(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 702 103 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
29.03.2023 Bulletin 2023/13

(21) Application number: **20159921.4**

(22) Date of filing: **27.02.2020**

(51) International Patent Classification (IPC):
B24B 9/10 *(2006.01)* ***B24B 27/00*** *(2006.01)*
B24B 47/22 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B24B 9/10; B24B 9/102; B24B 27/0076; B24B 47/22

(54) METHOD AND ASSEMBLY FOR GRINDING AND POLISHING A CORNER OF A GLASS SHEET

VERFAHREN UND ANORDNUNG ZUM SCHLEIFEN UND POLIEREN EINER ECKE EINER GLASSCHEIBE

PROCÉDÉ ET ENSEMBLE PERMETTANT DE MEULER ET DE POLIR UN ANGLE D'UNE FEUILLE DE VERRE

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **28.02.2019 IT 201900002925**

(43) Date of publication of application:
02.09.2020 Bulletin 2020/36

(73) Proprietor: **Bottero S.p.A.**
12100 Cuneo (IT)

(72) Inventors:
- **MARGARIA, Pierfranco**
  12100 Cuneo (IT)
- **FACCENDA, Aldo**
  12100 Cuneo (IT)

(74) Representative: **Bergadano, Mirko et al**
Studio Torta S.p.A.
Via Viotti, 9
10121 Torino (IT)

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EP-A1- 0 689 899
EP-A1- 2 246 152
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EP 3 702 103 B1

Description

TECHNICAL FIELD

[0001] The present invention relates to an assembly for grinding and polishing a corner of a glass sheet.

BACKGROUND ART

[0002] As is known, after grinding and polishing the perimeter surfaces of a glass sheet, machining of the sharp edges, that is to say, the corners where the polished perimeter surfaces come together, is often required.

[0003] Machining of the sharp edges normally comprises, for each sharp edge, a grinding step consisting in a chamfering or rounding of said corner and, very often, a subsequent step of polishing the previously ground corner.

[0004] The use of grinding and polishing assemblies for the rounding and subsequent polishing of such corners is known in the prior art, in which first a grinding wheel and then a polishing wheel are gradually moved along a predefined path according to the required geometry of the ground corner.

[0005] In most applications, the displacement of each wheel along said path is obtained by combining two rectilinear movements along two mutually orthogonal directions. The displacement of the wheels along each of the directions and in relation to the sheet to be machined is obtained by means of a respective electric motor, independent of the other electric motor and controlled together with the other electric motor by a numerical control system common to the two motors.

[0006] Though widely used, the assemblies of the type described above known in the prior art are difficult to control especially due to the fact that they must be controlled differently depending on whether the grinding wheel or the polishing wheel is used. In detail, the position of the grinding wheel must be strictly controlled since it removes material to define the geometry of the ground corner. The polishing wheel must, instead, be pushed and pressed against the profile that has been ground by the grinding wheel for the sole purpose of polishing the ground corner.

[0007] If the pushing force applied to the polishing wheel is insufficient, this may, in some cases, result in unpolished corners and, in other cases, corners with different levels of polish. In both cases, the constant quality of the machined sheets cannot be guaranteed and it is often necessary to reject some of them, which clearly causes production problems and affects costs.

[0008] Pressing the polishing wheel against the sheet with too much force might not adversely affect polishing of the corners, for a certain period at least, but certainly causes rapid wear on the polishing wheel with a consequent increase in tool costs and in the costs of replacing the wheel and loss of production owing to essential machine downtime.

[0009] Moreover, on the one hand, timely detection of excessive wear on the polishing wheel is not easy since this is not part of any statistical analysis of wheel wear and, on the other, traditional indicators, such as changes in the current absorbed by the respective motor or changes in the torque requested of that motor, are not meaningful, since the polishing wheel remains in contact with the sheet for a very short time and the shorter the path along which the polishing wheel is displaced, the shorter this time. In such conditions, any change in the torque of the respective motor could even be disguised by the moment of inertia of the rotating parts. The polishing wheel often becomes worn so quickly that it is only noticed when several corners have polish defects, but at that point the polishing wheel already needs replacing.

[0010] An assembly for grinding and polishing glass sheets is described, for example, in CN 105 382 656 B, forming the basis for the preamble of claim 1, in EP 0 689 899 A1 and in EP 2 246 152 A1.

DISCLOSURE OF INVENTION

[0011] The purpose of the present invention is to provide an assembly for grinding and polishing a corner of a glass sheet, which overcomes the problems described above in a simple and cost-effective manner and, in particular, makes it possible to maintain the quality of the machined product and, at the same time, to extend the service life of the wheels used for as long as possible.

[0012] According to the present invention there is provided an assembly for grinding and polishing a corner of a glass sheet, as claimed in Claim 1.

[0013] A further purpose of the present invention is to provide a method for grinding and polishing a corner of a glass sheet.

[0014] According to the present invention there is provided a method for grinding and polishing a corner of a glass sheet, as claimed in Claim 14.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The invention will now be described with reference to the accompanying drawings, illustrating a preferred embodiment thereof, in which:

Figure 1 is a schematic and substantially block diagram view of a machine for grinding glass sheets provided with an assembly for grinding and polishing corners produced according to the teachings of the present invention;

Figure 2 is an exploded perspective view of the assembly for grinding and polishing corners in Figure 1;

Figure 3 is a cross-sectional view on an enlarged scale along the line III-III of Figure 2;

Figure 4 is a cross-sectional view of a part of the assembly for grinding and polishing in Figure 3 arranged in a different functional configuration;

Figure 5 is a cross-sectional view along the line V-

V of Figure 1; and

Figure 6 is a cross-sectional view of a part of the assembly for grinding and polishing in Figure 5 arranged in a different functional configuration.

BEST MODE FOR CARRYING OUT THE INVENTION

[0016] In Figure 1, denoted as a whole by reference numeral 1 is a machine for grinding a glass sheet 2. In the example that is illustrated, the machine 1 is a bilateral machine, of the kind known in the prior art, comprising a base 3 with two lateral shoulders 4, only one of which is visible in the accompanying figures, and a conveyor 5, also of the kind known in the prior art, arranged between the shoulders 4 to feed the sheet 2 to be ground in a longitudinal and rectilinear direction 6 at a predefined speed.

[0017] On the machine 1, for each shoulder 4, a corner grinding and polishing assembly, denoted as a whole by reference numeral 10, is attached to or integral with the base 3.

[0018] Again with reference to Figure 1 and, in particular, to Figure 2, the assembly 10, which, in the example described, is an assembly for grinding and polishing the corners at the front 2A and at the rear 2B of the sheet 2, preferably, but not necessarily, while the sheet 2 is being moved along the direction 6, comprises an attachment frame 12, which is permanently connected to the respective shoulder 5 or coupled to said respective shoulder 4 in a releasable manner.

[0019] The assembly 10 further comprises two configurable electro-pneumatic movement devices, a lower one, denoted by reference numeral 13 and an upper one, denoted by reference numeral 14.

[0020] The lower device 13 comprises a lower guide and slide assembly 15 (Fig. 2) which, in turn, comprises a rectilinear guide 16 permanently connected to the frame 12 and extending parallel to the longitudinal direction 6 and a slide 18. The slide 18 is coupled to the guide 16 so as to be able to slide in a direction parallel to the longitudinal direction 6. Integrally connected to and carried by the slide 18 is a rectilinear guide 19 of an upper assembly 20 for guiding and sliding the upper device 14. The guide 19 extends in a rectilinear transverse direction 21 orthogonal to the longitudinal direction 6 and to the slide 16 and carries coupled thereto a slide 22 able to move in opposite directions along said transverse direction 21.

