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(54) A device for the positioning of cutting tools, cutting assembly containing such a device and rewinder comprising said assembly

(57) The device comprises: a slide (29) which is movable in a direction for positioning the cutting tools (11, 21); a sensor (53) for identifying the position of the cutting tools, movable together with said slide; a means for driving the slide in the positioning direction; a pair of jaws (45, 47) for grasping a gripping appendage of a cutting tool.

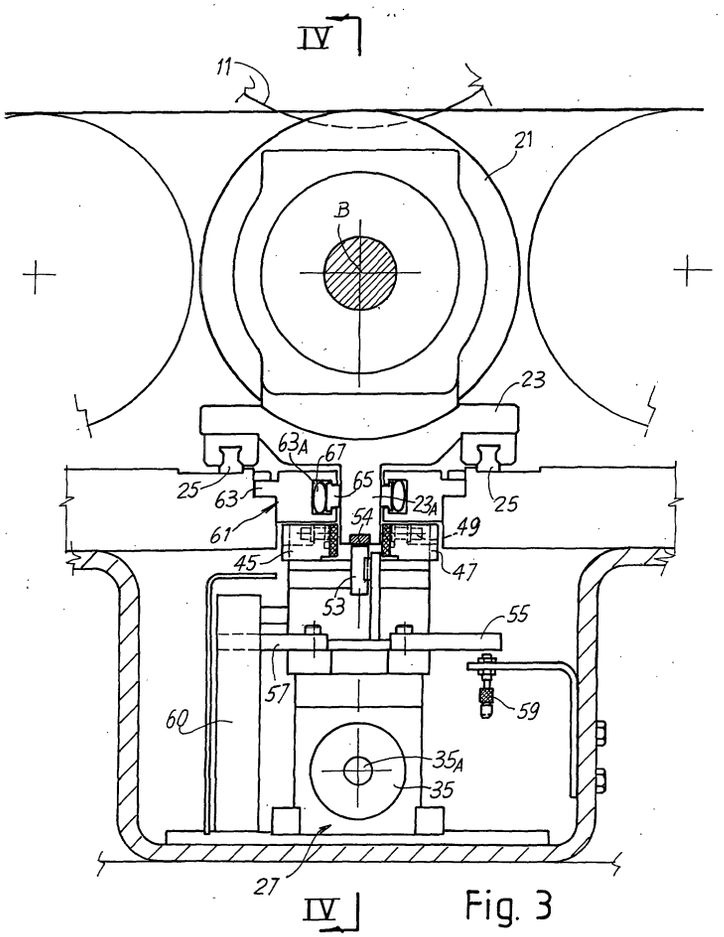

Fig. 3

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Description

[0001] The present invention relates to a device for the positioning of one or more cutting tools intended for cutting a weblike material lengthwise into a plurality of strips having a width less than the width of said weblike material.

[0002] The invention also relates to a cutting assembly comprising one or more cutting tools and a positioning device of the abovementioned type.

[0003] The invention further relates to a rewinder which comprises a cutting assembly and a positioning device of the abovementioned type for winding up a weblike material onto a plurality of rolls following division of the weblike material into strips having a width less than the width of the initial weblike material, which is fed from a reel.

[0004] In many industries, and especially in the sector of the production and processing of paper, fabrics, woven/nonwoven materials and other goods in web or sheet form it becomes necessary to unwind the weblike material from a reel of large diameter and substantial dimensions and to rewind it to form rolls of lesser dimensions. Frequently, the rolls have an axial dimension less than the axial dimension of the initial reel. In such cases, it is necessary to cut the weblike material lengthwise while it is being fed to the winding-up zone of the rewinder. To this end, cutting assemblies are provided comprising at least one series of disk-shaped tools, in particular in the form of circular blades. Normally, a first series of disk-shaped blades and a second series of disk-shaped counterblades are provided, although alternative solutions are also possible in which the disk-shaped blades interact with other counterpart systems.

[0005] The position of the cutting tools is set each time as a function of the dimensions of the rolls that it is desired to produce. The positioning has to be accurate and automatic. To this end, systems for reading the position of the tools are currently used, which systems make use of optical sensors. These reading systems present certain problems deriving primarily from the need to undertake frequent cleaning operations of the sensors in order to remove the dust which otherwise prevents the correct functioning of the sensors.

[0006] For gripping the tools and moving them into the desired positions, use is currently made of systems that provide a conical tang mounted on a movable slide, which tang is inserted into a conical seating of the support of the tool to be displaced. Once gripping has taken place, the slide moves in a positioning direction and brings the tool into the desired position. This system is such that a slight error in the reciprocal positioning of the tool and of the slide is not detected in that the conical tang nevertheless penetrates into the conical seating of the support of the tool. This, however, causes an error in the subsequent positioning of the tool.

[0007] EP-A-0 081 840 discloses a rewinder comprising a cutting assembly for dividing the incoming weblike material into a plurality of strips intended to form the various rolls in the winding-up zone.

