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(54) DRAWING APPARATUS AND METHOD FOR AIR SPINNING MACHINES WITH MULTIPLE FEEDS

(57) A drawing apparatus (4) for air spinning machines with multiple feeds, comprising at least a first and a second introducer element (8,12), independent of each other, so as to feed simultaneously at least two separate webs (NI, N2), an air spinning device (16) adapted to spin said webs (NI, N2), a drawing device (24) placed between the introducer elements (8,12) and the air spinning device (16), comprising a plurality of pairs of drawing rollers (28), comprising one drive roller (32) and one idle roller (36) per pair. At least one drive roller (32) of a pair of said drawing rollers (28) is mechanically split into a first drive roller (40) which intercepts a first web (NI) and a second drive roller (44) which intercepts the second web (N2). The first and second drive rollers (40,44) are operatively connected to separate drive means so that they can be operated at different speeds of rotation, to perform different degrees of drawing of the two webs (NI, N2) intercepted by said first and second drive rollers (40,44), wherein said first drive roller (40) is associated with a first idle roller (52) and said second drive roller (44) is associated with a second idle roller (56), said idle rollers (52,56) being mechanically separate from each other. A thrust device (60) is associated with said first and second idle rollers (52,56), which preloads each elastically in contact with the first drive roller (40) and the second drive roller (44), respectively, in a symmetric and equivalent manner so as to apply the same preload to said drive rollers (40,44).

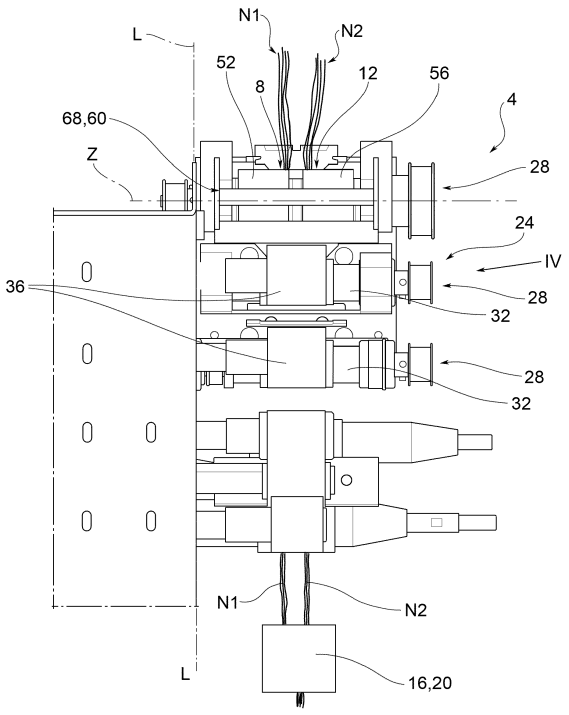

FIG.1

EP 3 798 338 A1

Description

FIELD OF APPLICATION

[0001] The present invention relates to a drawing apparatus and method for air spinning machines with multiple feeds.

BACKGROUND ART

[0002] As known, air spinning apparatuses, for example, of the air-jet type, produce yarn starting from a single web of fibres. The specific development area of the present invention is that of yarns obtained with multiple feeds, i.e., from more (at least two) webs of fibres which may be of different materials, of different colours (melange), of different quality or even of the same material. Such multiple feeding webs must be suitably drawn and mixed so as to produce a yarn with the desired features.

[0003] To date, the process for obtaining webs with different colours or materials may be of two types. The first involves the weighing of the raw materials based on the percentage ratio to be obtained, for example 50% cotton and 50% polyester, and the subsequent entry into the standard production cycle of the web. The second type, on the other hand, involves the preparation of several webs, normally six or eight in number and with a suitable thread count, for each of the materials making up the mixture which are subsequently coupled on a drawing frame repeatedly until the final obtainment of a homogeneous web with the desired thread count. In any case, the number of webs which are coupled for each material is directly proportional to the percentage ratio to be obtained. The result, in both cases, is a web of mixed material with a good mixture of the different fibres to be used to feed the air spinning machines, for example, of the air-jet type. The conventional processes described above, while ensuring a good quality of the yarn obtained, are however expensive, since the coupling of the different mixtures requires additional caution and processing. This type of known processing is currently used for the yarns of the melange type and for mixed yarns (cotton/polyester, cotton/viscose, etc.).

[0004] Furthermore, the known solution has the disadvantage of requiring a processing on a single web made of mixed material: thereby, the introducer pipe of such a mixed web inside the drawing devices is subject to contamination with fibres, for example, of coloured material embedded inside the mixed web itself. This means that the passage from a mixed web to another one requires a preventive cleaning of the introducer pipe to prevent it from contaminating the next web.

[0005] Moreover, the known solutions provide for the need to modify the calibration of the spinning machine according to the mixed yarn to be processed: this means that, from time to time, it is necessary to modify the settings of the machine according to the thread count of the mixed web to be drawn.

[0006] Furthermore, changing the percentage of raw materials in the mixed yarn requires "recreating" the web according to the new proportions, thus changing the set-up of the web preparation line every time the percentage of the single materials in the final web is changed.

[0007] Producing spinning apparatuses in which the webs introduced by the respective introducer pipes are drawn separately from one another by means of pairs of drawing rollers having separate motors is also known. Such a separation therefore allows the webs to be drawn separately and differently from one another, according to the required needs, before the latter are then fed into the spinning chamber. This solution certainly allows the composition of the yarn to be calibrated with greater precision by virtue of a precise processing of the webs according to the starting features of the webs themselves (thread count, colour, origin) before they are joined in the spinning chamber. Nevertheless, such a known solution works well only if the distinct adjustments/processings on the individual webs are optimized and differentiated with extreme precision. In other words, it is necessary that the different processes subjected to the webs may be effectively and easily obtained. Indeed, the devices of the prior art do not allow to ensure the differentiated processing precision on the individual webs. In other words, if, from the theoretical point of view, such known solutions allow to optimize the formation of the yarn by separating the processes on the individual webs, from a practical point of view it is not possible to really optimize the processing differences on the webs themselves due to the fact that the known apparatuses do not allow for the required processing precision, in particular when drawing, and the required sensitivity to the setting variations imposed according to the different yarns.