[0021] The lower end of a vertical rectilinear guide 25 is permanently connected to the slide 22, extends upwards and carries, slidingly coupled thereto, a slide 26, able to move in opposite directions from and towards the slide 22 in a direction 27 orthogonal to the directions 6 and 21 driven by a motor 28 integral with the guide 25.

[0022] The end of an arm 30 is permanently connected, in a known manner, to the slide 26 and extends in a cantilevered manner from the slide 26 and carries, coupled to a free end portion, a grinding head 31.

[0023] The grinding head 31 comprises a support 32 permanently connected to the arm 30, a vertical wheel shaft 33, which is rotatably coupled to the support 32 in a vertically fixed position and is able to rotate about its vertical axis 33A driven by a motor 34 coupled to the shaft 33 directly or by means of a known transmission, as in the example that is illustrated.

[0024] A grinding wheel 35 and a polishing wheel 36 arranged on top of the grinding wheel 35 are fitted to a lower end section of the shaft 33 in a known manner. The motor 34 is electrically connected to a numerical control unit 37, of a type known in the prior art and not described in detail, which is part of the assembly 10 and also controls the motor 28. The unit 37 comprises a selection block 38 for selecting one or the other of the wheels 35,36 depending on the machining process to be performed on the sheet 2.

[0025] Again with reference to Figure 2 and, in particular to Figures 3 and 5, the slides 18 and 22 are moved in opposite directions along the respective guides 16, 19 by respective configurable electro-pneumatic drive devices, denoted by reference numerals 39 and 40, respectively, both controlled by the unit 37.

[0026] The device 39 comprises a drive screw 41 housed inside the guide 16 parallel to the direction 6 and rotatably coupled to said guide 16 in an axially fixed position by means of a pair of end bearings. The screw 41 is turned in opposite directions by a geared motor 42 of a type known in the prior art, having an electric motor 43 controlled by the numerical control unit 37.

[0027] With reference to Figure 3, coupled to the screw 41 is a nut-screw 45 carrying, integrally connected to an axial end thereof, a tubular sleeve 46 surrounding the screw 41 with radial clearance (Figure 3).

[0028] An end section of the sleeve 46 defines the rod 47 of a double-acting pneumatic cylinder 48, which is part of the device 39 and extends coaxially with the axis 41A of the screw 41. The pneumatic cylinder 48, in turn, comprises a liner 49, which is permanently connected to the slide 22 by means of screws, surrounds the rod 47 and has two opposite end sections, denoted by reference numerals 50 and 51, which are coupled to an outer side surface of said rod 47 in a fluid-tight manner so as to delimit with said rod an airtight chamber 52. The chamber houses a plunger 53, which surrounds the rod 47 and is permanently connected to said rod 47. Conveniently, the plunger 53 is formed as one piece with the rod 47. The plunger 53 divides the chamber 52 into two variable-volume airtight chambers, denoted by reference numerals 54 (Figure 3) and 55 (Figure 4). The chambers 54 and 55 are both connected by means of ducts to a pneumatic valve assembly 56 of the type with proportional valves and controlled by the unit 44 to selectively pressurise the chambers 54 and 55 in a continuously controlled manner.

[0029] Again with reference to Figures 5 and 6, the device 14 is structurally and functionally identical to the device 13 and its component parts are denoted by the same reference numerals as the corresponding parts of

the device 13 with the addition of the subscript "'" to distinguish them from the corresponding parts of said device 13. The unit 37 and the pneumatic valve assembly 56 are common to the devices 39 and 40.

[0030] The method of operation of the assembly 10 will now be described starting from a grinding configuration, illustrated in Figures 3 and 5, in which the block 38 has selected the grinding wheel 35 bringing it into a lowered grinding position, and the devices 39 and 40 are both configured to move the wheel 35, for example to machine a corner 2A. In this configuration, the chambers 54,54' of the cylinders 48,48' are depressurised, whereas the chambers 55,55' are pressurised by the block 56. Once the chambers 55,55' have been pressurised, the respective end sections 51,51' of the corresponding liners 49,49' have respective axial shoulders that are practically in abutment against the corresponding plungers 53,53', thus achieving a rigid coupling between the sleeves 47,47' and said liners. Thus, during the grinding process, the assembly 1 is therefore configured as a conventional grinding assembly driven by electric motors numerically controlled by the unit 37.

[0031] When, instead, the block 38 selects the polishing wheel 36 to polish the surfaces that have been ground by the grinding wheel 35, the motors 43,43' continue to displace the shaft 31 and the wheel 35 along a path identical or parallel to the grinding path, the chambers 55,55' are depressurised and the chambers 54,54' are pressurised, as illustrated in Figures 4 and 6. In these conditions, a pneumatic spring is created between the plungers 53,53' and the sections 51,51', the stiffness or elasticity of which, depending on the path along which the wheel 36 is moved, is kept constant or changed in a controlled and continuous manner by adjusting the air pressure in the chambers 54,54'.

[0032] The pressure in each of the chambers 54,54' can be changed by changing the output pressure from the block 56. The variation in pressure in the chamber 54 can be achieved according to a principle of variation equal to or different from that of the chamber 54'. In such conditions, during polishing, the wheel 36 is pushed against the sheet 2, applying, along each of the directions 6 and 21, a respective predefined and constant force as the wear on the wheel 36 changes.

[0033] Alternatively, the air pressure in the chambers 54 and 54' is first brought to a predetermined constant value by the block 56, and, if necessary, it is adjusted by means of the motors 43,43' during the advancement of the wheel 36, that is, by modifying the instantaneous position of one or both of the plungers 53,53' in relation to a reference position, for example, the grinding position, and thus varying the volume of the chambers 54,54'.

[0034] The same considerations apply for machining the rear corners 2B, except that the pressurisation of the chambers 54 and 55 is inverted for the grinding step. In particular, during the grinding step the chamber 54 is pressurised and the chamber 55 is depressurised so that the section 50 of the liner 49 is brought to cooperate directly in abutment against the plunger 53.

[0035] From the above it is apparent that modifications and variations may be made to the assembly 10 described herein without departing from the scope of the independent claims.

[0036] For example, the liners 49,49' of the pneumatic actuators 48,48' could be permanently connected to the respective nut screws 45,45' and the plungers 53,53' could be permanently connected to the corresponding slides 18 and 22 or in any case act directly or indirectly on the arm 30.

[0037] Moreover, instead of extending along the directions 9 and 21, the pneumatic actuators could be arranged parallel to but in an eccentric position with respect to said directions 9 and 21.

[0038] Regardless of how the pneumatic actuators are arranged, the possibility of having a pressurised air chamber interposed along each of the directions between the corresponding electric motor, and of using said chamber as a pneumatic pressure spring to push the polishing wheel 36 means that any of the ground surfaces on the sheet can be polished with the polishing wheel 36 always in the condition called for in the project while therefore constantly maintaining a high production output and the required surface quality. In such conditions, the pushing force is not controlled by the electric motor but by the pneumatic springs.

[0039] From the above it is apparent that since the assembly 10 described herein is an independent grinding and finishing unit, not only is it suitable for use on bilateral machines other than the one described herein, but also on other non-bilateral grinding machines, such as rectilinear machines or machining centres. In the case of rectilinear machines, the assembly must clearly be turned so that the transverse direction is arranged vertically.

[0040] Furthermore, from the above it is clear that only one of the devices 13,14 is an electro-pneumatic device.

