



(51) International Patent Classification:
B24B 41/06 (2012.01) **B23Q 1/76** (2006.01)

(21) International Application Number:
PCT/EP2011/003189

(22) International Filing Date:
28 June 2011 (28.06.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
MI2010A001437 30 July 2010 (30.07.2010) IT

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

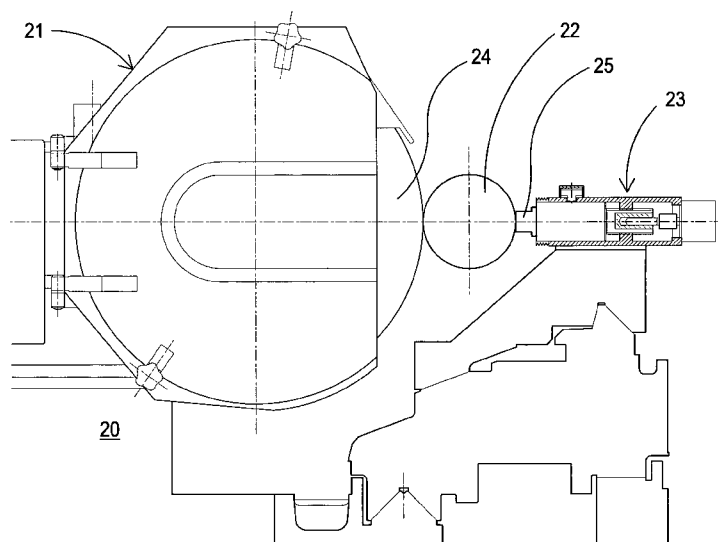
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: CONTRAST DEVICE FOR THE GRINDING OF PRODUCTS HELD BETWEEN CENTRES

Fig. 1



(57) Abstract: A contrast device for the grinding of products, particularly but not exclusively cylinders, held between centres, wherein a grinding machine (21) comprises a holding structure (20) equipped with a grinding wheel (24) to which a cylinder to be processed (22) is opposed, and the contrast device (23) is situated on the opposite side of the cylinder (22) with respect to the grinding wheel (24), the contrast device (23) comprising a slide (25) assembled on a short pipe (26) sliding inside a body (27) of the contrast device (23) by an interposed actuator (28, 35), there also being a blocking element (29) of the relative position of the short pipe (26) with respect to the body (27) and an irreversible blocking device (31, 32, 33) of the position of the pipe (26) with respect to the cylinder (22).

CONTRAST DEVICE FOR THE GRINDING OF PRODUCTS HELD BETWEEN CENTRES

The present invention relates to a contrast device for the grinding of products held between centres, particularly but not exclusively for cylinders.

In the field of cylinder grinding in general, a particular sector relates to the grinding of thin cylinders, thus called as the diameter/length ratio is extremely small.

10 An example of these cylinders is that of cylinders used in laminators in which two fundamental problems must be solved.

A first problem is that, during the grinding process, the grinding wheel, in order to be able to carry
15 out its function, must exert a thrust on the cylinder. This thrust, due to the slenderness of the cylinder being processed, generates a deflection of the cylinder itself which makes it impossible to obtain a satisfactory geometry, either in terms of profile or roundness.

20 A second problem lies in the fact that, at times, the combination of these forces with the thin form of the cylinder causes chattering between the grinding wheel and cylinder, which makes the surface of the cylinder unacceptable.

25 These problems are generally faced by applying one

or more contrast units on the supporting bench of the cylinder, which apply a force to the cylinder which is such as to balance that generated by the grinding wheel.

The contrast devices can be driven manually or automatically; in particular those driven automatically can be indifferently assembled on manual or automatic cycle machines.

In view of the general difficulties indicated above, it is possible to specifically define the objectives that the designer of these contrast devices is trying to achieve.

These objectives are generally the following:

- a) relatively small contrast force: the contrast device must be capable of exerting relatively small forces on the cylinder, possibly tending towards zero. If it exerts a much higher force on the cylinder with respect to the grinding wheel, also due to the fact that the contrast device and grinding wheel do not always lie on the same plane, it can deform the cylinder in the opposite sense, generating the same problem which would arise if only the grinding wheel were acting on the cylinder;
- b) constant contrast force during the grinding cycle: during the grinding cycle, the diameter of the cylinder decreases; the position of the contrast device must therefore be adjustable, in order to maintain a constant

contrast force for the whole duration of the grinding cycle;

c) high rigidity of the contrast device in the same direction and advance route of the grinding wheel: when the grinding wheel is in contact with the cylinder during the grinding, it may happen that, due to form errors of the grinding wheel itself, the force exerted by it on the piece being processed depends on its angular position. In particular, an increase in this force can cause a bending of the cylinder. The contrast device must be capable of opposing these force gradients, preventing the deformation of the cylinder.

The same phenomenon can be caused by form errors, this time on the cylinder, especially in the initial grinding phases; an eccentricity and/or circularity error can in fact generate forces which tend to move the contrast device as in the case of form errors of the grinding wheel. The contrast device must be able to also oppose these forces, preventing the deformation of the cylinder;

d) high protection degree of the contrast device with respect to the outside environment: contrast devices, however they may be, are extremely precise mechanical or electromechanical devices. They operate however in an extreme environment: the grinding area where these devices

are positioned, is in fact under the action of cooling sprays, polluted by fragments of the grinding wheel and parts of metal removed from the cylinder. It is therefore evident that contrast devices must be designed so as to envisage adequate countermeasures to preserve the mechanisms from the environment described above;

e) possibility of grinding damaged cylinders in automatic mode: grinding machines must very often restore cylinders which have been involved in lamination "accidents". These cylinders are normally damaged in varying degrees and under various aspects, among which: surface, eccentricity and circularity, can be mentioned.

In this situation, in order to be capable of grinding in automatic mode, the contrast device must be sufficiently rigid as to be able to inflect the cylinder, in order to "give it" the desired form.

It should be pointed out that the known contrast devices are not able to satisfy all these objectives from a) to e).

With respect to the known art, it should be noted that the contrast units indicated above generally consist of the following parts:

- a slide on which the surface of the rotating cylinder slides, made of a material having a low friction coefficient;

- a short pipe whereby it is possible to move the slide towards or away from the cylinder by activating a screw control; and

- a supporting structure of the short pipe which is
5 fixed to the bench of the machine.

Furthermore, the known contrast units can be driven in two ways:

manually: in this case the screw control is activated by the rotation of a handwheel; by rotating the
10 handwheel, the operator can regulate the contrast force applied by the slide to the cylinder;

automatically: in this case, numerous solutions have been attempted, among which the following can be mentioned: rotation of the screw driven by an electric servomotor and rotation of the screw driven by a pneumatic
15 servomotor. In any case, the system includes a detection system of either the establishment of the force applied to the slide or a magnitude proportional thereto.

As already indicated, this state of the art has a
20 series of problems.

In the case of manually controlled contrast devices, good results can be obtained, but this possibility is essentially linked to the ability and experience of the operator; furthermore, as already observed, the use of
25 these devices is limited to grinding machines which func-

tion according to a manual cycle.

The situation changes radically if the control of the contrast device is to be effected automatically. The traditional design of the known automatic devices described is in fact only capable of providing a satisfactory response to some of the above requisites a) to e). In spite of repeated attempts, none of the solutions so far proposed has been capable of solving the following problems: relatively small contrast force and constant contrast force during the grinding cycle.

The reason it is so difficult to achieve these two objectives essentially lies in the fact that when the slide must be moved, the motor must apply a torque to the screw which is sufficient for overcoming the friction of the first detachment between the screw and female screw and short pipe and guide, in addition to the inertias of the motor itself and parts in rotation and in translation. Even if many solutions have been applied for limiting the effects of this friction, the torque necessary for moving the mechanism is much higher than that necessary for exerting the contrast force and consequently the force that the mechanism exerts on the cylinder is generally higher than that requested. Furthermore, as the screw translation mechanism is generally irreversible and due to the necessity of having a support of the contrast

device which is as rigid as possible, this force remains applied to the cylinder. In this way, the control system of the force corrects the position of the slide in an attempt to diminish this force and allow it to converge to the desired value for subsequent approximations.