[0008] In particular, the known solutions involve the use of thrust means which elastically influence each pair of idle rollers, transversely juxtaposed, towards the corresponding pair of drive rollers: such an elastic force is important so as to allow drawing the webs without tearing the fibres and adjusting the number of fibres involved in the drawing as much as possible. Normally the workloads for each of the two webs are in the range of 12-18 kg and must be adjusted according to the material being processed and to the thread count thereof, so as to always work with the least load which ensures pinching the fibres without tearing them.

[0009] The known solutions, however, do not allow to have equal loads on the drawing rollers since they come from two different settings. In particular, the standard solutions, due to construction reasons, do not generate a common pressure on both rollers, since they are substantially formed by a beam (supporting the rotation of the rollers) wedged at one end, i.e., the inner end, while the thrust means exert the action thereof from the side of the opposite cantilevered end. This means that the known solution may not be equivalent to a beam pressed in a symmetric manner.

[0010] The asymmetry of the load and of the deforma-

tion of the beam supporting the idle rollers means that, regardless of the adjustment of the elastic means, the elastically influenced rollers are subjected to an asymmetric load due to the inevitable asymmetric deformations of the cantilevered beam structure. Thereby, the precision adjustments provided by means of the elastic means are cancelled and it is not possible to provide a fine adjustment of the drawing of the webs.

[0011] Furthermore, the known systems do not allow to easily adjust the reciprocal position of the two rollers with respect to the sliding direction of the web, since they are mounted on two distinct and not uniquely adjustable supports; in essence, it is extremely difficult to adjust them so that the two respective rotation axes are "aligned" with each other.

[0012] Furthermore, the known systems do not allow to satisfactorily adjust the distance of a drawing unit from the next unit, since the support structure of one of the two rollers is rigid.

[0013] The adjustment of the distance between two subsequent drawing units is necessary or desirable when the length of the fibre being processed changes, so as to standardize the obtainable result as much as possible.

OVERVIEW OF THE INVENTION

[0014] Therefore, the need is felt to solve the drawbacks and limitations mentioned above with reference to the prior art.

[0015] Such a need is met by a drawing apparatus for air spinning machines with multiple feeds according to claim 1 and by a drawing method for air spinning machines according to claim 19.

DESCRIPTION OF THE DRAWINGS

[0016] Further features and advantages of the present invention will become more comprehensible from the following description of preferred embodiments thereof given by way of non-limiting examples, in which:

Figure 1 shows a front view of a drawing apparatus for air spinning machines according to an embodiment of the present invention;

Figure 2 shows a front perspective view of the drawing apparatus of Figure 1;

Figure 3 shows a front perspective view of the apparatus of Figure 2, in which the drawing device of the present invention has been omitted;

Figure 4 is a perspective view of detail IV of Figure 1;

Figure 5 shows a front view of detail V shown in Figure 4;

Figure 6 shows a sectional view of detail VI shown in Figure 5.

[0017] Elements or parts in common to the embodiments described will be indicated hereafter using the same reference numerals.

DETAILED DESCRIPTION

[0018] With reference to the aforesaid Figures, 4 overall indicates a drawing apparatus for air spinning machines with multiple feed.

[0019] Said apparatus 4 comprises at least a first and a second introducer element 8,12, independent of each other, so as to feed simultaneously at least two webs N1, N2 of textile fibre. Said webs N1, N2 of textile fibre may be both identical to each other as well as different in quality, thread count, colour and/or material.

[0020] The apparatus 4 further comprises an air spinning device 16, fed by said webs N1, N2 of textile fibre, adapted to spin the webs N1, N2 of textile fibre and to produce yarn with certain features.

[0021] For the purposes of the present invention, the air spinning device 16 may be of any type, shape, and size.

[0022] For example, the air spinning device 16 comprises a spinning chamber 20 having a plurality of jets of air (not shown) oriented in a direction substantially tangential to the webs N1, N2 themselves in input in the spinning chamber 20 itself, so as to interweave said webs N1, N2 and obtain a single yarn F in output from the air spinning chamber 20.

[0023] As possible embodiment variants, the spinning chamber 20 may also comprise mechanical parts which are movable under the thrust of compressed air.

[0024] Apparatus 4 further comprises a drawing device 24 placed between the introducer elements 8,12 and the air spinning device 16, comprising a plurality of pairs of drawing rollers 28, comprising at least one drive roller 32 per pair 28, said drawing rollers 28 being adapted to perform a progressive drawing of each web simultaneously intercepted by them, in a known manner.

[0025] Drive roller 32 means a roller operatively connected to drive means, typically electric motors; usually, each drive roller 32 faces an idle roller 36 which presses on the webs N1, N2 with a suitable pressure and is set in motion by the drive roller 32 coupled thereto.

[0026] According to an embodiment, at least one drive roller 32 of a pair of said drawing rollers 28 of the spinning apparatus 4 is mechanically split into a first drive roller 40 which intercepts the first web N1 and a second drive roller 44 which intercepts the second web N2.

[0027] Said first and second drive rollers 40,44 are operatively connected to separate drive means so that they may be operated at different speeds of rotation, to perform different degrees of drawing of the two webs N1, N2 intercepted by said first and second drive rollers 40,44.

[0028] Preferably, said first drive roller 40 is associated with a first idle roller 52 and said second drive roller 44 is associated with a second idle roller 56, said idle rollers 52,56 being mechanically separate from each other.

[0029] By virtue of such a splitting, each idle roller 52,56 may follow, independently of the other one 56,52, the drawing degree (i.e., the rotation speed) imposed by

the corresponding drive roller 40,44.

[0030] According to an embodiment, the first and second split drive rollers 40,44 are arranged facing directly in output with respect to the introducer elements 8,12. In other words, the first and second split drive rollers 40,44 are the first rollers which intercept the webs N1, N2 in output from the respective introducer elements 8, 12.