Claims

1. An assembly (10) for grinding and polishing a corner (2A) (2B) of a glass sheet (2), the assembly comprising: a grinding wheel (35) and a polishing wheel (36), which can be selectively activated and are carried by the same motor-driven drive shaft (33); a first (13) and a second movement device (14) for displacing the motor-driven shaft (33) along a first rectilinear direction (41A) and a second rectilinear direction (21), respectively, which are transverse with respect to each other; each movement device (13)(14) comprising a corresponding rectilinear guide (16)(19), a corresponding slide (18) (22), slidably coupled to said guide (16)(19), a corresponding first mobile drive member (47) (47') for movement of the corresponding said slide (18) (22), and an electric motor (43) (43') for driving said first mobile drive member (47) (47'); the assembly (10) further comprising an

electronic numerical control unit (37) for controlling each of said electric motors (43) (43'), and being **characterised in that** at least one of the movement devices (13)(14) is a configurable electro-pneumatic device and further comprises a pneumatic actuator (39)(40) having at least one first variable-volume air chamber (54) (54') and means (56) for pressurising said first variable-volume air chamber (54) (54') and for pushing the polishing wheel (36) against the sheet (2); said pneumatic actuator (39) (40) comprising a second mobile member (51) (51'), which partially delimits said first variable-volume chamber (54)(54') and is connected to the corresponding said slide; and **in that** it comprises configuration means (55,56)(55',56') that can be activated for connecting the first (47) (47') and the second mobile drive members (51) (51') rigidly together or by interposition of said first air chamber (54)(54').

2. The assembly according to Claim 1, **characterised in that** both of the movement devices (13) (14) are configurable electro-pneumatic devices.

3. The assembly according to Claim 1 or 2, **characterised in that** said electronic control unit (37) comprises selection means (38) for selecting one of said grinding and finishing wheels (35)(36) and control means for controlling said configuration means (55,56) as a function of the grinding wheel selected.

4. The assembly according to any one of the preceding claims, **characterised in that** said configuration means comprise pneumatic means.

5. The assembly according to Claim 4, **characterised in that** said configuration means comprise a second variable-volume air chamber (55)(55') that can be pressurised by means of further pressurisation means (56) .

6. The assembly according to any one of the preceding claims, **characterised in that**, when said first and second mobile drive members (47) (47') (51) (51') are directly connected to one another, they have respective shoulders that are brought and kept in abutment against each other by said configuration means.

7. The assembly according to Claim 6, **characterised in that** said shoulders partially delimit said first variable-volume air chamber (54)(54').

8. The assembly according to any one of the preceding claims, **characterised in that** said first variable-volume air chamber (54) (54') extends parallel to a corresponding said rectilinear direction (41A) (21) .

9. The assembly according to any one of the preceding claims, **characterised in that** said first variable-volume chamber(54) (54') extends coaxially with a corresponding said rectilinear direction (41A) (21) .

10. The assembly according to any one of the preceding claims, **characterised in that** each said pneumatic actuator is a double-acting pneumatic actuator; said double-acting pneumatic actuator having a liner and a fluid-tight plunger that slides in said liner and delimiting said first variable-volume chamber (54)(54') and said second variable-volume chamber (55) (55'); one between said liner and said plunger being permanently connected to the corresponding said slide, and the other being permanently connected to the corresponding said first mobile drive member.

11. The assembly according to Claim 10, **characterised in that** said plunger is permanently connected to said first mobile drive member.

12. The assembly according to any one of the preceding claims, **characterised in that** each said movement device (13) (14) further comprises a nut-screw assembly (, which in turn comprises a screw, which extends along the corresponding said rectilinear direction and is rotatably coupled to the corresponding said guide in an axially fixed position, and a screw, which is angularly fixed with respect to the corresponding said guide and is permanently connected to the corresponding said first mobile drive member; said first mobile drive member being tubular and said screw traversing said first mobile drive member and being turned by a corresponding electric motor.

13. The assembly according to Claim 10, **characterised in that** said plunger is permanently connected to the corresponding said slide, and the liner is permanently connected to said first mobile drive member.

14. A method for grinding and polishing a corner (2A, 2B) of a glass sheet (2), the method being implemented using a grinding and polishing assembly (10) as per any one of the preceding claims and comprising a step of grinding the glass sheet (2) and a subsequent step of polishing the ground surface; wherein said grinding step is carried out by selecting the grinding wheel (35) and displacing said motor-driven shaft (33) by means of electric motors (43,43'), and in that said polishing step is carried out by selecting the polishing wheel (36) and using at least one pneumatic actuator (39, 40) for pushing the polishing wheel (36) against said ground sheet.

15. The method according to Claim 14, **characterised in that** said polishing step is carried out by activating configuration means (55, 56; 55'; 56') so as to set, in at least one of said directions, a first variable-volume air chamber (54, 54') of a corresponding said

pneumatic actuator (39, 40) between a first mobile drive member (47, 47') driven by the corresponding said electric motor (43, 43') and a second mobile drive member (51, 51') driven by the corresponding said pneumatic actuator (39, 40) and pressurising said first variable-volume air chamber (54, 54') so as to push the polishing wheel (36) by means of the corresponding second mobile drive member (51, 51').

16. The method according to Claim 15, **characterised in that** said grinding step is carried out after rigidly connecting together the first mobile drive member (47, 47') and the corresponding said second mobile drive member (51, 51').

17. The method according to Claim 16, **characterised in that** the permanent connection of said first mobile drive member (47, 47') to the corresponding said second mobile drive member (51, 51') is obtained by depressurising the corresponding said first variable-volume air chamber (54, 54') and pressurising a corresponding second variable-volume air chamber (55, 55') of the corresponding said pneumatic actuator (39, 40).

18. The method according to any one of Claims 15 to 17, **characterised in that** the pushing force on said polishing wheel (36) is applied by varying the pressure in said first variable-volume air chamber (54, 54').

Patentansprüche

1. Eine Baugruppe (10) zum Schleifen und Polieren einer Ecke (2A) (2B) einer Glasscheibe (2), wobei die Baugruppe umfasst: eine Schleifscheibe (35) und eine Polierscheibe (36), die selektiv aktiviert werden können und von der gleichen motorgetriebenen Antriebswelle (33) getragen werden; eine erste (13) und eine zweite Bewegungsvorrichtung (14) zum Verschieben der motorgetriebenen Welle (33) entlang einer ersten geradlinigen Richtung (41A) bzw. einer zweiten geradlinigen Richtung (21), die quer zueinander verlaufen; wobei jede Bewegungsvorrichtung (13) (14) eine entsprechende geradlinige Führung (16) (19), einen entsprechenden Schlitten (18) (22), der gleitend mit der Führung (16) (19) verbunden ist, ein entsprechendes erstes bewegliches Antriebselement (47) (47') zur Bewegung des betreffenden Schlittens (18) (22) und einen Elektromotor (43) (43') zum Antrieb des ersten beweglichen Antriebselements (47) (47') aufweist; die Baugruppe (10) ferner eine elektronische numerische Steuereinheit (37) zum Regeln jedes der Elektromotoren (43) (43') aufweist und **dadurch gekennzeichnet ist, dass** mindestens eine der Bewegungsvorrichtungen (13) (14) eine konfigurierbare elektropneumatische Vorrichtung ist und ferner ein pneumatischer Aktuator (39) (40) mit mindestens einer ersten Luftkammer (54) (54') mit variablem Volumen und Mitteln (56) zum Unterdrucksetzen der ersten Luftkammer (54) (54') mit variablem Volumen und zum Drücken der Polierscheibe (36) gegen die Scheibe (2) aufweist; wobei der pneumatische Aktuator (39) (40) ein zweites bewegliches Element (51) (51') aufweist, das die erste Kammer (54) (54') mit variablem Volumen teilweise begrenzt und mit dem betreffenden Schlitten verbunden ist; und dass er Konfigurationsmittel (55, 56) (55', 56') aufweist, die aktiviert werden können, um das erste (47) (47') und das zweite bewegliche Antriebselement (51) (51') starr miteinander oder durch Zwischenschaltung der ersten Luftkammer (54) (54') zu verbinden.