An automatic control system of the thrust force of the slide on the cylinder according to the current technology is therefore extremely complicated and the oscillation of the force around the desired value generates an instability phase in the equilibrium of the cylinder which is reflected in surface defects of the cylinder itself.

Finally, it is known that the thinner the cylinder is, the greater the problem of the stability of the force becomes.

A general objective of the present invention is to solve the drawbacks of the known art cited above in an extremely simple, economical and particularly functional manner.

A further objective of the present invention is to provide a contrast device for grindings, which is particularly but not exclusively for cylinders held between centres, which satisfies all five of the objectives specified above.

Yet another objective of the invention is to provide

a contrast device for the grinding of cylinders held between centres which is suitable for grinding machines with both manual and automatic cycles.

In view of the above objectives, according to the present invention, a contrast device has been conceived for the grinding of cylinders held between centres having the characteristics specified in the main claim and enclosed subclaims.

The structural and functional characteristics of the present invention and its advantages with respect to the known art will appear even more evident from the following description, referring to the enclosed schematic drawings, which, among other things, show an illustrative embodiment of a contrast device for the grinding of cylinders held between centres produced according to the same invention.

In the drawings:

- figure 1 is an enlarged raised sectional schematic side view of a grinding machine for cylinders with a contrast device according to the present invention:

- figure 2 is a schematic view from above showing the application of various devices as shown in figure 1;

- figure 3 is a raised view according to the arrow F of figure 1;

- figure 4 is an enlarged sectional schematic view

of a contrast device for the grinding of cylinders held between centres as shown in figure 1 in a non-operative position;

- figures 5 to 12 are views as per figure 4 illustrating the various operative phases of the contrast device according to the invention.

With reference to figures 1-4, these show an illustrative application of a contrast device for the grinding of cylinders held between centres. In particular, it can be observed that a so-called thin cylinder 22 (very small diameter/length ratio) is positioned in a holding structure 20 of a grinding machine 21. At least one contrast device 23 according to the invention is situated between the centres of the grinding machine in turn constrained to the holding structure 20 on the opposite side of the cylinder 22 with respect to a grinding wheel 24, also constrained to the holding structure 20. Figure 2 shows how there can also be the application of several contrast devices 23 all acting contemporaneously on the cylinder 22 on the opposite side with respect to the grinding wheel 24.

A contrast device 23 according to the invention, better illustrated in figures 4 and 5, comprises a slide 25, produced with a material having a low friction coefficient, which rests and slides against the cylinder 22

being processed.

The slide 25 is assembled on a short pipe 26 which slides inside a body 27 of the contrast device 23. The coupling between the parts - the body 27 and short pipe 5 26 - is protected in the front part by means of flexible expandable bellows 28, sealed and constrained to both parts. The bellow device 28 surrounds an end of the short pipe 26 and is constrained at its terminal ends to the body 27 and short pipe 26.

10 A blocking piston 29 is also envisaged, which blocks the relative position of the short pipe 26 with respect to the body 27. The piston 29 is for example of the simple effect type and is positioned in a normal direction with respect to a longitudinal axis 30 of the contrast 15 device 23.

The piston 29 exerts a force perpendicular to the axis 30 of the short pipe 26 which is sufficient for guaranteeing its axial stability due to the friction created.

20 Finally, a screw 31 is assembled in the rear part of the body 27 of the contrast device 23, which rotates inside a screw die 32, integral with the body 27, which is activated by a motor 33 and which acts as an irreversible blocking means of the position of the short pipe 26 with 25 respect to the cylinder 22.

For this purpose, the shaft of the motor 33 and the screw 31 are connected by means of a coupling capable of transmitting the torque and allowing reciprocal axial sliding.

5 The free end of the screw 31, opposite the motor 33, rests on a bottom of the short pipe 26.

A control system 34 of the contrast device 23 feeds pressurized air into an expandable chamber 35 defined by the bellows 28 and outer surface of the short pipe 26.

10 With reference to figures 4-12, the contrast device according to the invention functions according to the following method.

In a first phase, once the cylinder 22 has been assembled between the centres C, the slide 25 is moved towards the cylinder 22, from the position of figure 4 to
15 that of figure 5.

In order to effect this, the control system 34 of the contrast device 23 sends pressurized air into the chamber 35 defined by the bellows 28 and outer surface of the short pipe 26. As a result of this pressure, the bellows 35 - being constrained to the body 27 of the contrast device 23-, can only extend in one direction entraining the short pipe 26 and consequently the slide 25. When the slide 25 strikes the surface of the cylinder 22
20 being processed, it exerts a greater force than that re-
25

quired, due to the mass inertia of the short pipe 26 and that of the slide 25. As there is nothing which restricts the movement of the slide 25 in the opposite direction, however, the force is stabilized very shortly after the
5 impact, at a value equal to the air pressure for the annular surface defined by the bellows 28 and short pipe 26 which can therefore be determined as desired by varying one or both of these parameters.

In this way, the first objective previously indicated of a relatively small contrast force (objective a)
10 is effectively achieved.

Furthermore, the air pressure in the annular chamber 35 defined by the bellows 28 generates a slight pressurization inside the system which guarantees the mechanisms
15 from contamination on the part of particles coming from the outside environment, thus also achieving the objective (objective d) of a high protection degree of the device with respect to the outside environment.

Once this position and condition have been reached,
20 the pneumatic cylinder 29 is activated so as to release its force on the short pipe 26 thus exerting a braking force (figure 6). The braking force depends on the friction coefficient between the piston of the cylinder 29 and the short pipe 26 and can be determined as required
25 in the project phase by acting, once again, on the feed-

ing pressure or on the diameter of the cylinder or both.

At this point, the screw 31 is activated by the motor 33 (figure 7) and advances inside the screw die 32 sending the head of the screw itself in contrast with the butt of the short pipe 26. As the short pipe 26 has already braked, the position of the slide 25 is not altered and the force exerted by the slide 25 on the cylinder 22 does not vary. At the same time, the new position of the screw 31 guarantees the stability of the position of the short pipe 26.

In this way, the objective of high rigidity of the contrast device (objective c) has also been achieved.

The grinding can therefore be effected with excellent performances and results obtained on the cylinders being processed.

It is also evident that each time the grinding wheel 24 arrives at the end of the passage and consequently does not exert any pressure on the cylinder 22, the contrast force generated by one or more slides 23 must be re-established. Otherwise, due to the decrease in the diameter of the ground cylinder 22, this force would progressively diminish until it becomes null.

For this purpose, pressure is removed from the chamber of the pneumatic cylinder 29. In this way, the bellows 28 can receive further air and push the short pipe

26 and the slide 25 against the cylinder 22 being processed once again, as previously illustrated (figure 8).

As already indicated, after a very short period of time, the pressure in the chamber 35 between the bellows 28 and short pipe 26 is stabilized and the pneumatic brake can be re-blocked, i.e. the piston of the cylinder 29 can be engaged again on the short pipe 26 (figure 9).

Finally, to conclude what has already been seen previously, the screw 31 is activated again in order to guarantee the irreversibility of the position of the short pipe 26 (figure 10).

In this way, the objective of high rigidity of the contrast device 23 is again achieved and it can consequently be affirmed that the contrast force remains practically constant for the whole grinding cycle (objective b).

The contrast device according to the invention therefore achieves the general objective previously specified.

With this device, it is also possible however to process damaged cylinders on the grinding machine.

Once said cylinder 22 has been positioned between the centres, in fact, proceeding as in the previous case, the control system 34 of the contrast device 23 sends

pressurized air into the chamber 35 between the bellows 28 and short pipe 26. The situation previously described whereby the slide moves towards the cylinder (figure 11) is obtained.