[0031] Preferably, the webs N1, N2 are fed according to a longitudinal feed direction L, the introducer elements 8,12 are juxtaposed along a transverse direction Z, perpendicular to said longitudinal feed direction L.

[0032] It should be noted that the longitudinal direction L is conventionally inclined with respect to a vertical direction Y, perpendicular to a horizontal direction X, parallel to a supporting surface of the spinning apparatus 4.

[0033] The first and second split drive rollers 40,44 are aligned to each other parallel to said transverse direction Z and revolve around transverse rotation axes, parallel to the transverse direction Z.

[0034] The number of pairs of drawing rollers 28 may be varied as a function of the total drawing ratio to be obtained and is not binding for the purposes of the present invention.

[0035] For example, the use of two or more webs in the feeding and the consequent increase in the size of the web in input may require the insertion of a fifth pair of drawing rollers so as to ensure the correct distribution of the drawing along the path thereof (where usually 4 pairs of drawing rollers are used). The drawing ratio is given by the ratio between the input thread count and the output thread count.

[0036] In general, the addition of a fifth pair of drawing rollers allows the main drawing ratio to be kept constant and not having to exceed in the increase of the other ratios, which *per se* are much less efficient than the main drawing performed with a belt.

[0037] Advantageously, a thrust device 60 is associated with said first and second idle rollers 52,56, which preloads each elastically in contact with the first drive roller 40 and the second drive roller 44, respectively, in a symmetric and equivalent manner so as to apply the same preload to said drive rollers 40,44. The preload, in turn, influences the quality and quantity, i.e., the drawing degree of the web, which may be obtained under the same boundary conditions, such as the speed of rotation and the diameter of the drive rollers 40,44, for example.

[0038] More in detail, said thrust device 60 is configured to influence said first and second idle rollers 52,56 simultaneously and with the same elastic load against the first drive roller 40 and the second drive roller 44, respectively.

[0039] According to a possible embodiment, the first and second idle rollers 52,56 are symmetrically supported by a common support pin 64 sustained by a frame 68 of the thrust device 60.

[0040] The support pin 64 comprises opposite, axial support ends 72,76 which each interface with an upright 80 of the frame 68 of the thrust device 60 so as to be guided symmetrically by the frame 68 in a direction moving towards the corresponding drive rollers 40,44.

[0041] Preferably, said support pin 64 comprises a central shoulder 84, symmetrically arranged between said opposite axial support ends 72,76, adapted to separate and axially space said idle rollers 52,56 from each other.

[0042] The thrust device 60 comprises thrust means 88 which exert an elastic thrust at said opposite axial support ends 72,76 and/or said central shoulder 84.

[0043] Preferably, at least one guide bushing 92 is interposed between each idle roller 52,56 and the support pin 64.

[0044] For example, said at least one guide bushing 92 comprises an axial shoulder 96. Preferably, each support pin 64 comprises a pair of guide bushings 92 arranged with the relative axial shoulders 96 inverted. In other words, the axial shoulders 96 are arranged on opposite sides, so as to create a bilateral axial constraint at the corresponding idle roller 52,56 interposed therebetween.

[0045] The opposite axial support ends 72,76 of the support pin 64 are inserted in respective longitudinal guides 100 which are symmetric to each other.

[0046] Said longitudinal guides 100 extend along prevailing longitudinal directions, parallel to each other and perpendicular to said support pin 64.

[0047] Furthermore, the frame 68 of the thrust device 60, comprises a mounting with a thrust arm 104 which interfaces on said support pin 64 and elastic thrust means 108 which determine the elastic thrust of the support pin 64 and of the relative idle rollers 52,56 against the respective drive rollers 40,44.

[0048] According to a possible embodiment, the thrust arm 104 is configured so as to act simultaneously on said opposite axial support ends 72,76 of the support pin 64.

[0049] According to a further embodiment, the thrust arm 104 is configured so as to act on an intermediate shoulder 84 of the support pin 64, arranged between said opposite axial support ends 72,76.

[0050] Preferably, the thrust arm 104 is configured so as to act simultaneously both on the intermediate shoulder 84 of the support pin 64 as well as on said opposite axial support ends 72,76.

[0051] The elastic thrust means 108 may comprise coil springs and/or foil springs.

[0052] It is also possible to provide, as elastic thrust means 108, hydraulic and/or pneumatic actuators, alternatively or together with coil and/or foil springs.

[0053] It should be noted that the drawing apparatus 4 according to the present invention may also be produced and supplied as an extra. In other words, it is possible to produce a drawing unit equipped with a relative thrust device 60 (shown in Figure 4) to be associated with a drawing apparatus so as to allow, if necessary, greater adjustments on the drawing of the webs. The drawing apparatus without such an extra is shown in Figure 3.

[0054] As it may be appreciated from the description above, the spinning device of the air-jet type in accordance with the invention allows to overcome the drawbacks presented in the prior art.

[0055] In particular, the present invention allows to have uniform loads since it is possible to independently act with the forces F1 at the axial ends of the common support pin, or with the force F2 in the centre of the support pin itself (Figure 5); it is also possible, as shown, to exert the elastic preload thrust both on the opposite axial ends as well as at the centre or centre line of the support pin itself, thus making the adjustment almost perfect, symmetric and uniform.

[0056] From a constructive point of view, the solution according to the present invention is also simple and inexpensive to produce and maintain.

[0057] It is therefore a system mechanically different from those of the prior art, which allows to obtain an extremely precise and independent adjustment with respect to the rest of the drawing unit, and therefore to improve the application of the drawing forces on the webs.

[0058] Furthermore, the present invention allows to easily modify the reciprocal position of the two rollers with respect to the sliding direction of the web, by virtue of the adjustments provided.

[0059] Such an adjustment of the distance between two subsequent drawing units is particularly useful when the length of the fibre being processed changes so as to standardize as much as possible.

[0060] Those skilled in the art, in order to meet contingent and specific needs, may make several modifications and variations to the spinning devices of the air-jet type described above, all of which are within the scope of the invention as defined by the following claims.