2. Die Baugruppe nach Anspruch 1, **dadurch gekennzeichnet, dass** es sich bei den beiden Bewegungsvorrichtungen (13) (14) um konfigurierbare elektropneumatische Vorrichtungen handelt.

3. Die Baugruppe nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die elektronische Steuereinheit (37) Auswahlmittel (38) zum Auswählen einer der Schleif- und Endbearbeitungsscheiben (35) (36) und Steuermittel zum Regeln der Konfigurationsmittel (55, 56) in Abhängigkeit von der ausgewählten Schleifscheibe aufweist.

4. Die Baugruppe nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Konfigurationsmittel pneumatische Mittel aufweisen.

5. Die Baugruppe nach Anspruch 4, **dadurch gekennzeichnet, dass** die Konfigurationsmittel eine zweite Luftkammer (55) (55') mit variablem Volumen aufweisen, die mit Hilfe weiterer Druckerzeugungsmittel (56) unter Druck gesetzt werden kann.

6. Die Baugruppe nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass**, wenn das erste und das zweite bewegliche Antriebselement (47) (47') (51) (51') direkt miteinander verbunden sind, sie jeweils Schultern aufweisen, die durch die Konfigurationsmittel in Anlage aneinander gebracht und gehalten werden.

7. Die Baugruppe nach Anspruch 6, **dadurch gekennzeichnet, dass** die Schultern die erste Luftkammer (54) (54') mit variablem Volumen teilweise begrenzen.

8. Die Baugruppe nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sich die erste Luftkammer (54) (54') mit variablem Volumen parallel zu einer betreffenden geradlinigen Richtung

(41A) (21) erstreckt.

9. Die Baugruppe nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sich die erste Kammer (54) (54') mit variablem Volumen koaxial zu einer betreffenden geradlinigen Richtung (41A) (21) erstreckt.

10. Die Baugruppe nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** jeder pneumatische Aktuator ein doppelt wirkender pneumatischer Aktuator ist, wobei der doppelt wirkende pneumatische Aktuator eine Auskleidung und einen fluiddichten Kolben aufweist, der in der Auskleidung gleitet und die erste Kammer (54) (54') mit variablem Volumen und die zweite Kammer (55) (55') mit variablem Volumen begrenzt, wobei eine der beiden Komponenten, die Auskleidung und der Kolben, dauerhaft mit dem betreffenden Schieber verbunden ist und die andere dauerhaft mit dem betreffenden ersten beweglichen Antriebselement verbunden ist.

11. Die Baugruppe nach Anspruch 10, **dadurch gekennzeichnet, dass** der Kolben dauerhaft mit dem ersten beweglichen Antriebselement verbunden ist.

12. Die Baugruppe nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** jede der Bewegungsvorrichtungen (13) (14) ferner eine Mutter-Schrauben-Baugruppe aufweist, die ihrerseits eine Schraube, die sich entlang der entsprechenden geradlinigen Richtung erstreckt und drehbar mit der entsprechenden Führung in einer axial fixierten Position gekoppelt ist, und eine Schraube aufweist, die in Bezug auf die entsprechende Führung winkelfest ist und dauerhaft mit dem entsprechenden ersten beweglichen Antriebselement verbunden ist; wobei das erste bewegliche Antriebselement rohrförmig ist und die Schraube das erste bewegliche Antriebselement durchquert und von einem entsprechenden Elektromotor gedreht wird.

13. Die Baugruppe nach Anspruch 10, **dadurch gekennzeichnet, dass** der Kolben dauerhaft mit dem betreffenden Schieber verbunden ist und die Auskleidung dauerhaft mit dem ersten beweglichen Antriebselement verbunden ist.

14. Ein Verfahren zum Schleifen und Polieren einer Ecke (2A) (2B) einer Scheibe (2), wobei das Verfahren unter Verwendung einer Baugruppe (10) nach einem der vorhergehenden Ansprüche durchgeführt wird und einen Schritt des Schleifens der Scheibe (2) und einen nachfolgenden Schritt des Polierens der geschliffenen Oberfläche aufweist; wobei der Schleifschritt durch Auswählen der Schleifscheibe (35) und Verschieben der motorgetriebenen Welle (33) mittels Elektromotoren (43, 43') durchgeführt wird, und wobei der Polierschritt durch Auswählen der Polierscheibe (36) und Verwenden mindestens eines pneumatischen Aktuators (39, 40) zum Schieben der Polierscheibe (36) gegen die geschliffene Scheibe durchgeführt wird.

15. Ein Verfahren nach Anspruch 14, **dadurch gekennzeichnet, dass** der Polierschritt durch die Aktivierung von Konfigurationsmitteln (55, 56; 55'; 56'), um in mindestens einer der genannten Richtungen eine erste Luftkammer (54, 54') mit variablem Volumen eines betreffenden pneumatischen Aktuators (39, 40) zwischen einem ersten beweglichen Antriebselement (47, 47'), das von dem betreffenden Elektromotor (43, 43') angetriebenen ersten beweglichen Antriebselement (47, 47') und einem zweiten beweglichen Antriebselement (51, 51'), das von dem betreffenden pneumatischen Aktuator (39, 40) angetrieben wird und die erste Luftkammer (54, 54') mit variablem Volumen mit Druck beaufschlagt, um die Polierscheibe (36) mit Hilfe des betreffenden zweiten beweglichen Antriebselements (51, 51') zu schieben.

16. Das Verfahren nach Anspruch 15, **dadurch gekennzeichnet, dass** der Schleifschritt ausgeführt wird, nachdem das erste mobile Antriebselement (47, 47') und das betreffende zweite mobile Antriebselement (51, 51') starr miteinander verbunden wurden.

17. Das Verfahren nach Anspruch 16, **dadurch gekennzeichnet, dass** die dauerhafte Verbindung des ersten beweglichen Antriebselements (47, 47') mit dem entsprechenden zweiten beweglichen Antriebselement (51, 51') durch Druckentlastung der betreffenden ersten Luftkammer (54, 54') mit variablem Volumen und Druckbeaufschlagung einer entsprechenden zweiten Luftkammer (55, 55') mit variablem Volumen des betreffenden pneumatischen Aktuators (39, 40) erreicht wird.

18. Das Verfahren nach einem der Ansprüche 15 bis 17, **dadurch gekennzeichnet, dass** die Schubkraft auf die Polierscheibe (36) durch Veränderung des Drucks in der ersten Luftkammer (54, 54') mit variablem Volumen aufgebracht wird.