[0008] EP-B-0 347 060 and EP-B-0 499 340 disclose positioning devices for cutting tools that can be used in machines for the lengthwise cutting of a continuous weblike material, as for example in a rewinder. According to this prior art, the blades for cutting the weblike material are carried by a plurality of carriages that are movable in translation along positioning guides. A continuous belt having two strands parallel to the positioning guides is driven by a positioning actuator. By means of a pair of jaws, each carriage can be temporarily linked to the belt and drawn into the desired position. The system is complex and not particularly reliable or precise.

[0009] GB-A-2 290 496 discloses a different positioning device for the tools for cutting a weblike material. This device comprises an optical (laser) detector for identifying the position of the cutting edge of each tool and a gripping member for gripping the individual tools which grasps the tools at the cutting edge. The system is bulky and may cause damage to the cutting edge of the tools. Furthermore, the system for reading the position of the tools is not reliable, especially when it is operating in dusty environments, which production plants for paper, fabric and nonwoven materials typically are. It is an object of the present invention to provide a positioning device for the cutting tools which overcomes the disadvantages of the conventional devices and which, in particular, allows accurate and precise positioning of the cutting tools.

[0010] It is a further object of the present invention to provide a cutting assembly having a positioning device for the tools that guarantees precise positioning of the tools.

[0011] These and other objects and advantages that will be apparent to persons skilled in the art from reading the text that follows are substantially achieved by means of a device comprising:

- a slide which is movable in a direction for positioning the cutting tools;
- on said slide, a gripping member for the cutting tools;
- a sensor for identifying the position of the cutting tools, movable together with said slide;
- a means for moving the slide in the positioning direction;

and characterized in that said gripping member comprises a pair of jaws for grasping a gripping appendage of a cutting tool.

[0012] According to a particularly advantageous embodiment of the invention, the pair of jaws may be associated with a detector for detecting that gripping of said gripping appendage has taken place. This detector may be a microswitch presented on the gripping surface of one of the jaws.

[0013] To compensate for any machining tolerances

and ensure reliable gripping, it is possible, according to an improved embodiment of the invention, to provide for the pair of jaws to be able to move in a direction transverse to the positioning direction of the tools. To this end, provision may be made for the pair of jaws to be carried by a support mounted in an overhanging manner on said slide with the interposition of a linear guide, which is orthogonal to the positioning direction and along which said support can be displaced.

[0014] For reliable reading of the position of the tools that is not sensitive to any dusts or other detritus, it is advantageous to provide for the sensor to be a magnetic rather than optical sensor.

[0015] Further advantageous features of the positioning device, of the assembly that comprises it and of a rewinding machine using such a device are indicated in the appended claims and are described in detail with reference to an example of embodiment.

[0016] The invention will be better understood with reference to the description and the appended drawings, which show a possible, nonlimiting embodiment of the invention. More particularly, in the drawings:

Fig. 1 shows a diagrammatic lateral view of a rewinder to which two devices according to the invention have been applied;
Fig. 2 shows a lateral view of the cutting assembly of the rewinder according to Fig. 1;
Fig. 3 shows an enlarged lateral view of the positioning device for the counterblades of the cutting assembly according to fig. 2;
Fig. 4 shows a view along the line IV-IV in Fig. 3; and
Fig. 5 shows a view along the line V-V in Fig. 4.

[0017] Fig. 1 shows, generally and diagrammatically, a rewinder 1 comprising a pair of winding rollers 3,5 on which a series of mutually coaxial rolls R is formed. The rolls R are formed from strips of weblike material obtained by the lengthwise cutting of a single weblike material N coming from a parent reel, unwinding within an unwinder, illustrated diagrammatically and of a type known per se.

[0018] For the purpose of cutting the weblike material N into strips having a width less than the width of the material N, a cutting assembly is provided, generally designated 9 and comprising a series of mutually coaxial disk-shaped cutting blades 11 aligned along an axis A (see in particular Fig. 2). A single blade is visible in the drawing, but it is necessary to understand that, along the axis A, a plurality of blades are provided in a number sufficient to cut the weblike material N into the desired number of strips required at a given time.

[0019] Each blade is carried by a support 13. The complex formed by the support 13 and by the disk-shaped blade 11 will be generally designated a cutting tool. Each support 13 slides along guides 15 parallel to the axis A and orthogonal to the direction of advance of the weblike material N and of the strips S into which the latter is divided by the cutting assembly 9. In this manner, each support may be brought to the point at which it is desired to perform the lengthwise cutting of the weblike material N. The positioning of each cutting tool 11, 13 is achieved by means of a positioning device generally designated 17, and the locking of the cutting tools in the desired position is achieved in a manner known per se, which will be described hereinbelow with reference to the counterblades with which the disk-shaped blades 11 interact.

[0020] The cutting assembly 9 comprises, for each disk-shaped blade 11, a counterblade 21 carried by a respective support 23. A single counterblade 21 can be seen in the figures but it must be understood that along the axis B (parallel to the axis A) a plurality of identical counterblades are provided. The complex comprising counterblade 21 and support 23 constitutes a respective cutting tool by analogy with the components 11, 13.