5 The force is therefore stabilized at a certain desired value, defined by the annular surface and feeding pressure.

At this point, the screw 31 is activated by the motor 33 sending the head of the screw itself 31 in contrast with the butt of the short pipe 26. As the short pipe 26 has not braked, the screw 31 is capable of exerting a force on the slide 25 which is in relation to the torque applied to the screw 31 control. If this force is sufficiently great, it is capable of bending the cylinder 10 22 and keeping it in that position, thanks to the irreversibility of the movement of the screw 31 (figure 12).

In this way the remaining objective specified above of the possibility of grinding damaged cylinders (objective e) has also been achieved.

20 The value of this force can obviously be regulated as required by means of the torque applied to the screw 31.

The objective mentioned in the preamble of the described has therefore been achieved.

25 The contrast device according to the invention is

particularly appreciated in completely automatic plants, where the operator can control the same device inside a control cabin and is consequently perfectly isolated from the surrounding polluted environment.

5 The forms of the structure for producing a contrast device 23 of the invention, as also the materials and assembly modes, can obviously differ from those shown for purely illustrative and non-limiting purposes in the drawings.

10 The protection scope of the invention is therefore delimited by the enclosed claims.

CLAIMS

1. A contrast device for the grinding of products, for example cylinders, held between centres, wherein said grinding machines (21) comprise a holding
5 structure (20) equipped with a grinding wheel (24) to which a cylinder to be processed (22) is opposed, and at least one contrast device (23) is situated on the opposite side of the cylinder (22) with respect to the grinding wheel (24), the contrast device (23)
10 comprising a slide (25) assembled on a short pipe (26) sliding inside a body (27) of the contrast device (23) by an interposed actuator (28, 35), there also being a blocking element (29) of the relative position of the short pipe (26) with respect to the body (27) and an
15 irreversible blocking device (31, 32, 33) of the position of the pipe (26) with respect to the cylinder (22).

2. The contrast device according to claim 1, characterized in that said blocking element (29) is a
20 piston.

3. The contrast device according to claim 1, characterized in that said interposed actuator consists of an expandable annular chamber (35) defined between bellows (28), which surrounds an end of said short pipe
25 (26) and is constrained at its ends to said short pipe (26) and to said body (27) of the device, said chamber (35) being connected to a control system (34) of the contrast device (23).

4. The contrast device according to one or more of
30 the previous claims, characterized in that said blocking piston (29) of the relative position of the short pipe (26) with respect to the body (27), is of

the simple effect type and is situated in a normal position with respect to a longitudinal axis (30) of the contrast device (23).

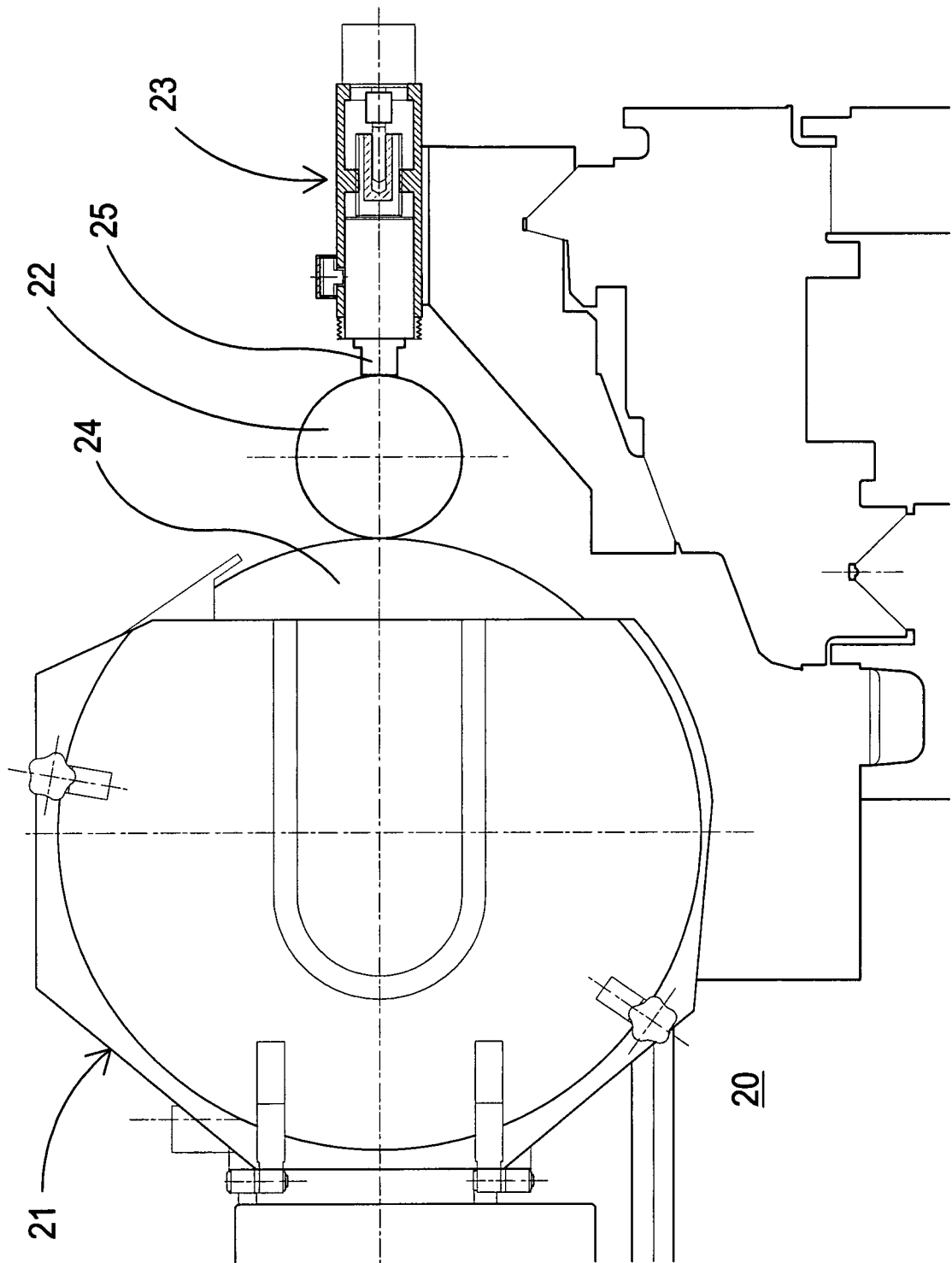
5 5. The contrast device according to one or more of the previous claims, characterized in that said irreversible blocking device of the position of the short pipe (26) with respect to the cylinder (22) comprises a screw (31) which rotates inside a screw die (32), integral with the rear end of the body (27) is
10 activated by a motor (33) and rests on a bottom of said short pipe (26).