Revendications

1. Ensemble (10) pour meuler et de polir un angle (2A) (2B) d'une feuille de verre (2), l'ensemble comprenant : une roue de meulage (35) et une roue de polissage (36), qui peuvent être sélectivement activées et sont portées par le même arbre d'entraînement entraîné par moteur (33) ; un premier (13) et un deuxième dispositif de mouvement (14) pour

déplacer l'arbre entraîné par moteur (33) le long d'une première direction rectiligne (41A) et d'une deuxième direction rectiligne (21), respectivement, qui sont transversales l'une par rapport à l'autre ; chaque dispositif de mouvement (13) (14) comprenant un guide rectiligne correspondant (16) (19), une glissière correspondante (18) (22), couplée de façon coulissante audit guide (16) (19), un premier élément d'entraînement mobile correspondant (47) (47') pour un mouvement de ladite glissière correspondante (18) (22), et un moteur électrique (43) (43') pour entraîner ledit premier élément d'entraînement mobile (47) (47') ; l'ensemble (10) comprenant en outre une unité de commande numérique électronique (37) pour commander chacun desdits moteurs électriques (43) (43'), et étant **caractérisé en ce qu'**au moins un des dispositifs de mouvement (13) (14) est un dispositif électropneumatique configurable et comprend en outre un actionneur pneumatique (39) (40) ayant au moins une première chambre à air à volume variable (54) (54') et des moyens (56) pour pressuriser ladite première chambre à air à volume variable (54) (54') et de pousser la roue de polissage (36) contre la feuille (2) ; ledit actionneur pneumatique (39) (40) comprenant un deuxième élément mobile (51) (51'), qui délimite partiellement ladite première chambre à volume variable (54) (54') et est relié à ladite glissière correspondante ; et **en ce qu'**il comprend des moyens de configuration (55, 56) (55', 56') qui peuvent être activés pour relier les premier (47) (47') et deuxième éléments d'entraînement mobiles (51) (51') ensemble de façon rigide ou par interposition de ladite première chambre à air (54)(54').

2. Ensemble selon la revendication 1, **caractérisé en ce que** les deux dispositifs de mouvement (13) (14) sont des dispositifs électropneumatiques configurables.

3. Ensemble selon la revendication 1 ou 2, **caractérisé en ce que** ladite unité de commande électronique (37) comprend des moyens de sélection (38) pour sélectionner une desdites roues de meulage et de polissage (35) (36) et des moyens de commande pour commander lesdits moyens de configuration (55) (56) en fonction de la roue de meulage sélectionnée.

4. Ensemble selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les moyens de configuration comprennent des moyens pneumatiques.

5. Ensemble selon la revendication 4, **caractérisé en ce que** lesdits moyens de configuration comprennent une deuxième chambre à air à volume variable (55) (55') qui peut être pressurisée au moyen d'autres moyens de pressurisation (56).

6. Ensemble selon l'une quelconque des revendications précédentes, **caractérisé en ce que**, lorsque lesdits premier et deuxième éléments d'entraînement mobiles (47) (47') (51) (51') sont directement reliés l'un à l'autre, ils ont des épaulements respectifs qui sont amenés et maintenus en butée l'un contre l'autre par lesdits moyens de configuration.

7. Ensemble selon la revendication 6, **caractérisé en ce que** lesdits épaulements délimitent partiellement ladite chambre à air à volume variable (54) (54') .

8. Ensemble selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ladite première chambre à volume variable (54) (54') s'étend parallèlement à une dite direction rectiligne correspondante (41A) (21) .

9. Ensemble selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ladite première chambre à volume variable (54) (54') s'étend coaxialement à une dite direction rectiligne correspondante (41A) (21) .

10. Ensemble selon l'une quelconque des revendications précédentes, **caractérisé en ce que** chaque dit actionneur pneumatique est un actionneur pneumatique à double action ; ledit actionneur pneumatique à double action ayant un revêtement interne et un plongeur étanche aux fluides qui coulisse dans ledit revêtement interne et délimitant ladite première chambre à volume variable (54) (54') et ladite deuxième chambre à volume variable (55) (55') ; l'un entre ledit revêtement interne et ledit plongeur étant relié de façon permanente à ladite glissière correspondante, et l'autre étant relié de façon permanente audit élément d'entraînement mobile correspondant.

11. Ensemble selon la revendication 10, **caractérisé en ce que** ledit plongeur est relié de façon permanente audit premier élément d'entraînement mobile.

12. Ensemble selon l'une quelconque des revendications précédentes, **caractérisé en ce que** chaque dit dispositif de mouvement (13) (14) comprend en outre un ensemble écrou-vis, qui à son tour comprend une vis, qui s'étend le long de ladite direction rectiligne correspondante et est couplée en rotation audit guide correspondant dans une position axialement fixe, et une vis, qui est fixée angulairement par rapport audit guide correspondant et est reliée de façon permanente audit premier élément d'entraînement mobile correspondant ; ledit premier élément d'entraînement mobile étant tubulaire et ladite vis traversant ledit premier élément d'entraînement mo-

bile et étant tournée par un moteur électrique correspondant.

13. Ensemble selon la revendication 10, **caractérisé en ce que** ledit plongeur est relié de façon permanente à ladite glissière correspondante, et le revêtement interne est relié de façon permanente audit premier élément d'entraînement mobile.

14. Méthode pour le meulage et le polissage d'un angle (2A, 2B) d'une feuille de verre (2), la méthode étant mise en œuvre au moyen d'un ensemble de meulage et de polissage (10) selon l'une quelconque des revendications précédentes et comprenant une étape de meulage de la feuille de verre (2) et une étape ultérieure de polissage de la surface meulée ; dans laquelle ladite étape de meulage est réalisée par la sélection de la roue de meulage (35) et le déplacement dudit arbre entraîné par moteur (33) au moyen de moteurs électriques (43, 43'), et en ce que ladite étape de polissage est réalisée par la sélection de la roue de polissage (36) et l'utilisation d'au moins un actionneur pneumatique (39, 40) pour pousser la roue de polissage (36) contre ladite feuille meulée.

15. Méthode selon la revendication 14, **caractérisée en ce que** ladite étape de polissage est réalisée par l'activation de moyens de configuration (55, 56 ; 55' ; 56') de manière à définir, dans au moins l'une desdites directions, une première chambre à air à volume variable (54, 54') d'un dit actionneur pneumatique correspondant (39, 40) entre un premier élément d'entraînement mobile (47, 47') entraîné par ledit moteur électrique correspondant (43, 43') et un deuxième élément d'entraînement mobile (51, 51') entraîné par ledit actionneur pneumatique correspondant (39, 40) et en pressurisant ladite première chambre à air à volume variable (54, 54') de manière à pousser la roue de polissage (36) au moyen du deuxième élément d'entraînement mobile correspondant (51, 51').

16. Méthode selon la revendication 15, **caractérisée en ce que** ladite étape de meulage est réalisée après une liaison rigide du premier élément d'entraînement (47, 47') et dudit deuxième élément d'entraînement mobile correspondant (51, 51') ensemble.

17. Méthode selon la revendication 16, **caractérisée en ce que** la liaison permanente dudit premier élément d'entraînement mobile (47, 47') audit deuxième élément d'entraînement mobile correspondant (51, 51') est obtenue par dépressurisation de ladite première chambre à air à volume variable correspondante (54, 54') et pressurisation d'une deuxième chambre à air à volume variable correspondante (55, 55') dudit actionneur pneumatique correspondant (39, 40).

18. Méthode selon l'une quelconque des revendications 15 à 17, **caractérisée en ce que** la force de poussée sur ladite roue de polissage (36) est appliquée par variation de la pression dans ladite première chambre à air à volume variable (54, 54').