Claims

1. Drawing apparatus (4) for air spinning machines with multiple feeds, comprising:

   - at least a first and a second introducer element (8,12), independent of each other, so as to be able to feed simultaneously at least two separate webs (N1, N2) of textile fibre,
   - an air spinning device (16) suitable to spin said webs (N1, N2) of textile fibre,
   - a drawing device (24) placed between the introducer elements (8,12) and the air spinning device (16), comprising a plurality of pairs of drawing rollers (28), comprising one drive roller (32) and one idle roller (36) per pair, said drawing rollers (28) being suitable to perform a progressive drawing of each web simultaneously intercepted by them,
   - wherein at least one drive roller (32) of a pair of said drawing rollers (28), is mechanically split into a first drive roller (40) which intercepts a first web (N1) and a second drive roller (44) which intercepts the second web (N2),
   - said first and second drive rollers (40,44) being operatively connected to separate drive means so that they can be operated at different speeds of rotation, to perform different degrees of drawing of the two webs (N1, N2) intercepted by said first and second drive roller (40.44),
   - wherein said first drive roller (40) is associated with a first idle roller (52) and said second drive roller (44) is associated with a second idle roller (56), said idle rollers (52,56) being mechanically separate from each other,
   - wherein a thrust device (60) is associated with said first and second idle rollers (52,56), which preloads each elastically in contact with the first drive roller (40) and the second drive roller (44) respectively, in a symmetric and equivalent manner so as to apply to said drive rollers (40,44) the same preload.

2. The drawing apparatus (4) for air spinning machines with multiple feeds, according to claim 1, wherein said thrust device (60) is configured to influence said first and second idle rollers (52,56) simultaneously and with the same elastic load against the first drive roller (40) and the second drive roller (44) respectively.

3. The drawing apparatus (4) for air spinning machines with multiple feeds according to claim 1 or 2, wherein said first and second drive rollers (52,56) are symmetrically supported by a common support pin (64) sustained by a frame (68) of the drawing device (60).

4. The drawing apparatus (4) for air spinning machines with multiple feeds, according to claim 3, wherein said support pin (64) comprises opposite, axial support ends (72, 76) which each interface with an upright (80) of the frame (68) of the thrust device (60) so as to be guided symmetrically by the frame (68) in a direction moving towards the corresponding drive rollers (40,44).

5. The drawing apparatus (4) for air spinning machines with multiple feeds, according to claim 4, wherein said common support pin (64) comprises a central or intermediate shoulder (84), arranged symmetrically between opposite, axial support ends (72,76), suitable t0 separate and axially distance said idle rollers (52,56) from each other.

6. The drawing apparatus (4) for air spinning machines with multiple feeds, according to claim 5, wherein the thrust device (60) comprises thrust means (88) which exert an elastic thrust at said opposite axial support ends (72,76) and/or said central shoulder

(84).

7. The drawing apparatus (4) for air spinning machines with multiple feeds, according to any of the claims from 3 to 6, wherein between each idle roller (52,56) and the common support pin (64) at least one guide bushing (92) is interposed.

8. The drawing apparatus (4) for air spinning machines with multiple feeds according to claim 7, wherein said at least one guide bushing (92) comprises an axial shoulder (96) .

9. The drawing apparatus (4) for air spinning machines with multiple feeds, according to claim 8, wherein each support pin (64) comprises a pair of guide bushings (92) arranged with the relative axial shoulders (96) inverted with each other.

10. The drawing apparatus (4) for air spinning machines with multiple feeds according to any of the claims from 4 to 9, wherein the opposite axial ends (72,76) of the support pin (64) are inserted in respective longitudinal guides (100) symmetrical to each other, said longitudinal guides (100) extending along prevailing longitudinal directions parallel to each other and perpendicular to said common support pin (64).

11. The drawing apparatus (4) for air spinning machines with multiple feeds according to any of the claims from 4 to 10, wherein the frame (68) comprises a mounting with a thrust arm (104) which interfaces on said support pin (64) and elastic thrust means (88) which determine the elastic thrust of the support pin (64) and of the relative idle rollers (52,56) against the respective drive rollers (40,44).

12. The drawing apparatus (4) for air spinning machines with multiple feeds, according to claim 11, wherein the thrust arm (104) is configured so as to act simultaneously on said opposite axial ends (72,76) of the support pin (64).

13. The drawing apparatus (4) for air spinning machines with multiple feeds, according to claim 11 or 12, wherein the thrust arm (104) is configured so as to act on an intermediate shoulder (84) of the support pin (64), arranged between said opposite axial ends (72,76).

14. The drawing apparatus (4) for air spinning machines with multiple feeds according to the claim 11, 12 or 13, wherein said elastic thrust means (88) comprise coil springs and/or foil springs.

15. The drawing apparatus (4) for air spinning machines with multiple feeds according to the claim 11, 12, 13 or 14, wherein said elastic thrust means (88) comprise hydraulic and /or pneumatic actuators.

16. The drawing apparatus (4) for air spinning machines with multiple feeds according to any of the preceding claims, wherein said first and second split drive rollers (40,44) are arranged facing in output with respect to the introducer elements (8,12).

17. The drawing apparatus (4) for air spinning machines with multiple feeds according to any of the claims from 1 to 16, wherein the webs (N1, N2) are fed in a longitudinal feed direction (L), the introducer elements (8,12) are juxtaposed in a transverse direction (Z), perpendicular to said longitudinal feed direction (L), the split drive rollers (32) are aligned with each other parallel to said transverse direction (Z) and revolve around transverse rotation axes, parallel to the transverse direction (Z).

18. The drawing apparatus (4) for air spinning machines with multiple feeds according to any of the claims from 1 to 13, wherein said air spinning device comprises a spinning chamber (20) having a plurality of jets of air oriented in a direction substantially tangential to said webs in input in the spinning chamber (20), so as to interweave said webs (N1, N2) and obtain a single yarn (F) in output from the air spinning chamber (20).

19. Drawing method (4) for air spinning machines with multiple feeds, comprising the steps of:

- preparing a drawing apparatus according to any of the claims from 1 to 18,
- performing the drawing of said webs (N1, N2) with said drawing apparatus.