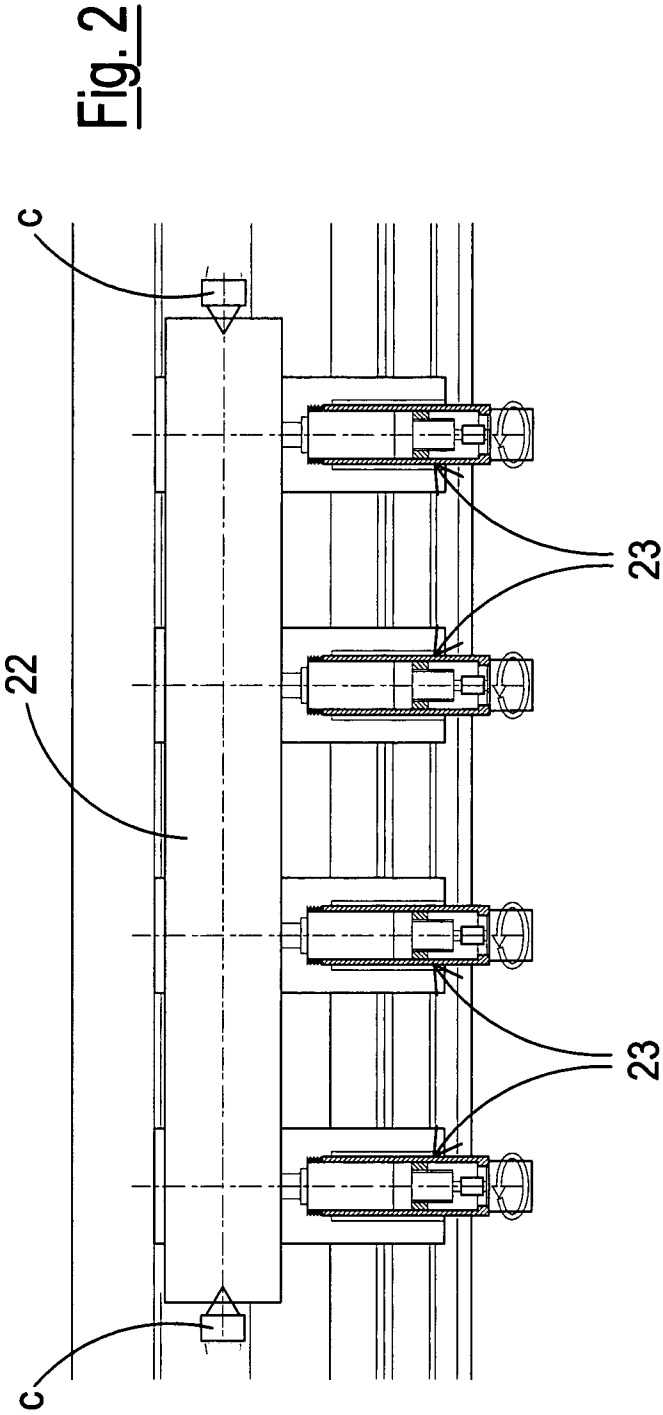
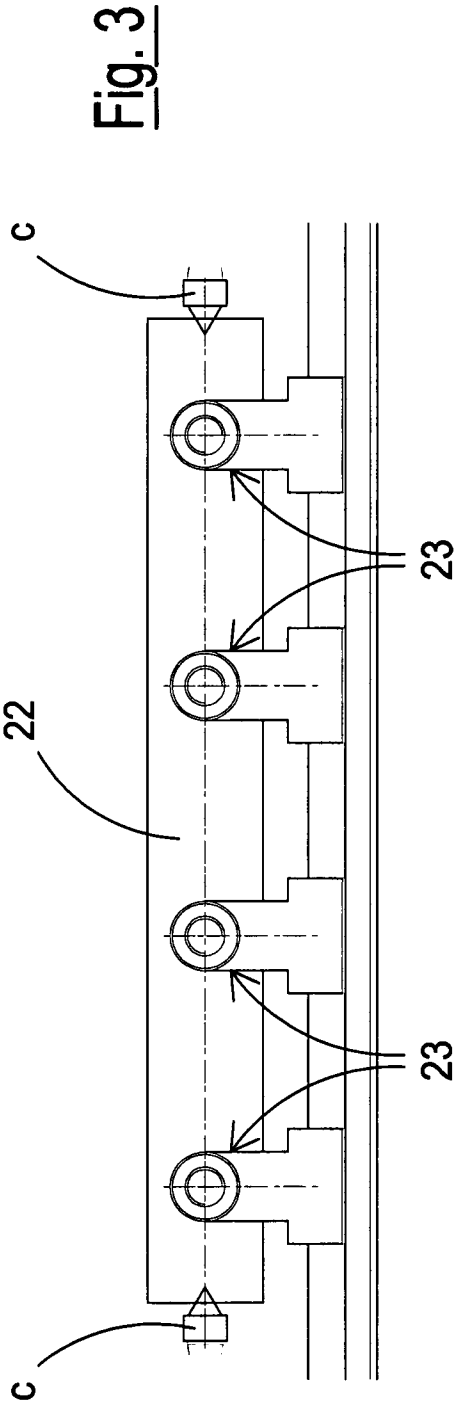
6. The contrast device according to one or more of the previous claims, characterized in that said slide (25) is made of a material with a low friction
15 coefficient.

7. The contrast device according to one or more of the previous claims, characterized in that it is arranged in a certain number on the opposite side with respect to said grinding wheel (24).