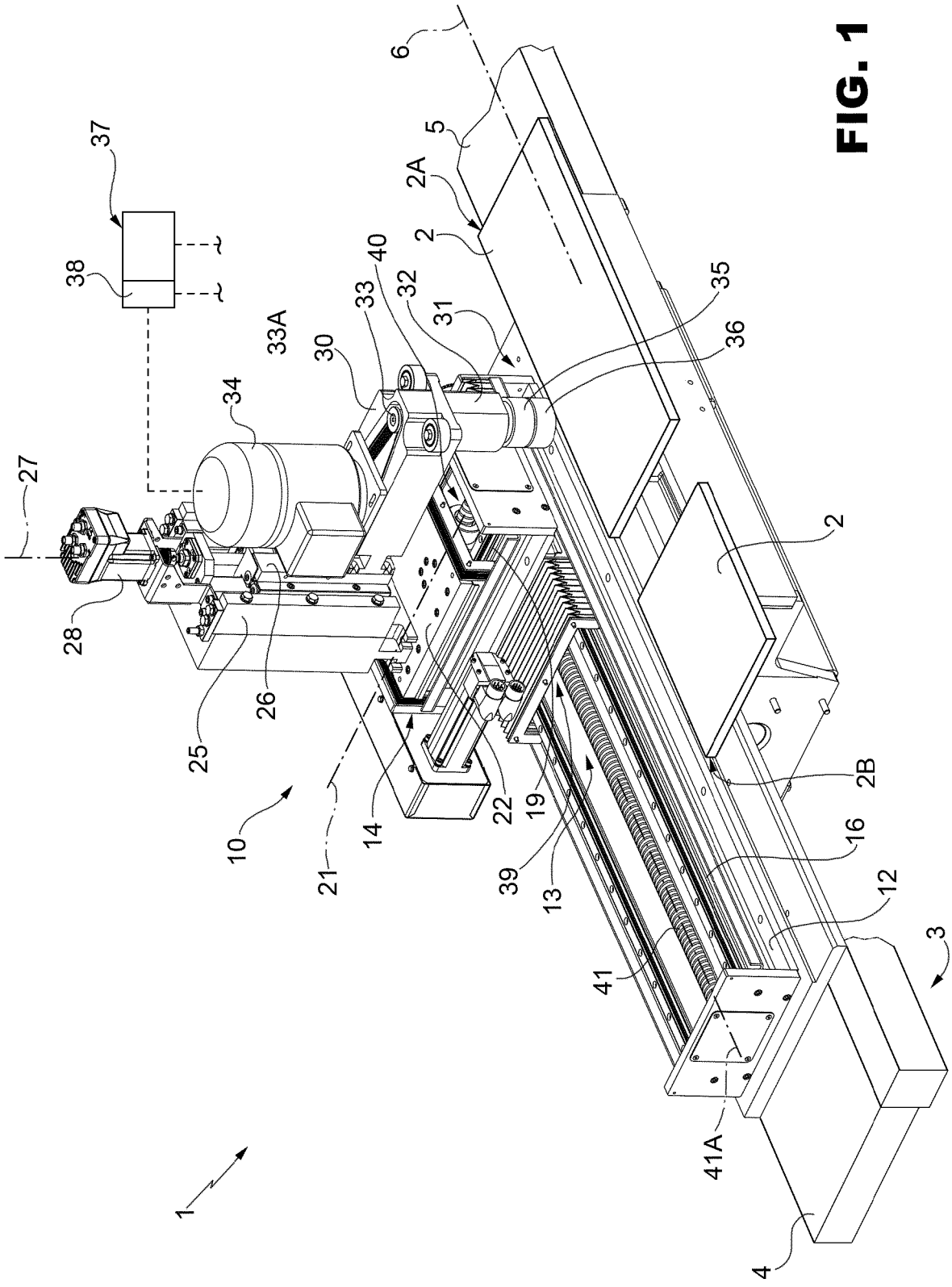

6
5
2A
2
37
38
40
33
32
31
35
36
33A
30
34
27
28
25
26
10
21
14
22
19
39
13
2
2B
16
12
3
41
41A
4
1

FIG. 1

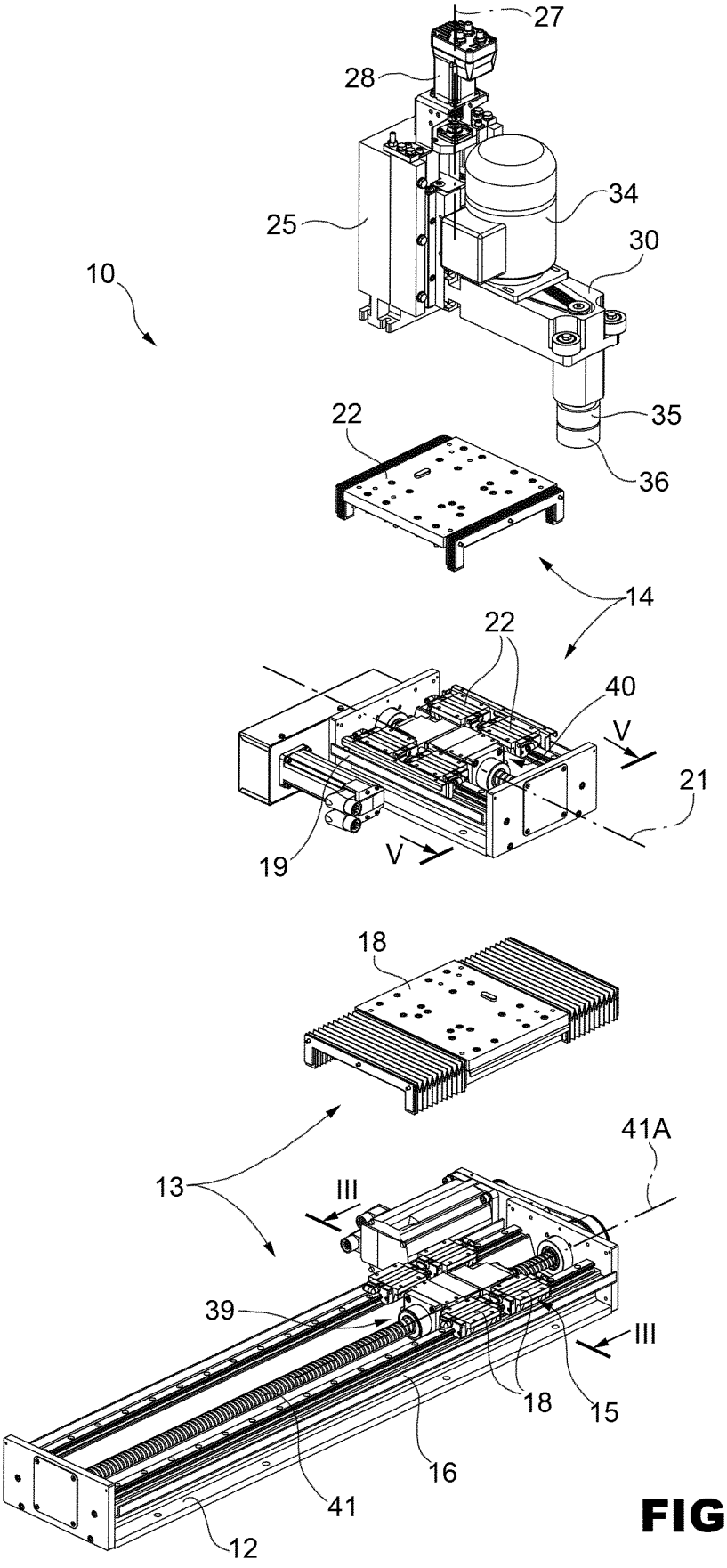