20. The drawing method according to claim 19, comprising the step of adjusting the workloads for each of said two webs (N1, N2) in the range of 12-18 kg.

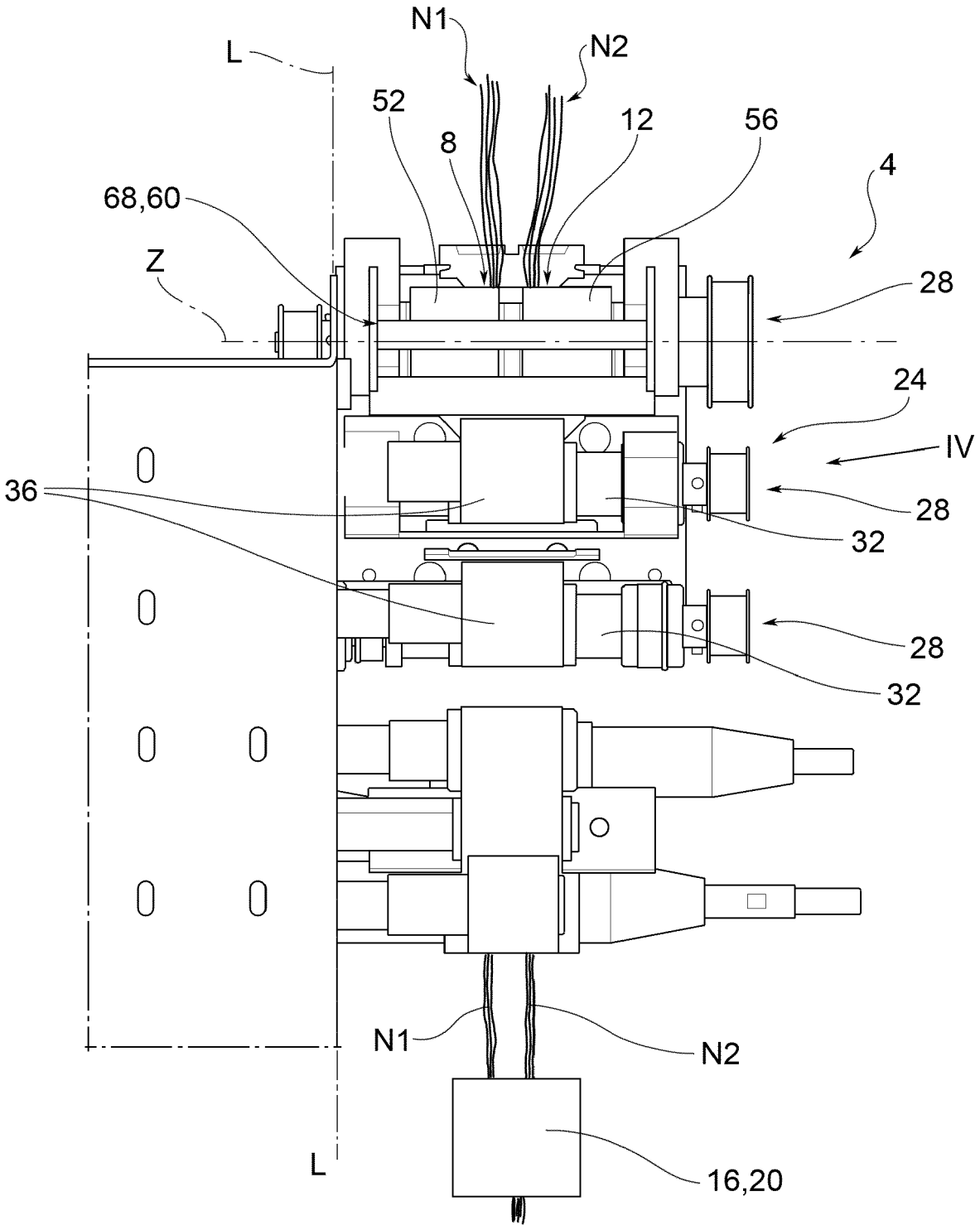

FIG.1

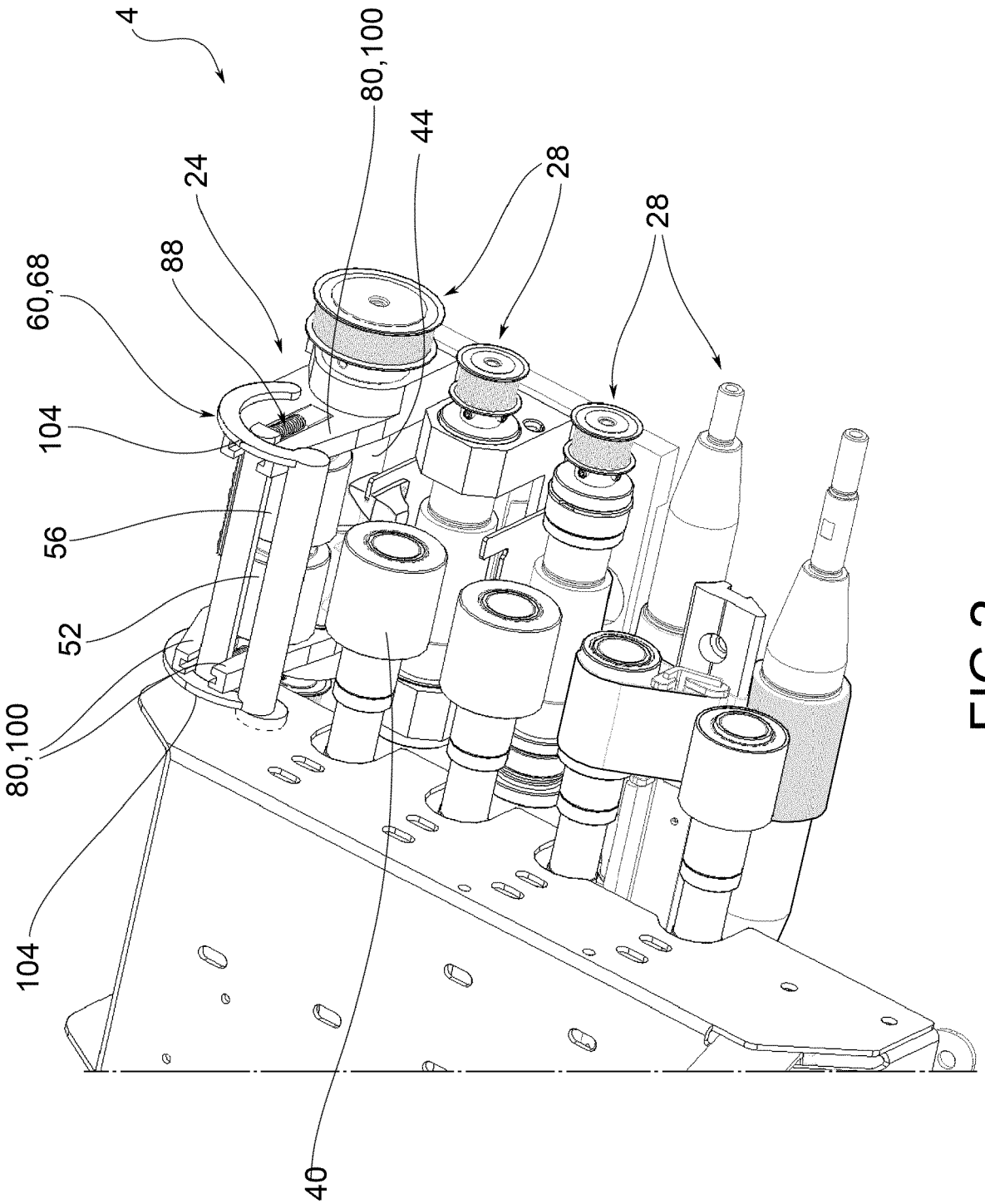

FIG.2

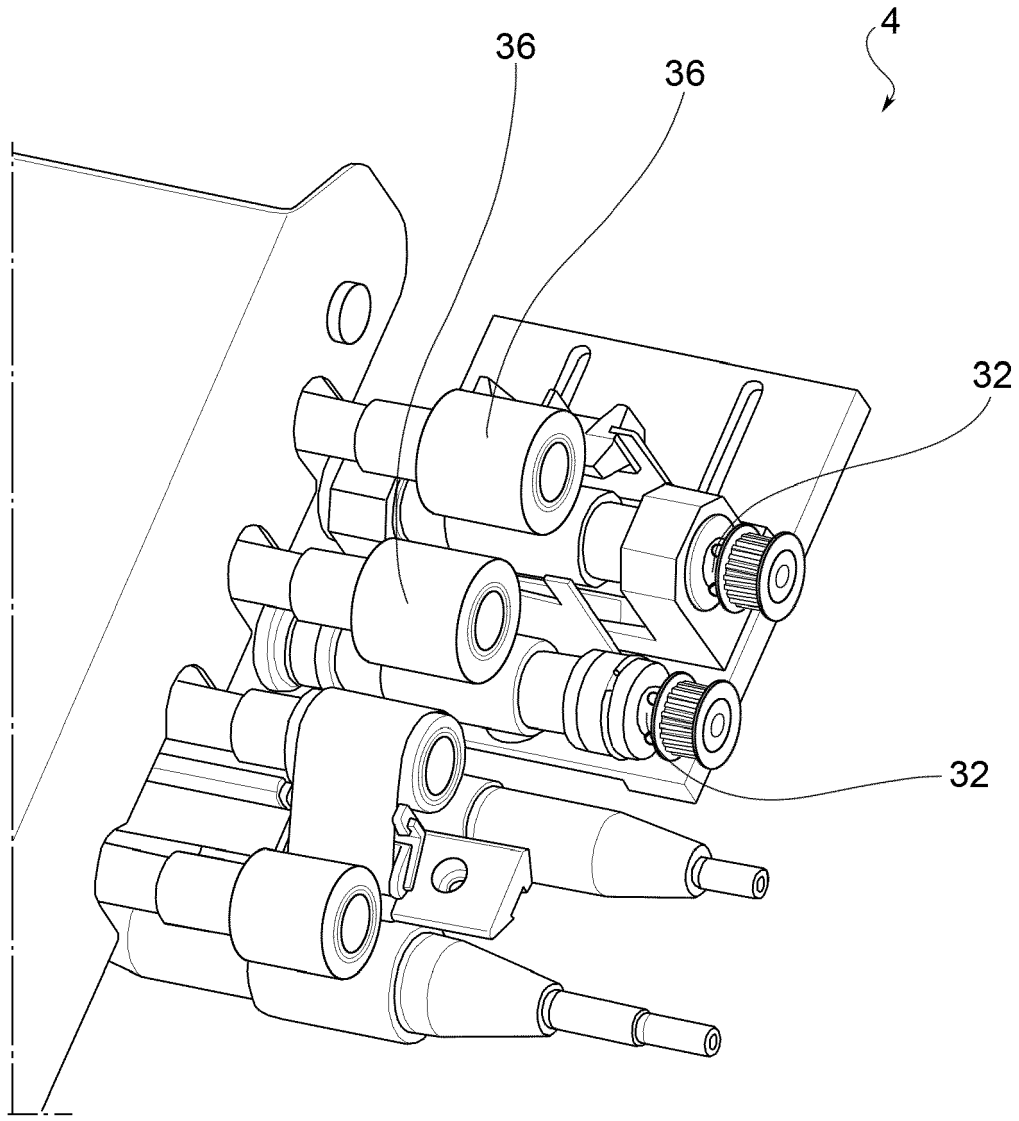

FIG.3

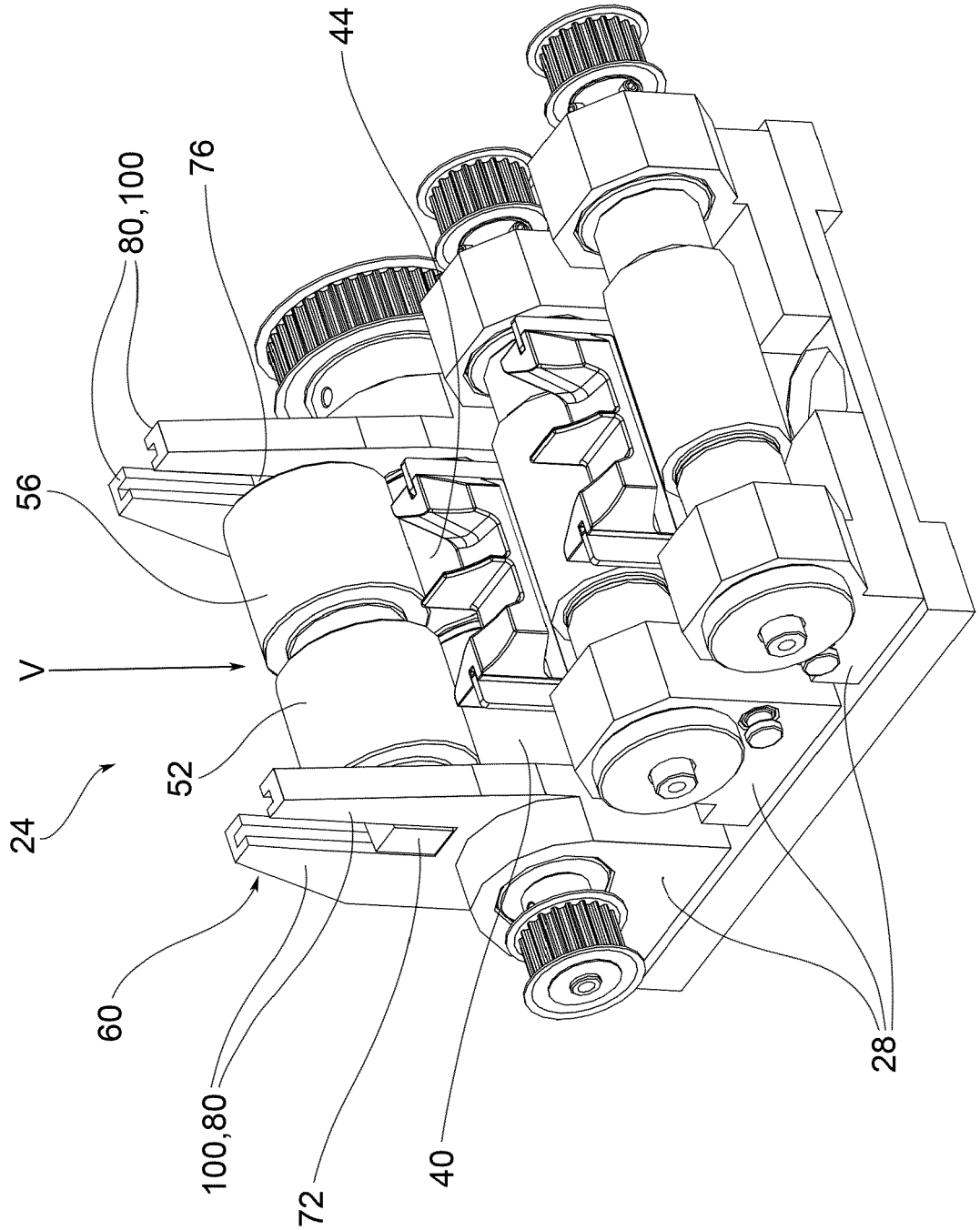

FIG.4