[0021] Each support 23 can be positioned along guides 25 parallel to the axis B. The reference 27 generally designates a positioning device, equivalent to the device 17, and which will be described in detail with reference to Figs. 3 to 5 and serves to position the cutting tools 21, 23 along the guides 25.

[0022] The positioning device 27 comprises a slide or carriage 29 which is movable in the direction of the arrow f29 along guides 31 parallel to the guides 25. The movement is controlled by a threaded bar 33 driven by an actuator 35.

[0023] On the slide 29 is placed a linear guide 37 along which slides a cursor 39 solidly fixed to a support 41 borne in an overhanging manner on said slide 29 by means of the interposition of the abovementioned linear guide. Disposed on the support 41 is a gripping member for the cutting tools 21, 23 comprising a pair of jaws 45, 47 movable in a direction orthogonal to the direction of movement of the slide 29. The opening and closing movements of the jaws 45, 47 are designated by the arrows f45 and f47. The opening and closing movements of the jaws are controlled by cylinder-and-piston actuators (not shown) situated below.

[0024] Each jaw 45, 47 possesses, on its gripping surface, a coating of a material having a high coefficient of friction, designated 45A and 47A respectively, for gripping onto an appendage 23A of the support 23. A microswitch 49 is further associated with the jaw 45, passing through the coating 45A and being presented on the gripping surface of said jaw to interact with the appendage 23A. The microswitch 49 constitutes a gripping detector, which serves to detect when gripping of the cutting tool by the pair of jaws 45, 47 has taken place.

[0025] The support 41 bears, moreover, a plate 51 on which is mounted a magnetic sensor 53 which serves to read the position of the tools 21, 23 in the manner described below. The magnetic sensor 53 interacts with permanent magnets accommodated in the appendage 23A of each cutting tool 21, 23, designated 54 in the case of the tool shown in Figs. 3 and 4.

[0026] Also solidly fixed to the support 41 are two brackets 55 and 57. The bracket 55 interacts with a zero sensor 59, i.e. a sensor that allows the control unit that controls the entire rewinder (and is generally designated 2 in Fig. 1) to determine the starting point for the movement of the device 27 and therefore the position of the tools relative to the zero reference. Fixed to the bracket 57 is the end of a flexible pipe 60 which accommodates the cables and lines for supplying the various members borne by the support 41.

[0027] Above the path of the positioning device 27 is disposed a locking system for the cutting tools, generally designated 61. The locking system comprises, on each side of the appendages 23A of the various tools 21, 23, a profiled section 63 forming a seating 63A into which are inserted a cursor 65 and an air chamber 67. The inflation of the air chambers 67 in the two seatings 63A of the two profiled sections 63 thrusts the respective cursors 65 against the flanks of the aligned appendages 23A of the various cutting tools 21, 23 to cause the locking thereof in the desired position.

[0028] The manner in which the positioning device functions is as follows.

[0029] By means of the actuator 35 and the threaded bar 33, the slide 29 together with the support 41 is brought into the zero position, identified by the zero sensor 59. With a gradual movement in the direction of the arrow f29, the slide 29 and the support 41 are moved in translation over the whole transverse extent of the rewinding machine. An encoder associated with the threaded bar 33 and diagrammatically represented at 35A enables the central unit 2 to know the position of the slide 29 and hence of the support 41 and of the magnetic sensor 53. When this moves into alignment with the various cutting tools 21, 23 it identifies their position by detecting the presence of the respective permanent magnets 54. In this manner, a single stroke of the slide 27 enables the central unit 2 to determine the current positions of all of the cutting tools 21, 23.

[0030] When the position of one, some or all of the cutting tools 21, 23 has to be changed for the processing of a subsequent job, the slide 27 and the support 41 associated therewith are moved in translation into alignment with the position of the cutting tools that have to be displaced. The locking system 61 is opened, so as to permit the movement in translation of the tools along the guides 25. The slide 27 is brought into a position such as to align the jaws 45, 47 (which are in the opened position, in other words extended) with the appendage 23A of the tool 21, 23 that has to be moved. This position is identified by the central unit 2 on the basis of the reading of the position of the individual tools taken during a preceding phase, in the manner described. Said position of alignment having been reached, the jaws are tightened to clamp the appendage 23A. The fact that gripping of the appendage 23A has taken place is detected by means of the microswitch 49. When the latter indicates consent to the central unit 2, the slide 27 is again moved in translation to bring the tool 21, 23 into the new position. The procedure is repeated for each of the cutting tools 21, 23 that it is desired to move. The positioning of the various tools having been completed, the locking system 61 is activated and all the cutting tools are locked in the new positions.

[0031] Any errors in the machining of the appendages 23A have no influence on the correct functioning of the gripping system described above, as a result of the self-centering capability of the jaws 45, 47 by means of a transverse sliding of the support 41 along the linear guide 37.