20

Fig. 1





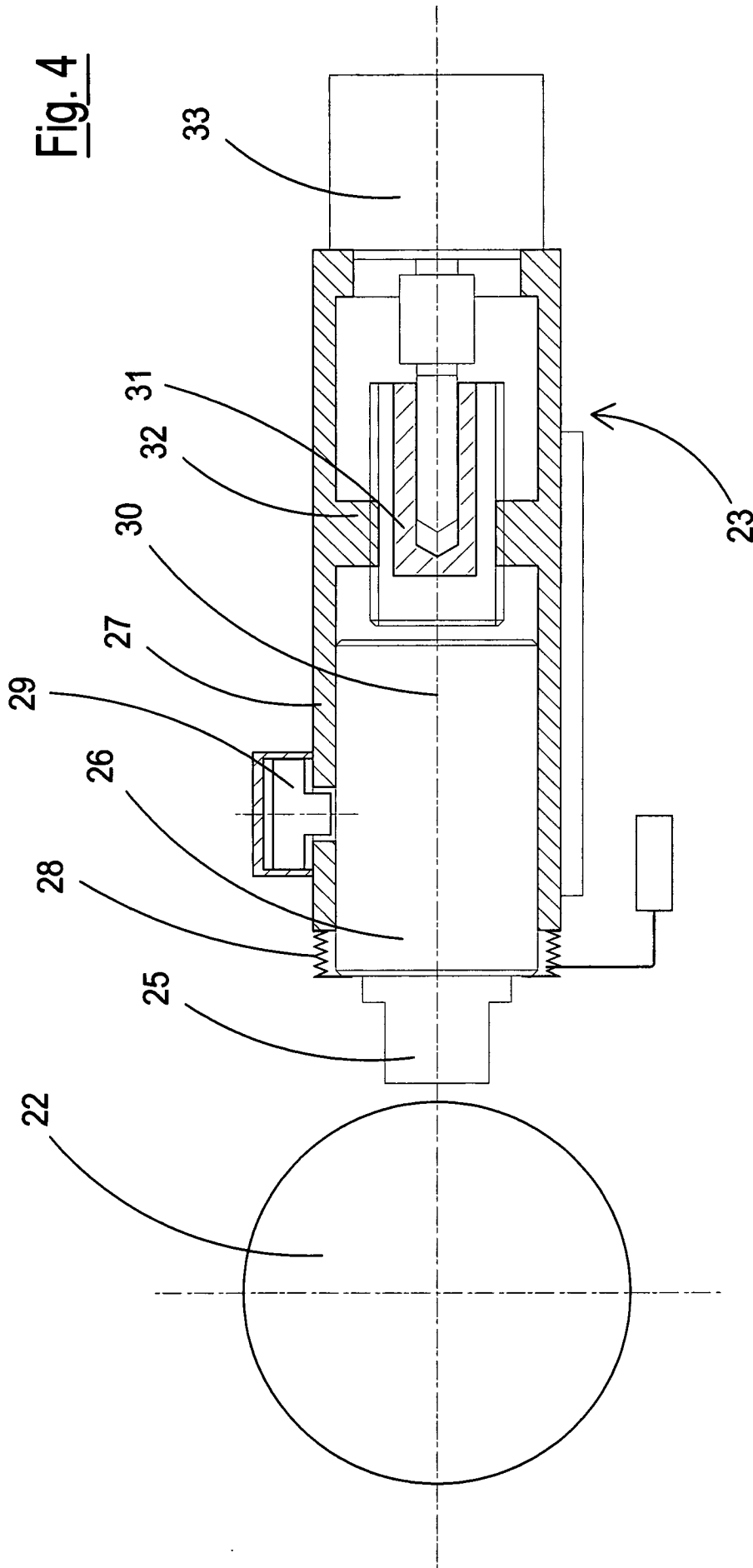
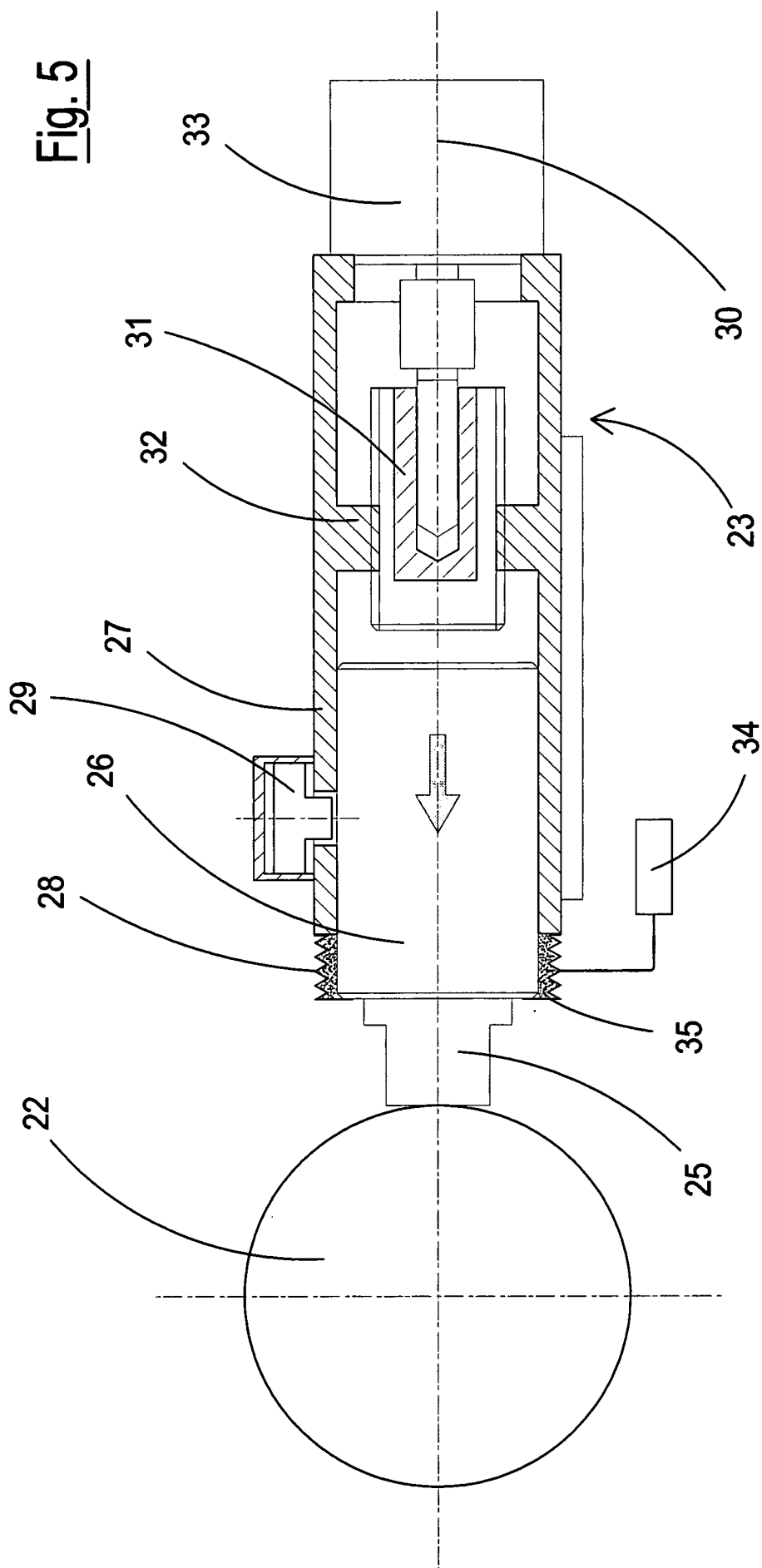