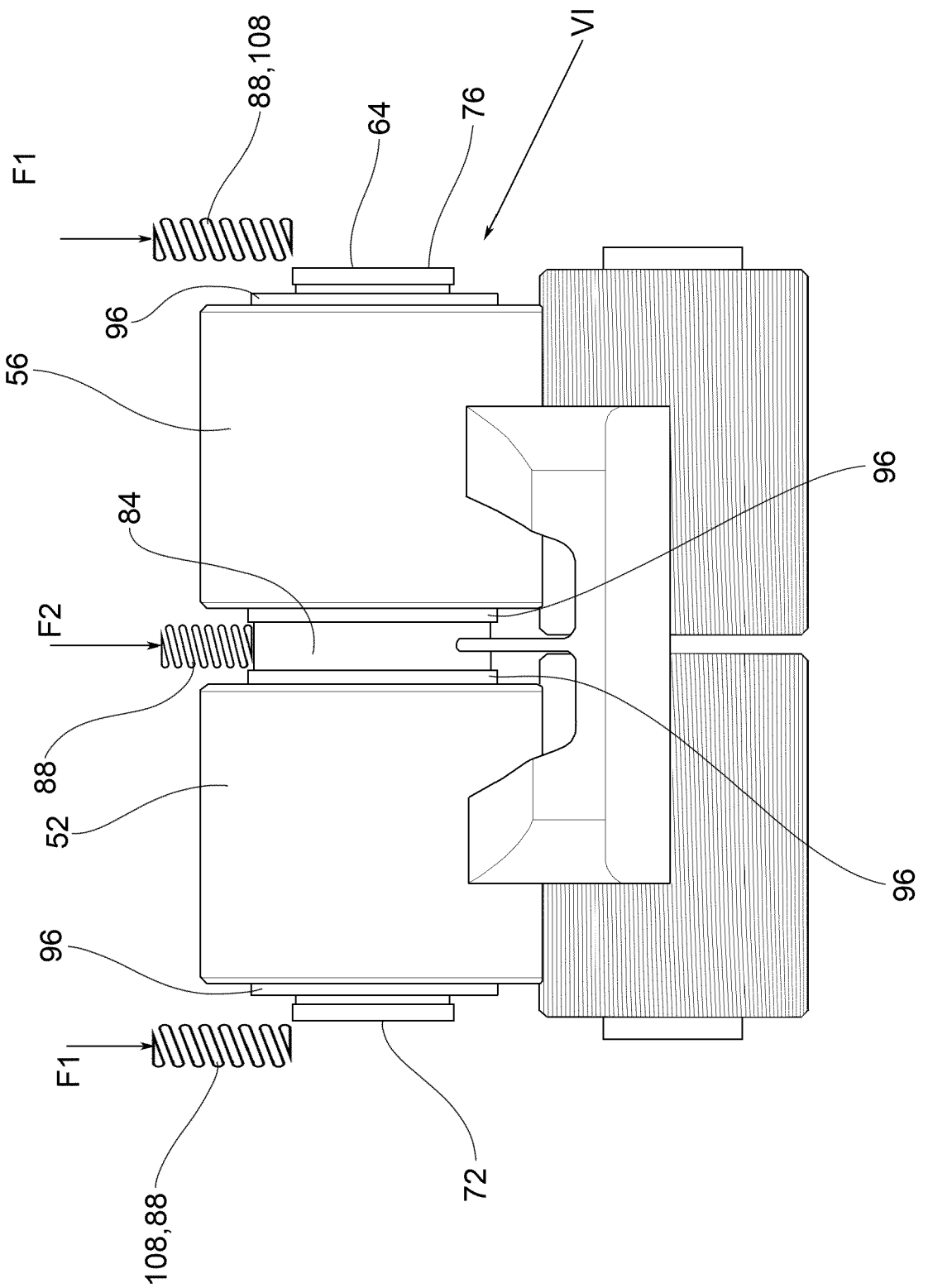

FIG.5

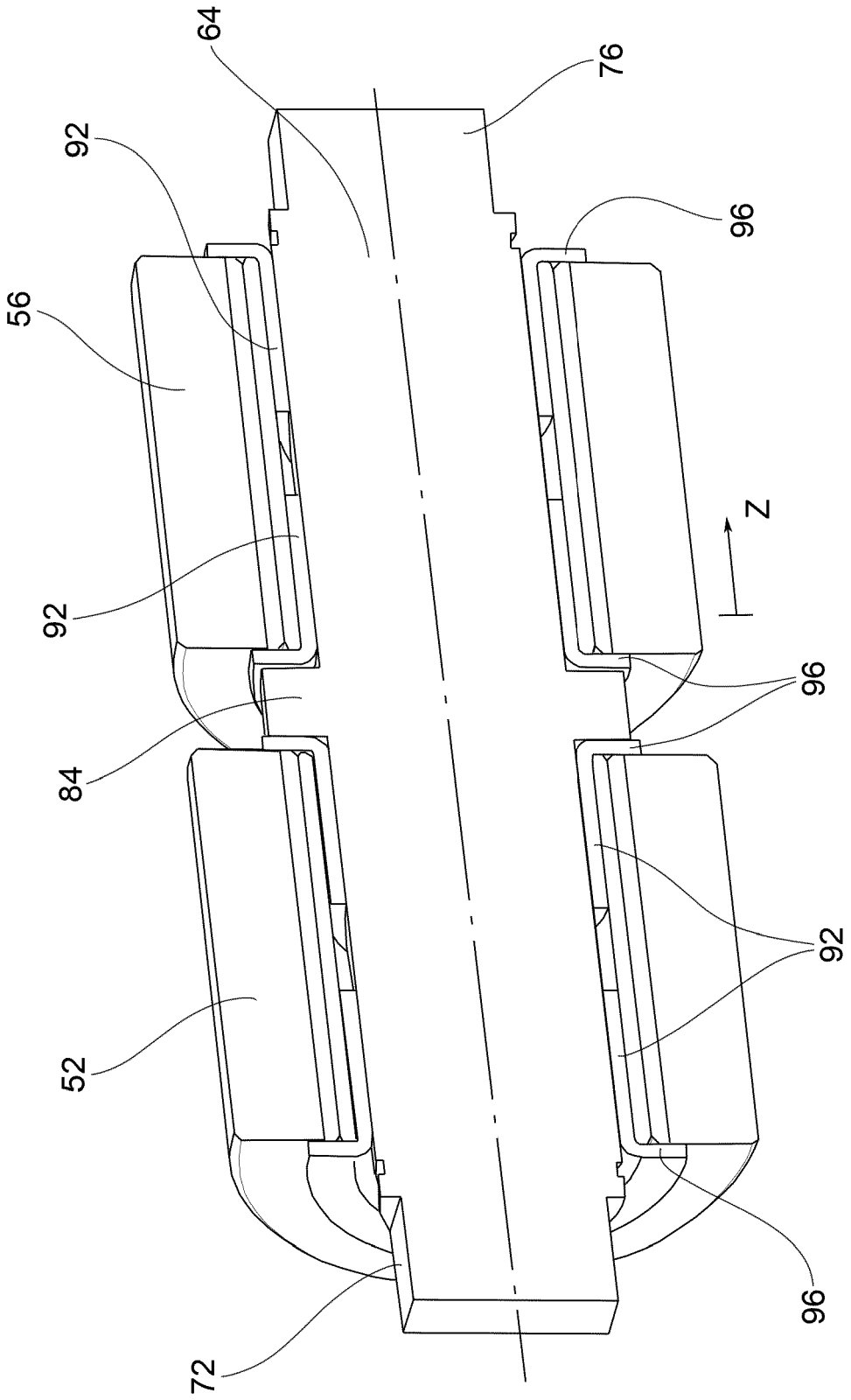

FIG.6

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EUROPEAN SEARCH REPORT

Application Number
EP 20 19 6460

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 3 321 401 A1 (SAVIO MACCH TESSILI S P A [IT]) 16 May 2018 (2018-05-16) * paragraph [0011] - paragraph [0022]; figure 3 * * claims 14, 16, 17 *	1,2, 16-20	INV. D01H5/50
X	IT FI20 070 128 A1 (PAFASYSTEM S R L) 6 December 2008 (2008-12-06) * page 3, line 13 - page 6, line 7; figures 1-4 *	1-3,7-9, 16,17, 19,20	
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A,P	EP 3 650 591 A1 (SAVIO MACCH TESSILI S P A [IT]) 13 May 2020 (2020-05-13) * claims 1, 2, 12-14; figure 2 *	1,2, 16-19	

TECHNICAL FIELDS SEARCHED (IPC)

D01H
D02G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	25 January 2021	Todarello, Giovanni

CATEGORY OF CITED DOCUMENTS

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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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