[0032] The positioning device 17 for the cutting tools 11, 13 is produced and operates substantially in the same manner as has been described for the positioning device 27. In this way, both the cutting blades 11 and the counterblades 21 can be precisely positioned. The possibility is not excluded that the cutting blades 11 interact, for example, with a grooved counterpart surface, a counterpart channel or other suitable counterpart means. Depending on the configuration of the counterpart means it might be necessary to position them or counterpart means might be used that do not require positioning. In the former case it is possible to adopt (as in the example described) two positioning devices, while in the latter case a single positioning system will be adopted.

[0033] It is understood that the drawing shows only one possible, nonlimiting embodiment of the invention, which may be varied in terms of shapes and arrangements without thereby departing from the scope of the underlying concept of the invention as defined in the appended claims. The presence of any reference numerals in the claims serves to facilitate reading thereof in the light of the preceding text and the appended drawings and does not limit their scope of protection.

Claims

1. A device for the positioning of cutting tools for the lengthwise cutting of weblike material, comprising:

   - a slide which is movable in a direction for positioning the cutting tools;
   - on said slide, a gripping member for the cutting tools;
   - a sensor for identifying the position of the cutting tools, movable together with said slide;
   - a means for moving the slide in the positioning direction;

   characterized in that said gripping member comprises a pair of jaws for grasping a gripping appendage of a cutting tool.

2. The device as claimed in claim 1, **characterized in that** said pair of jaws is associated with a detector

for detecting that gripping of said gripping appendage has taken place.

3. The device as claimed in claim 2, **characterized in that** said detector is a microswitch presented on the gripping surface of one of the jaws.

4. The device as claimed in one or more of the preceding claims,
characterized in that said pair of jaws can move in a direction transverse to the positioning direction.

5. The device as claimed in claim 4, **characterized in that** said pair of jaws is carried by a support mounted in an overhanging manner on said slide with the interposition of a linear guide, which is orthogonal to the positioning direction and along which said support can be displaced.

6. The device as claimed in one or more of the preceding claims,
characterized in that said sensor is a magnetic sensor.

7. A cutting assembly for the lengthwise cutting of a weblike material fed through said assembly, comprising at least a first series of cutting tools which can be positioned and locked in respective positions along a positioning direction, and at least a first positioning device for positioning the tools of said first series of cutting tools along said positioning direction, **characterized in that** said first positioning device is produced in accordance with one or more of claims 1 to 6.

8. The cutting assembly as claimed in claim 7, comprising a second series of cutting tools which can be positioned and locked in respective positions along said positioning direction, and a second positioning device for positioning the tools of said second series of cutting tools along the positioning direction, **characterized in that** said second positioning device is produced in accordance with one or more of claims 1 to 6.

9. The cutting assembly as claimed in claim 8, **characterized in that** said first series of cutting tools comprises a plurality of rotating disk-shaped blades cooperating with respective counterblades forming said second series of cutting tools.

10. A cutting assembly for the lengthwise cutting of a weblike material fed through said cutting assembly, with at least a first series of cutting tools which can be positioned and locked in respective positions along a positioning direction, and at least a first positioning device for positioning said cutting tools of said first series along said positioning direction and comprising a slide which is movable in said positioning direction and associated with a sensor for identifying the position of the cutting tools, and a means for driving the slide along the positioning direction, **characterized in that** said positioning device further comprises a pair of jaws for grasping a gripping appendage of a cutting tool.

11. The cutting assembly as claimed in claim 10, **characterized in that** said pair of jaws is associated with a detector for detecting that gripping of said gripping appendage has taken place.

12. The cutting assembly as claimed in claim 11, **characterized in that** said detector is a microswitch presented on the gripping surface of one of the jaws.

13. The cutting assembly as claimed in one or more of claims 10 to 12, **characterized in that** said pair of jaws can move in a direction transverse to the positioning direction.

14. The cutting assembly as claimed in claim 13, **characterized in that** said pair of jaws is carried by a support mounted in an overhanging manner on said slide with the interposition of a linear guide, which is orthogonal to the positioning direction and along which said support can be displaced.

15. The cutting assembly as claimed in one or more of claims 10 to 14, **characterized in that** said sensor is a magnetic sensor.

16. The cutting assembly as claimed in one or more of claims 10 to 15, **characterized in that** said magnetic sensor interacts with tablets of magnetic material inserted into said appendages of the cutting tools.

17. The cutting assembly as claimed in one or more of claims 10 to 16, **characterized in that** it comprises a second series of cutting tools and a respective second positioning device analogous to said first positioning device.

18. The cutting assembly as claimed in one or more of claims 10 to 17, **characterized in that** each tool of said first and/or said second series of cutting tools comprises a support which is slidable along a guide system and is solidly fixed to said gripping appendage.

19. A rewinding machine for the formation of rolls of wound-up weblike material, comprising a cutting assembly as claimed in one or more of claims 7 to 18.