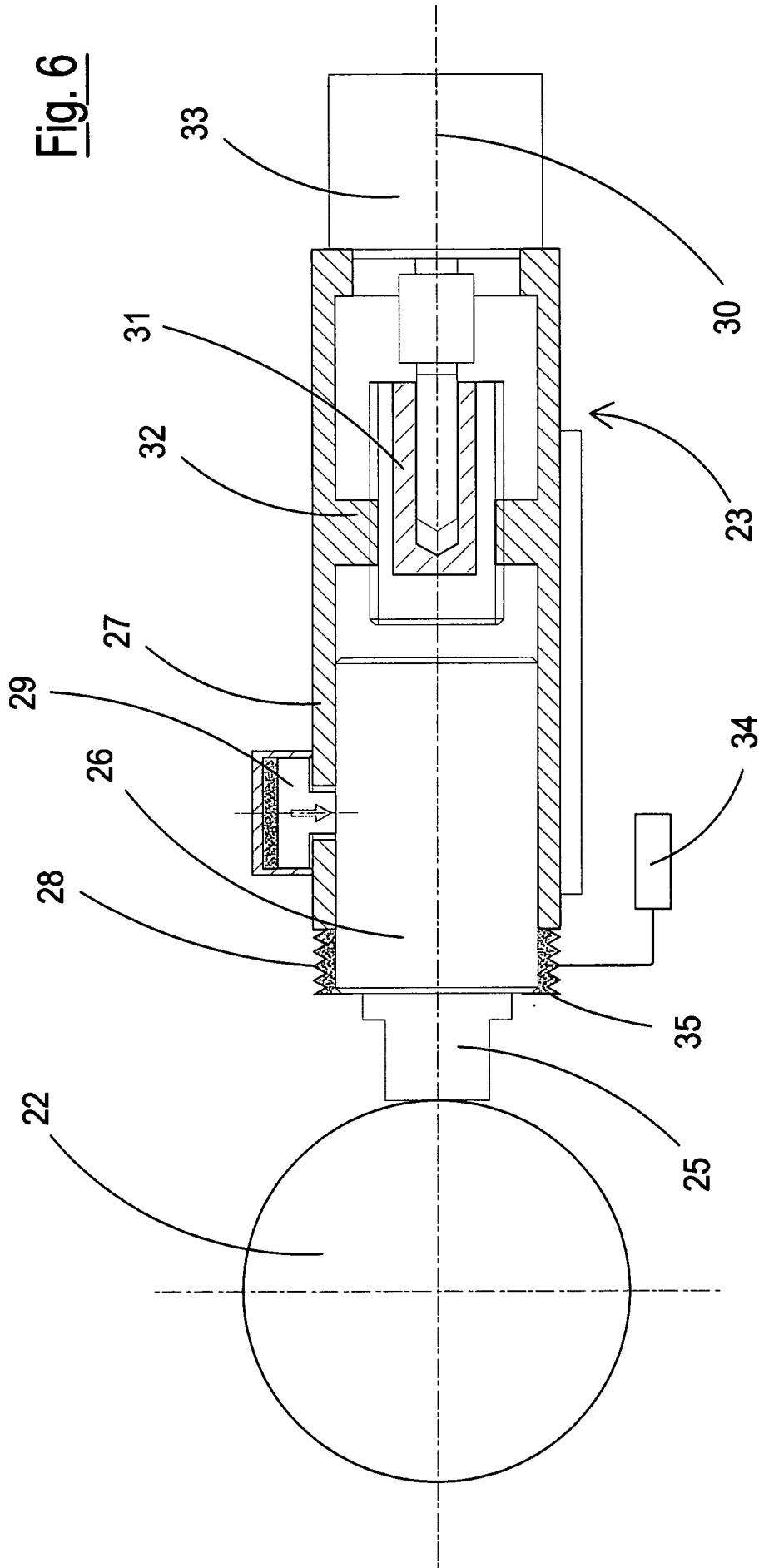
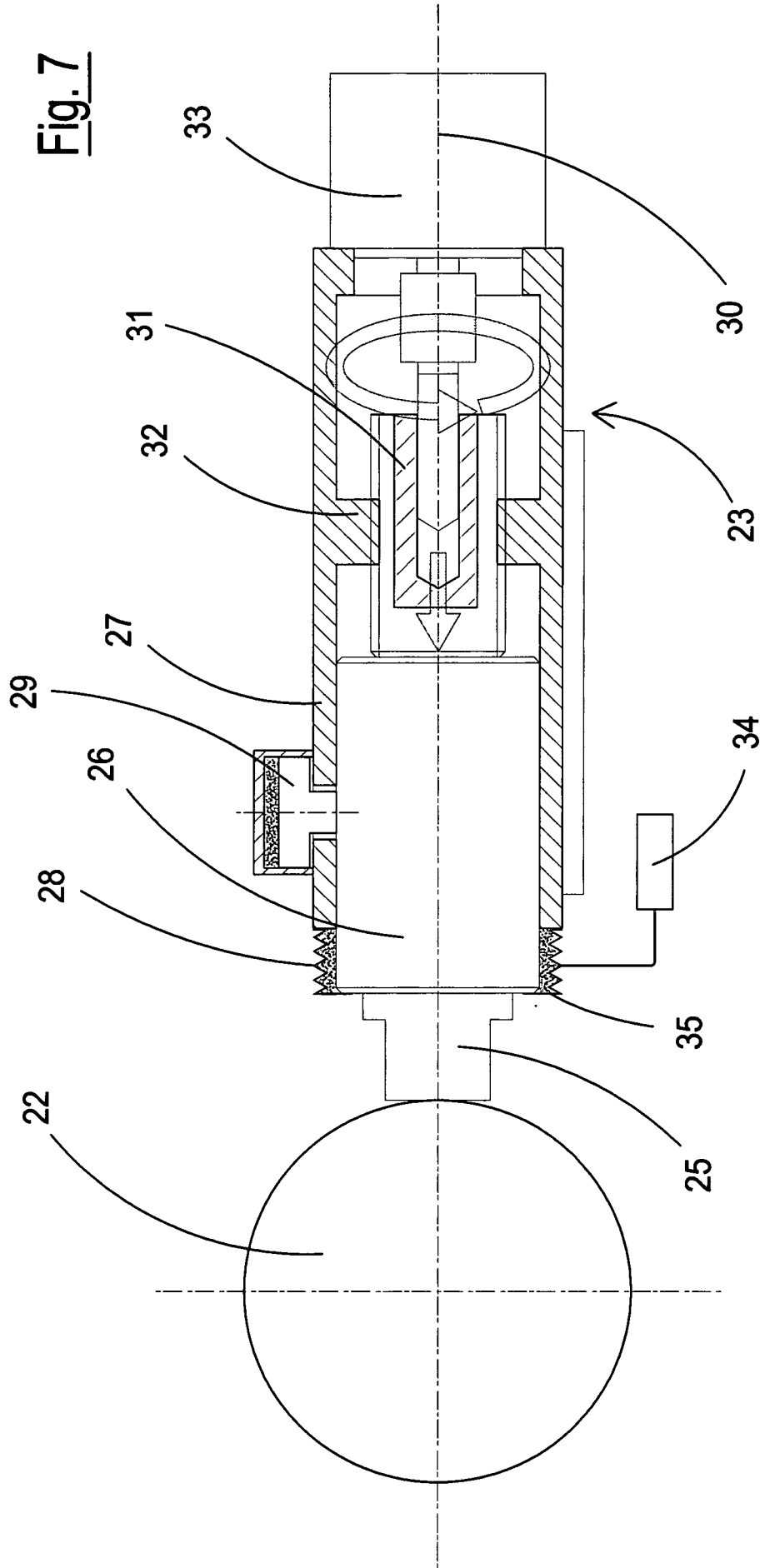
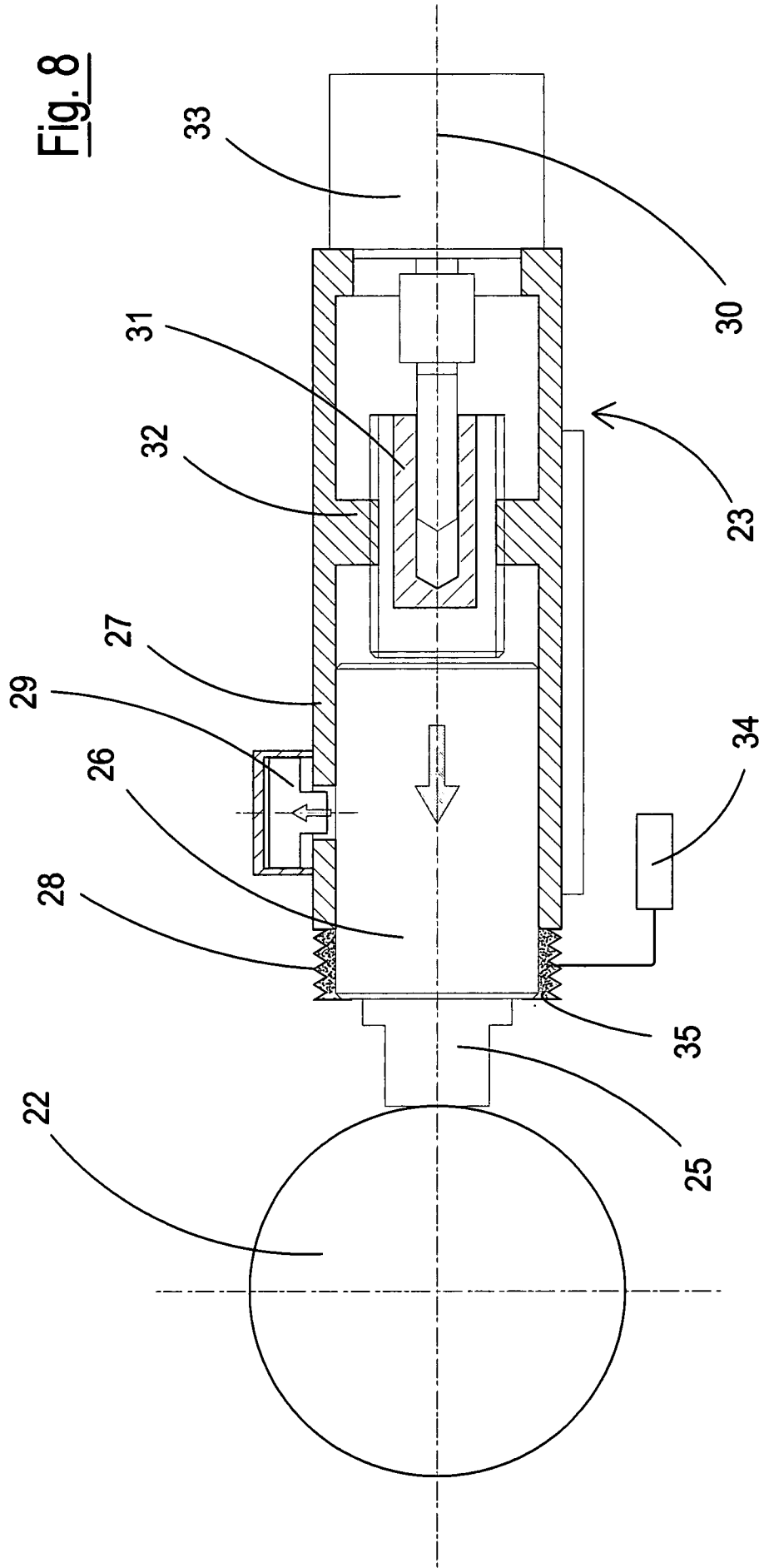