27
28
25
34
30
10
35
22
36
14
22
40
V
21
19
V
18
41A
13
III
39
III
18
15
16
41
12

FIG. 2

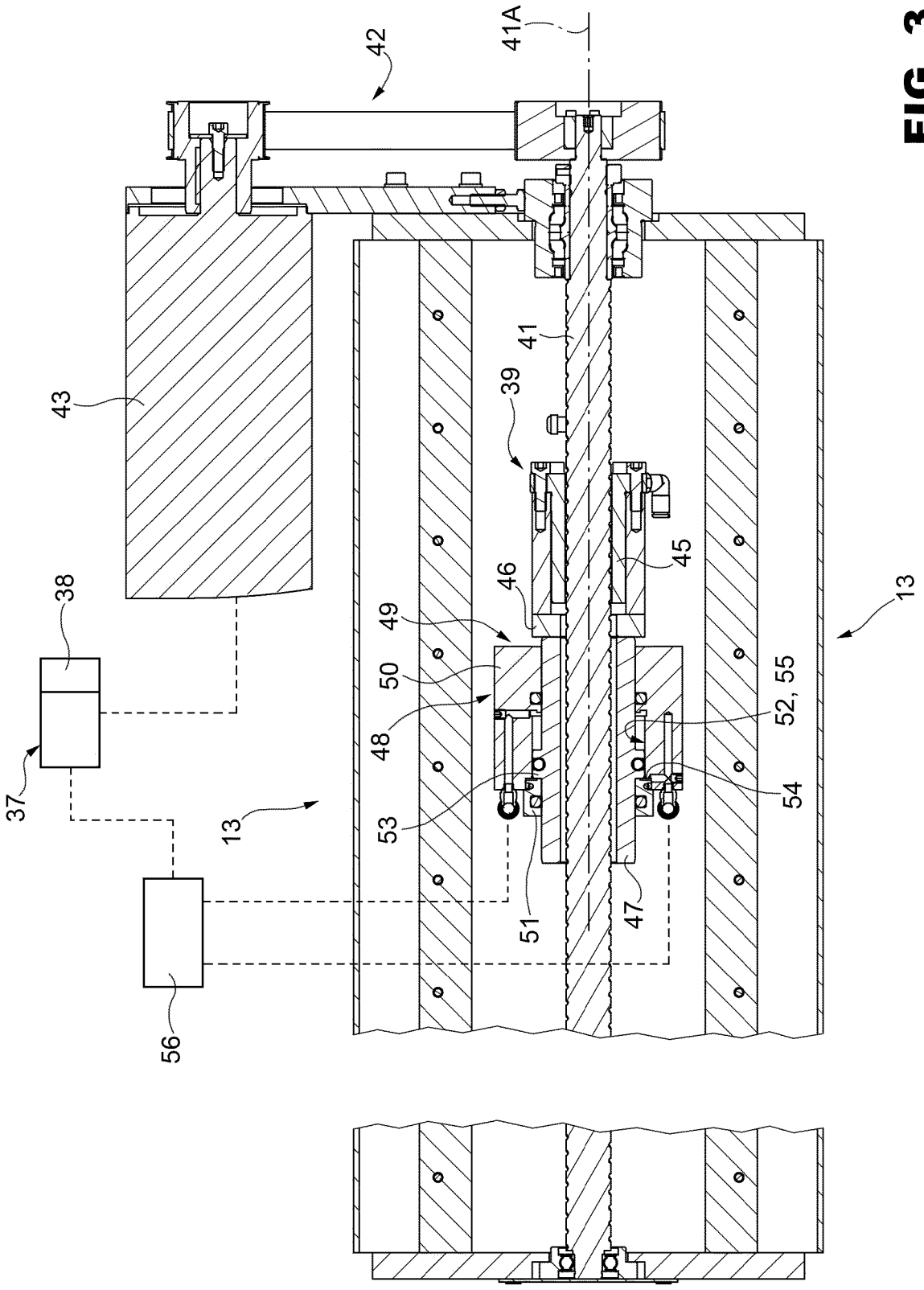
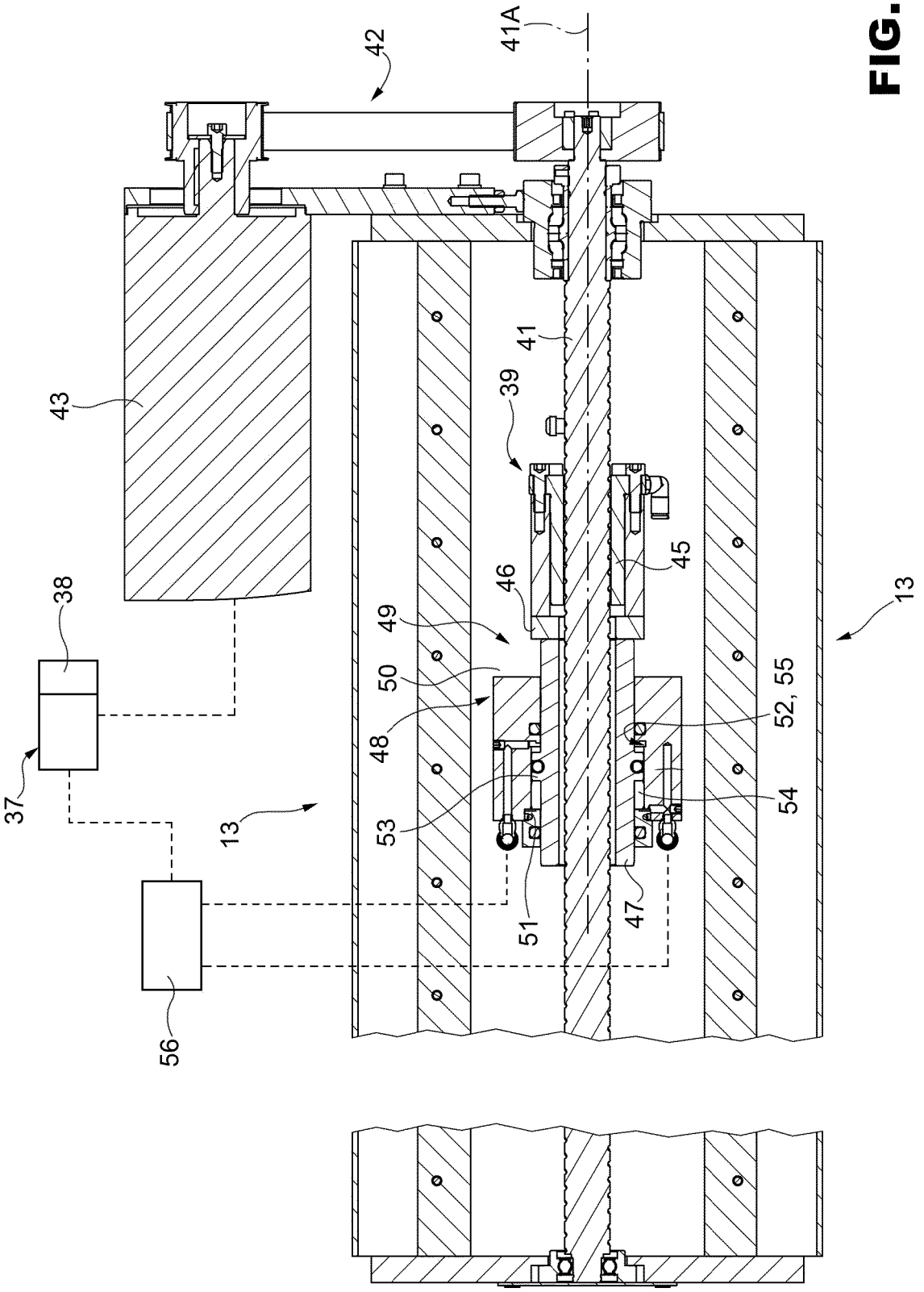