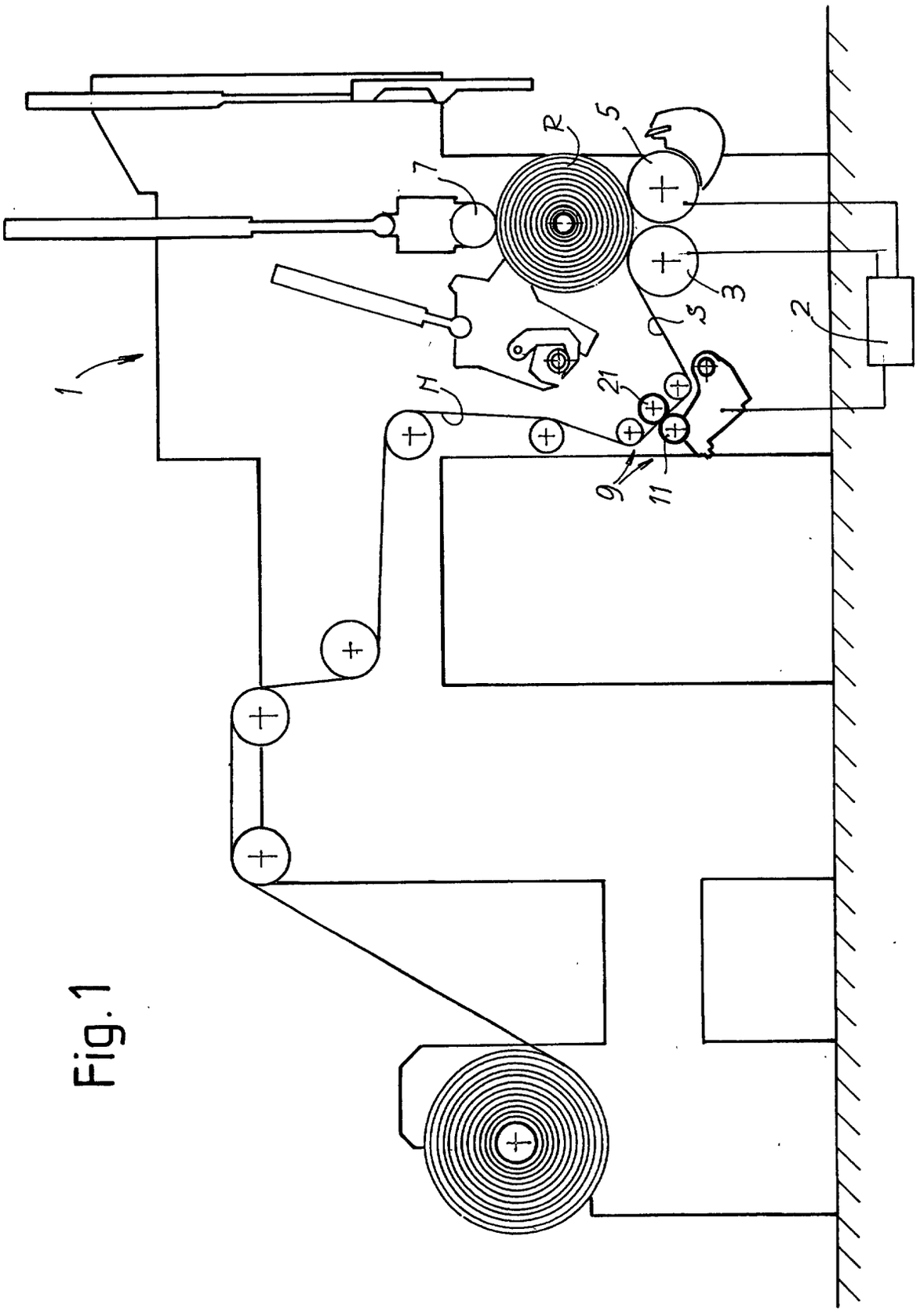

Fig. 1

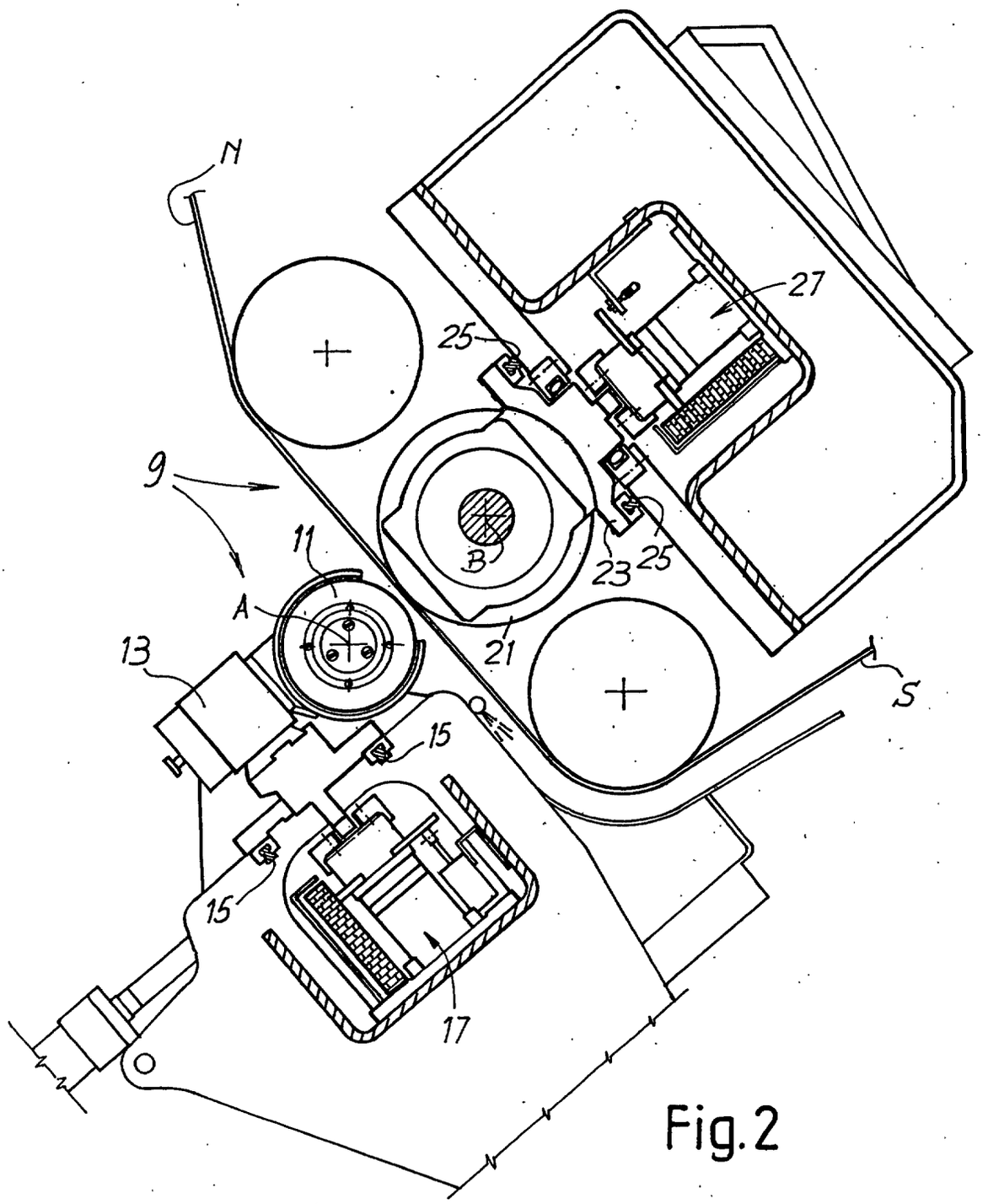

Fig.2

