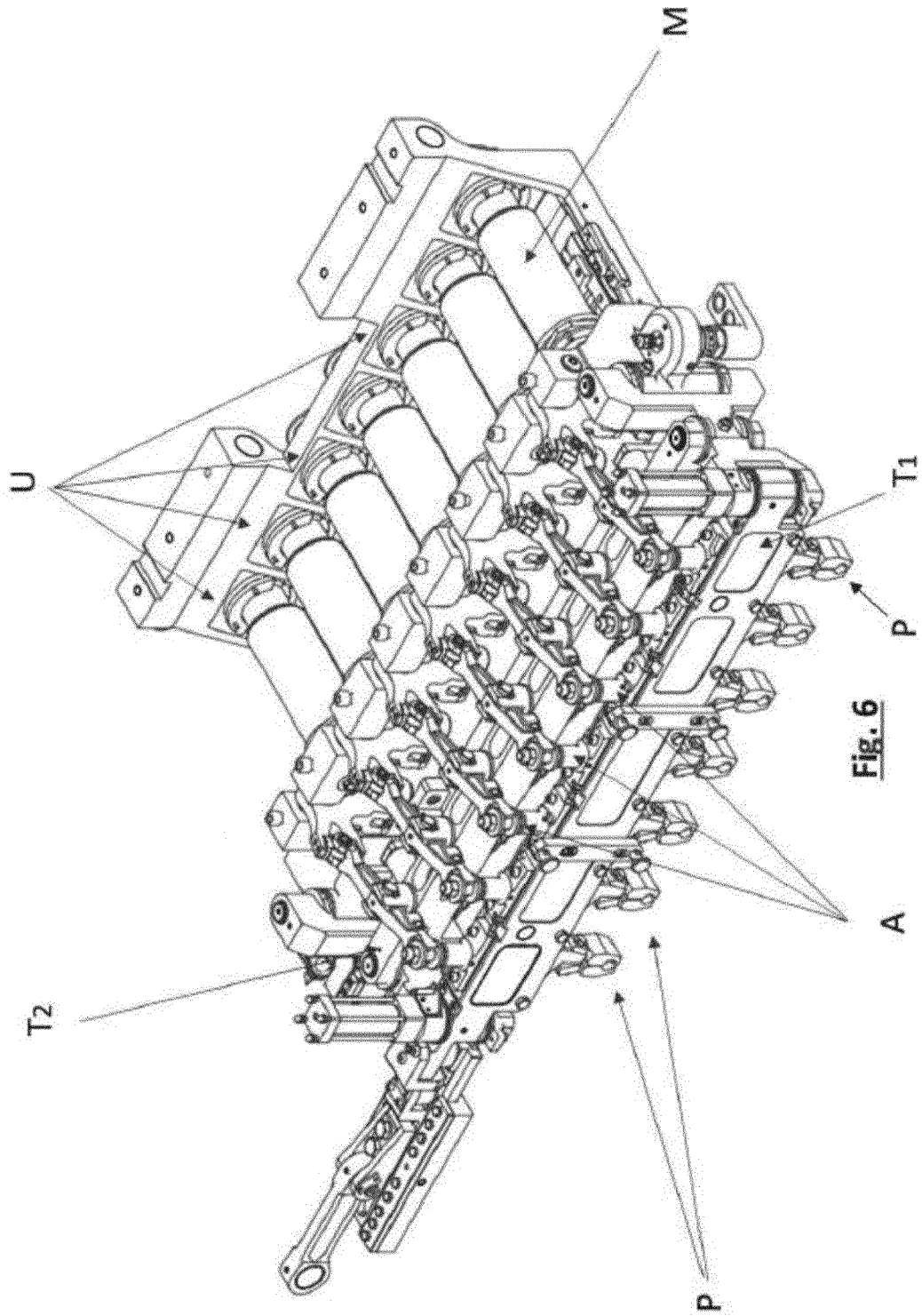


Fig. 6



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Application Number
EP 21 19 0828

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