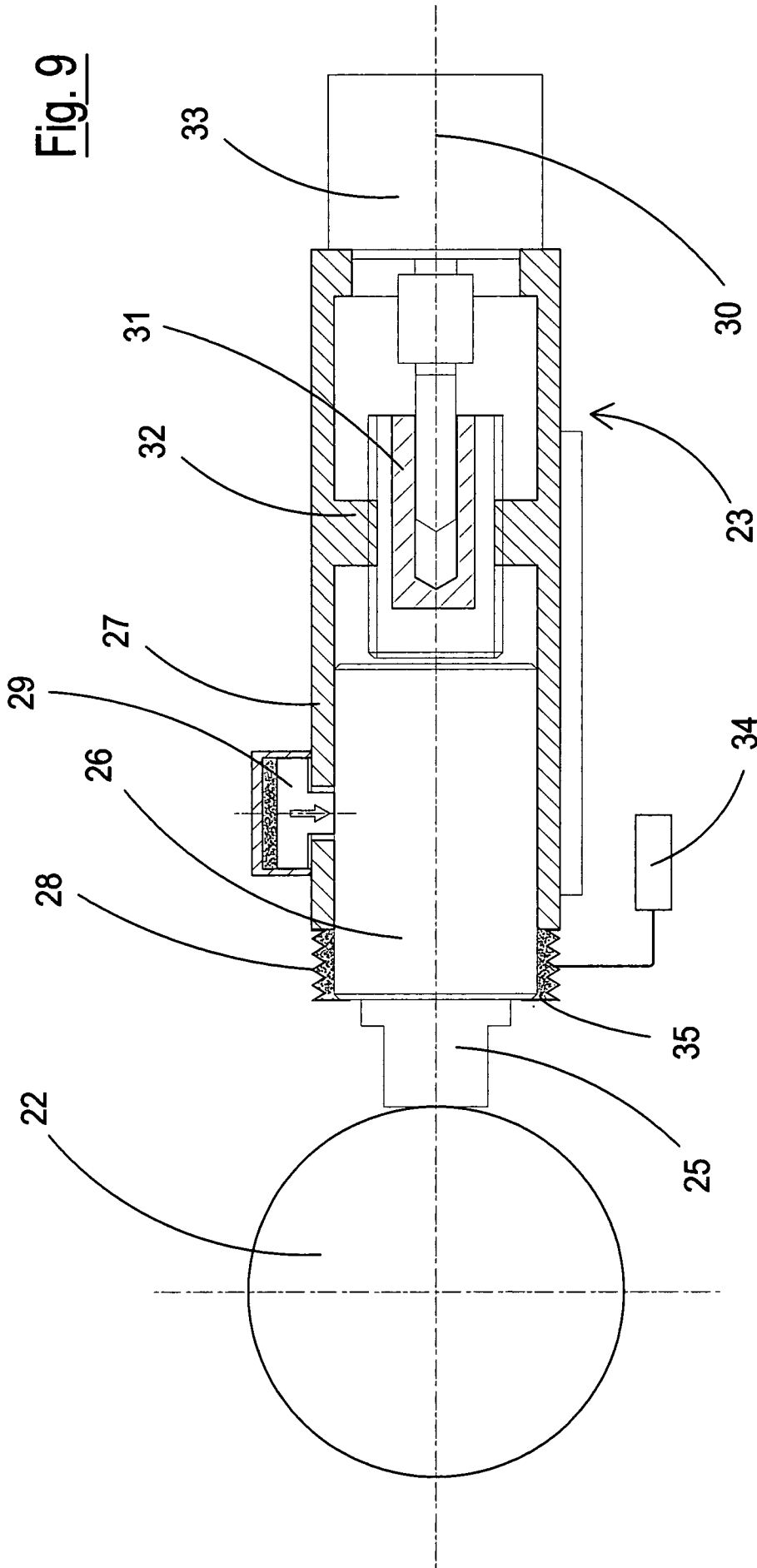
Fig. 5

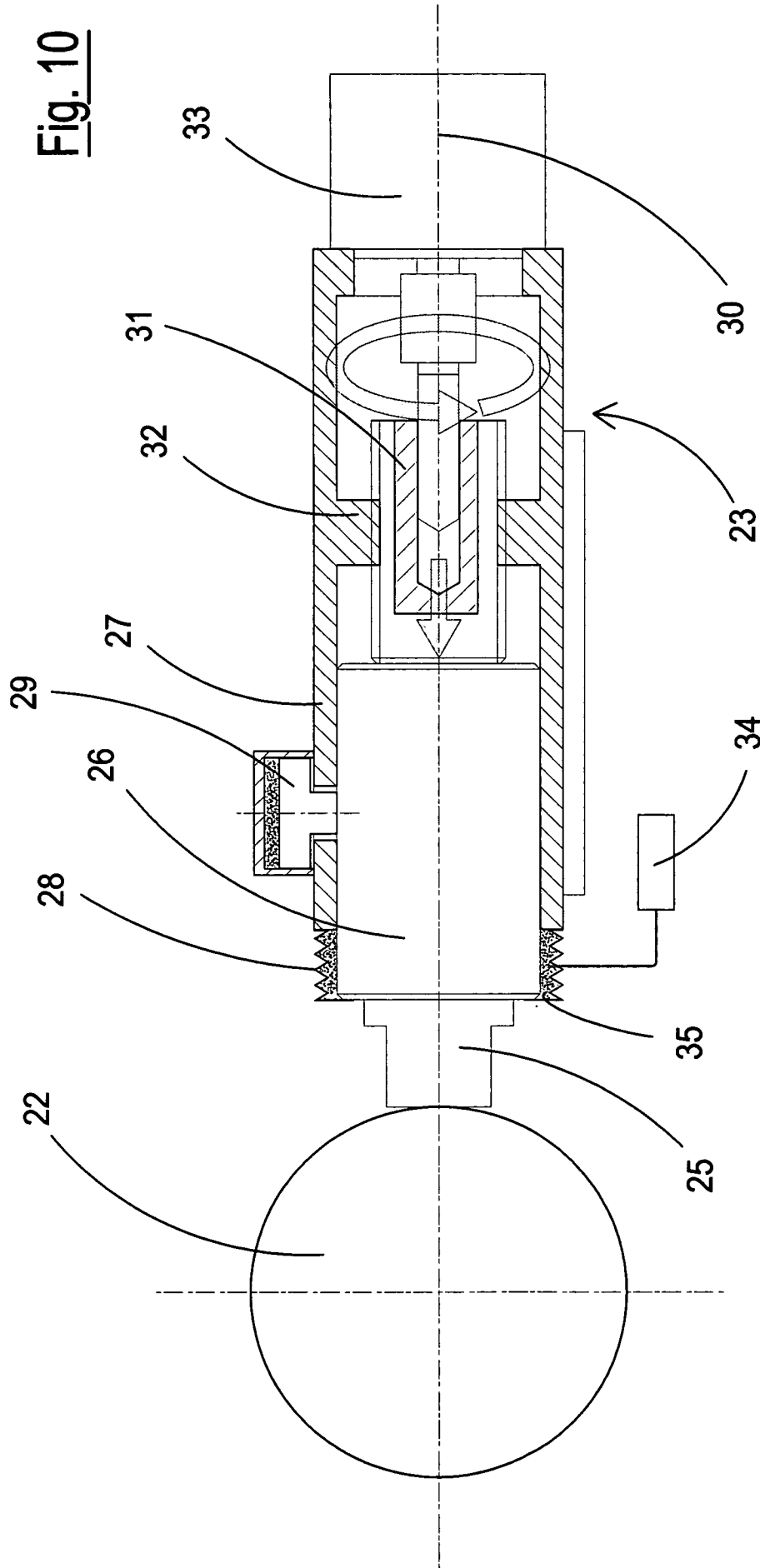












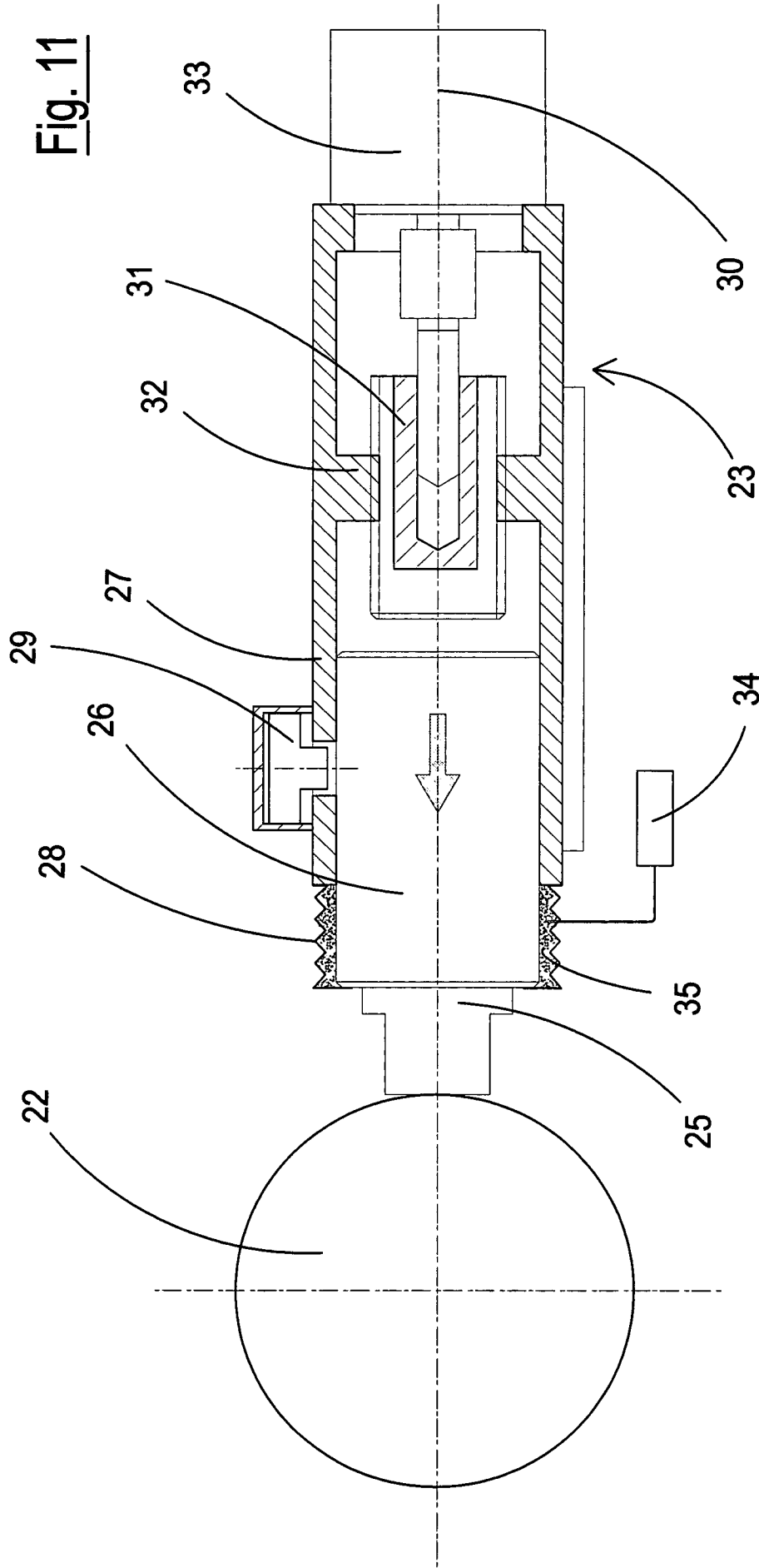
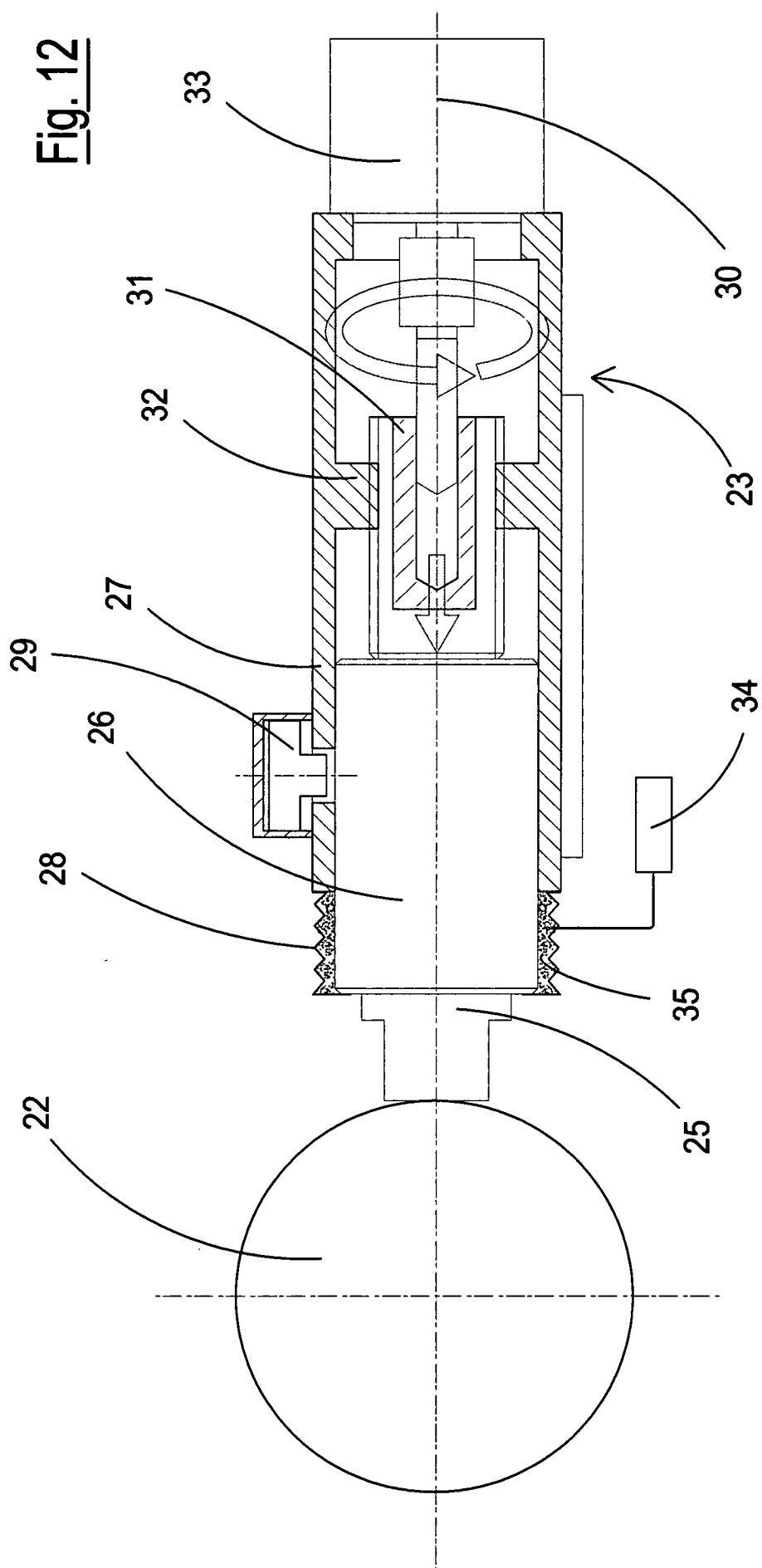


Fig. 12



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/003189

A. CLASSIFICATION OF SUBJECT MATTER
INV. B24B41/06 B23Q1/76
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B24B B23Q B23B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	EP 0 899 061 A2 (SCHUNK GMBH & CO KG [DE]) 3 March 1999 (1999-03-03)	1,2,4,7
Y	figures 1,2,4,5 paragraphs [0003], [0004], [0007], [0012], [0017], [0022], [0023], [0029] - [0032]	5,6
Y	----- CH 301 352 A (FORTUNA WERKE SPEZIALMASCHINEN [DE]) 31 August 1954 (1954-08-31) figure 1 page 1, line 18 - line 33 page 2, line 70 - line 78 ----- -/-	5



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

19 July 2011

Date of mailing of the international search report

27/07/2011

Name and mailing address of the ISA/

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Janzon, Mirja

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/003189

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 1 216 793 A1 (TECHINT SPA [IT]) 26 June 2002 (2002-06-26) figures 1,3 paragraphs [0001], [0002], [0005], [0016], [0020], [0023], [0025], [0026] -----	6
A	DE 102 32 584 A1 (HERKULES MEUSELWITZ GMBH MASCH [DE]) 10 April 2003 (2003-04-10) figure 1 paragraphs [0002], [0003], [0012], [0014] - [0017], [0022], [0025], [0035], [0037], [0052] -----	3

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2011/003189

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