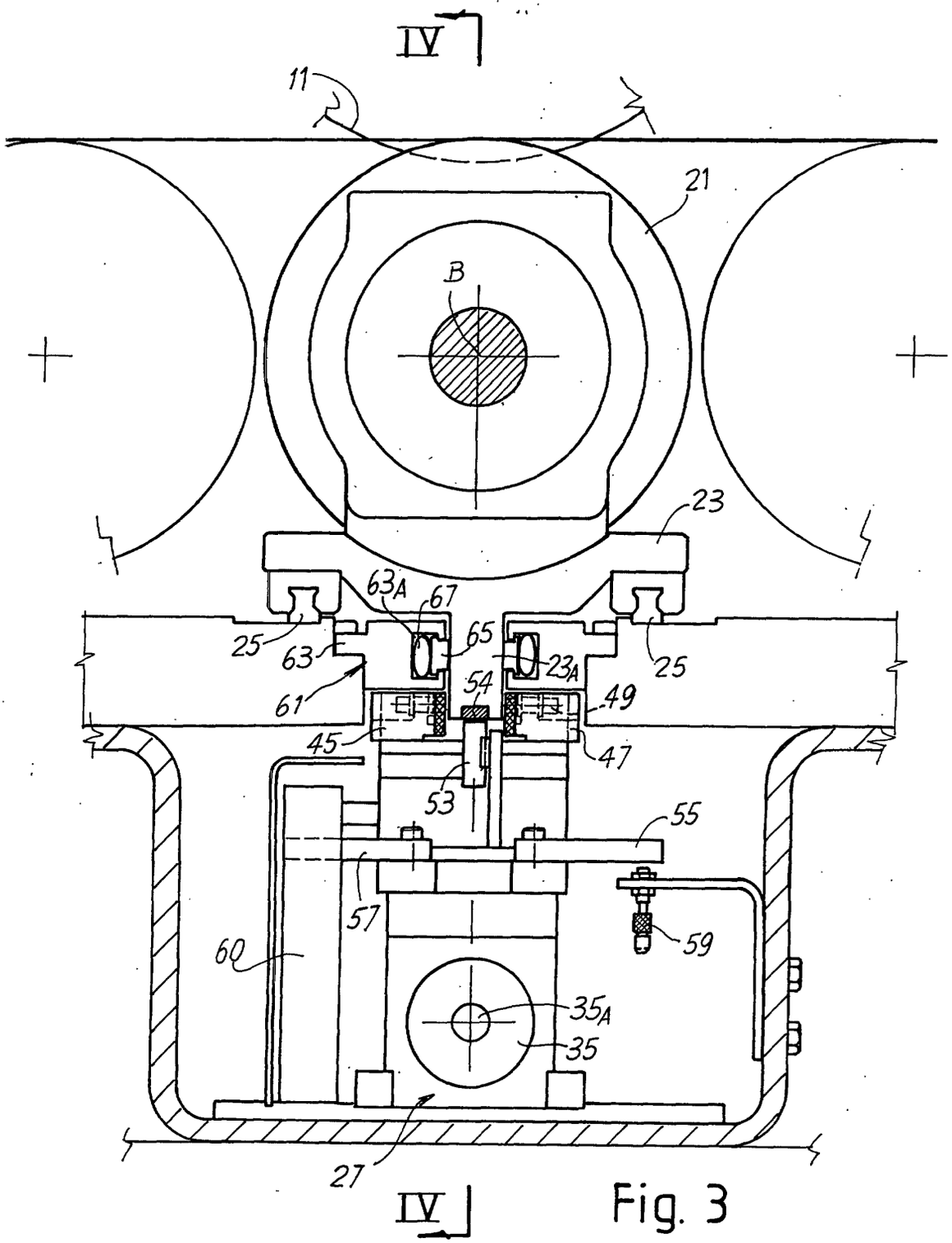
IV
11
21
B
23
63A
67
65
25
63
61
23A
54
49
45
47
53
55
57
59
60
35A
35
27
IV