FIG. 3

FIG. 4



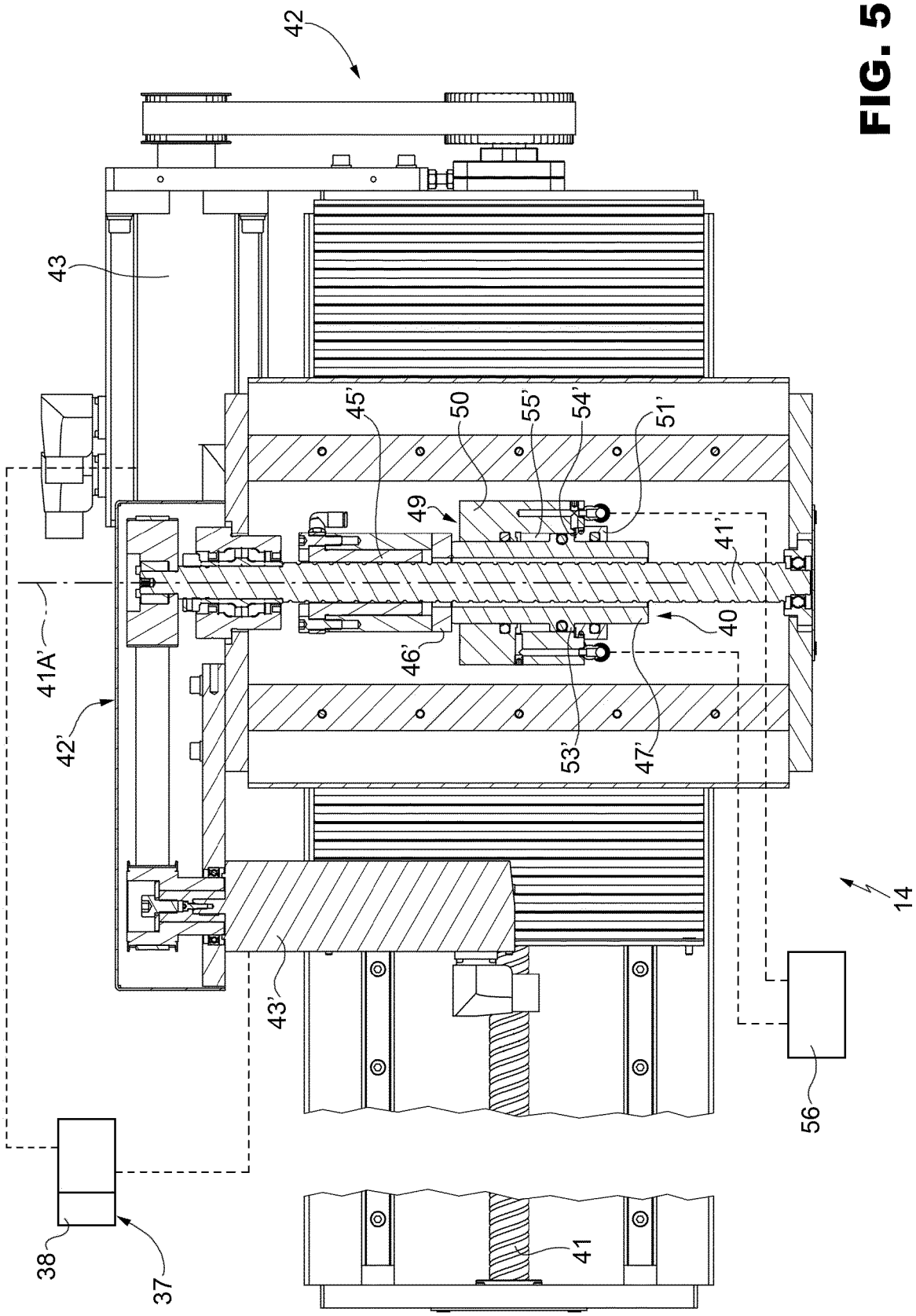
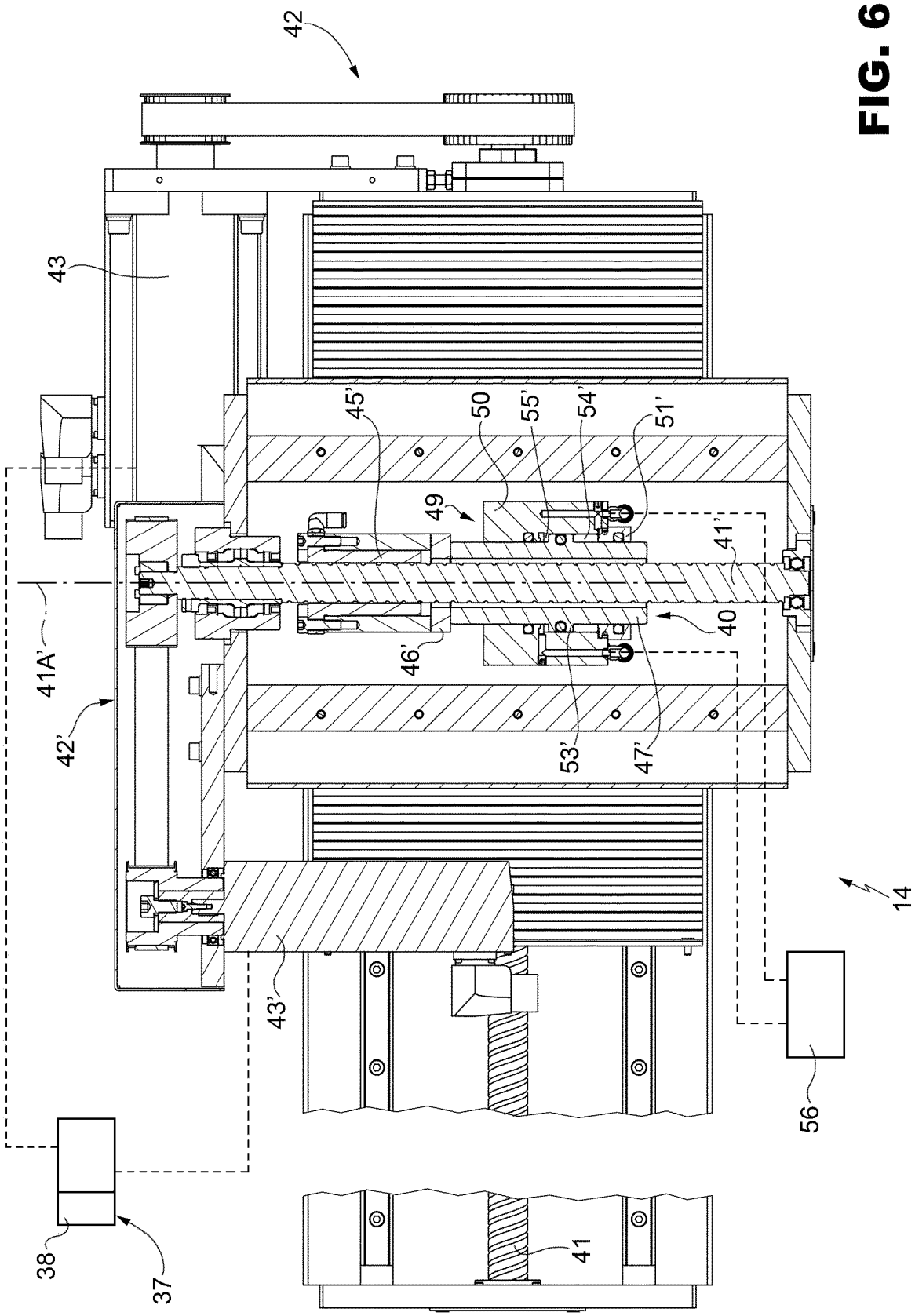


FIG. 5

FIG. 6



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