Fig. 3

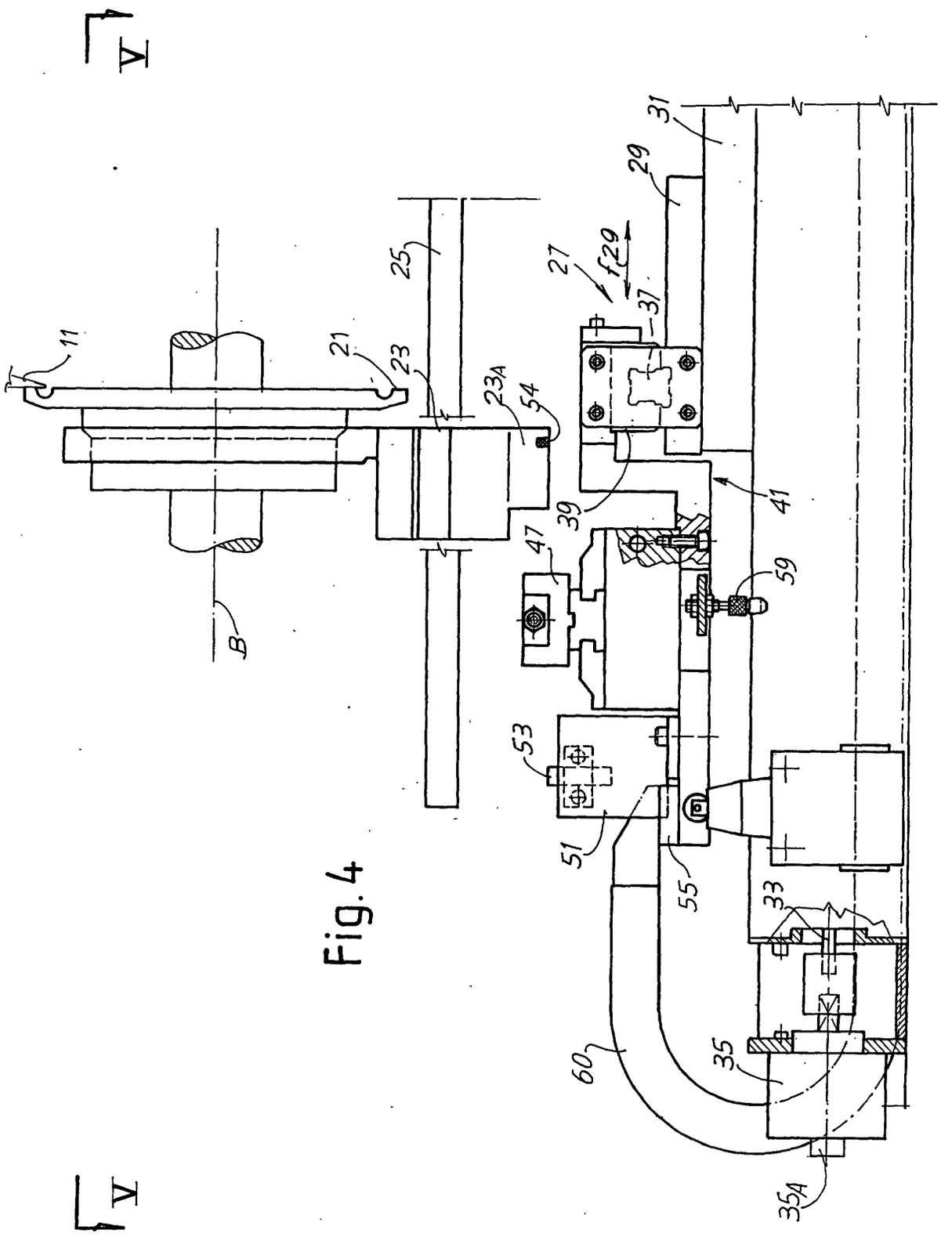

Fig. 4

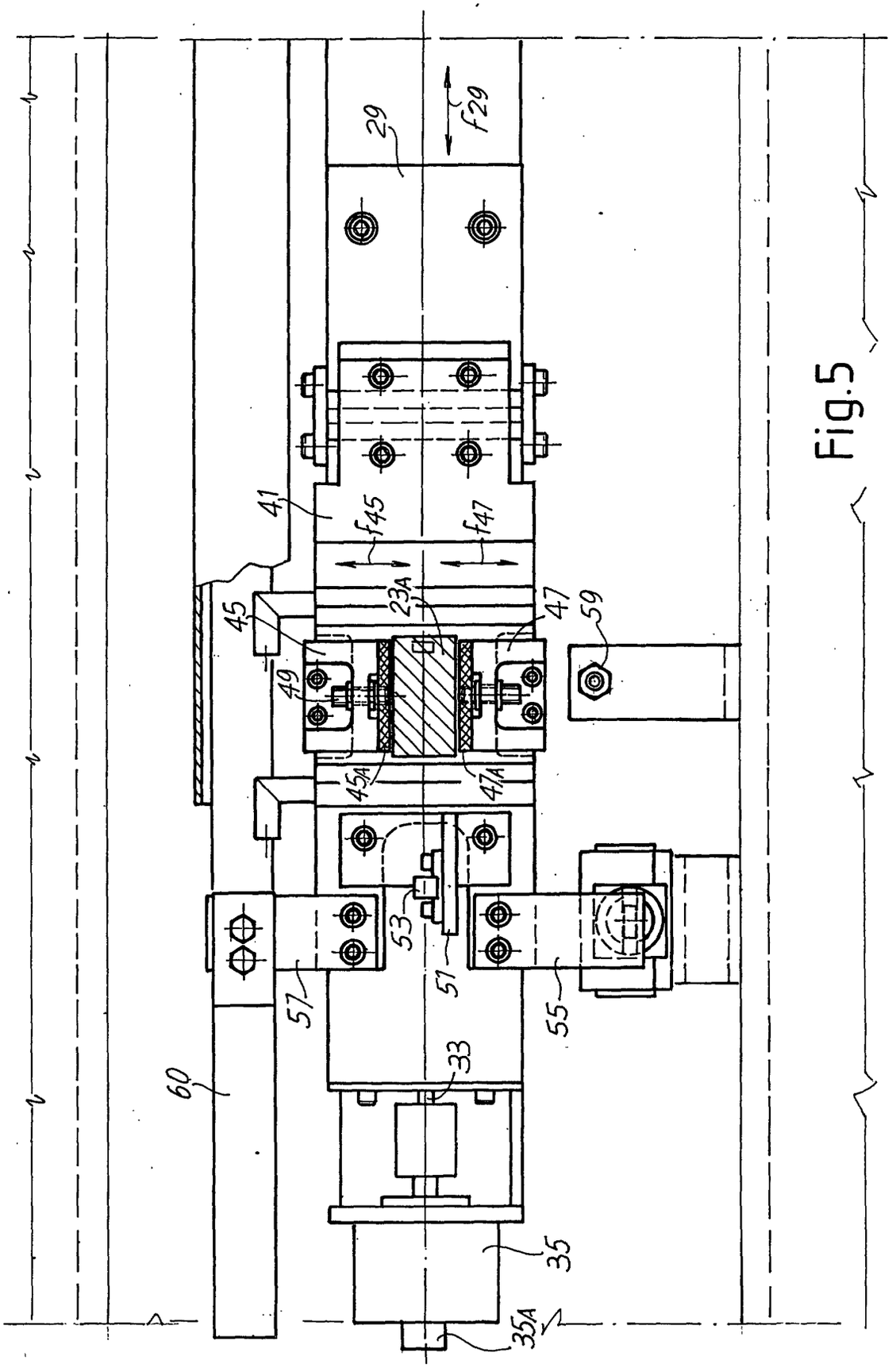

Fig.5

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EUROPEAN SEARCH REPORT

Application Number
EP 01 83 0207

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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
THE HAGUE	11 January 2002	Vaglienti, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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D : document cited in the application
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European Patent Office

Application Number
EP 01 83 0207

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

European Patent Office

LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 01 83 0207

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims: 1-5 7-14 17-19

   self centring grippers

2. Claims: 1, 6; 10, 15; 10, 16

   magnetic sensor

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 01 83 0207

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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