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

(11) EP 1 066 935 A2

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
10.01.2001 Bulletin 2001/02

(51) Int. Cl.^{7}: **B27J 5/00**

(21) Application number: **00113533.4**

(22) Date of filing: **27.06.2000**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **30.06.1999 IT TO990559**

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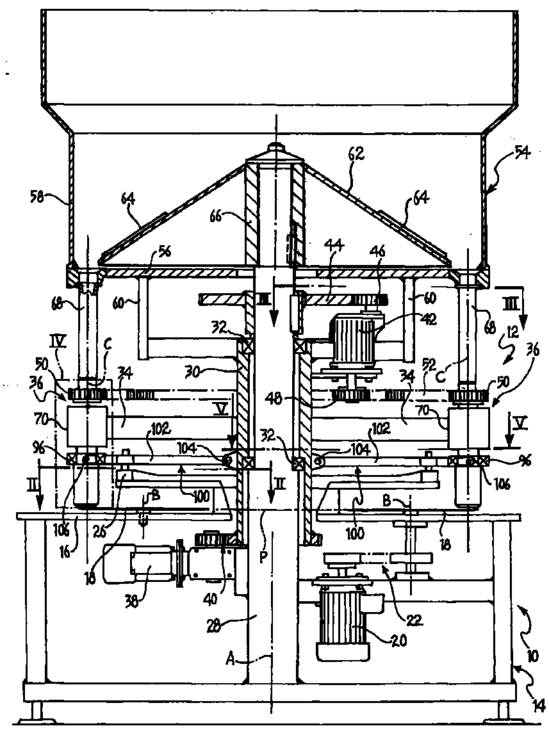
(54) **A machine for producing cork discs, particularly for composite stoppers**

(57) The machine comprises a stationary structure (10) and a rotary structure (12). One of these structures (10) has at least one driven, rotary, circular blade (18) and the other structure (12) comprises one or more supply ducts (76) in which a series of cork stoppers or other cylindrical cork elements progress in succession. Pincer means (88) are associated with the opening of the or each supply duct (76). The pincer means (88) are operated in synchronism with the rotation of the rotary structure (12) on each occasion in order to hold the first cylindrical element of the series whilst it is cut by the circular blade (18) and to release the element after the cutting has been performed and before the next cutting operation so that the portion of the cylindrical element which has not yet been cut progresses until it engages a support track for the cutting of a subsequent disc.

FIG. 1



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Description

[0001] The present invention relates to a machine for producing cork discs, particularly for composite stoppers.

[0002] It is known that a natural cork stopper is produced from the cortex or bark of the trunk of the cork oak (*Quercus suber L.*).

[0003] The bark of the tree is removed from the trunk periodically in the form of so-called planks several centimetres thick.

[0004] The flattened and seasoned planks are then cut into parallel strips the longitudinal axes of which correspond to the circumferential direction in the original bark.

[0005] A direction in which cork has the greatest impermeability to liquids and to gases is that corresponding to the height of the strip, that is, to the longitudinal direction in the original bark.

[0006] In the perpendicular direction, which corresponds to the radial direction of growth of the bark on the tree, lenticels, which appear as channels full of dust formed by dead cells, extend through the cork, throughout its thickness. It is through these channels that the gaseous exchange between the internal tissues of the trunk and the surrounding air took place in the tree.

[0007] In this second direction, the impermeability of the cork, particularly to gases, is less good owing to the presence of the above-mentioned channels.

[0008] For this reason, natural cork stoppers are produced by die-cutting of the above-mentioned strips in the direction which corresponds to the above-mentioned longitudinal direction.

[0009] Natural cork stoppers are becoming more and more expensive and tend to be used only for corking expensive, still or sparkling wines, particularly if they are to be aged in the bottle.

[0010] To reduce costs, stoppers made of reconstituted cork, that is, a material constituted by ground cork granules bound with a suitable adhesive, are being used more and more frequently.

[0011] The impermeability of these stoppers is good, but not excellent and, moreover, decreases with the passage of time. Another disadvantage of reconstituted cork stoppers is that the glue which holds the granules together may alter the organoleptic properties of the wine or other beverage contained in the bottle.

[0012] To prevent these problems, composite stoppers are used, that is, one or more natural cork discs are glued to the end of the stopper which is to be disposed inside the bottle. Sometimes, the stoppers are provided with these discs at both ends, to avoid problems in selecting the orientation of the respective ends in corking machines.

[0013] According to the prior art, the discs are produced by semi-manual die-cutting from thin portions of the planks from which it is not possible to form stoppers.

[0014] Owing to the way in which the discs have been produced, the above-mentioned channels formed by the lenticels are oriented in the direction of the thickness of the disc, so that its impermeability is not very good.

[0015] For this reason, two or more superposed discs are sometimes used on the end of the stopper which is to be disposed inside the bottle, so that the channels are offset from one disc to another.

[0016] A first object of the invention is to provide a machine for producing cork discs which eliminates all of the manual work connected with the cutting of the discs and which can operate automatically.

[0017] A second object of the invention is to provide a machine which can produce cork discs having excellent impermeability by virtue of the fact that the above-mentioned channels are oriented in a direction perpendicular to their thickness, so that it is not necessary to superpose two or more discs on the end of the same stopper.

[0018] According to the invention, these objects are achieved by means of a machine as claimed.

[0019] A machine according to the invention enables discs to be produced from cylindrical elements constituted by natural cork stoppers.

[0020] By virtue of the fact that these discs are cut in a manner such that the direction in which the cork has the greatest impermeability is oriented along their axes, which are the axes of the stoppers from which they are produced, a single disc glued to the end which is to be disposed inside the bottle, or to each end, to prevent the above-mentioned orientation problem, will suffice to ensure the impermeability of the stopper.

[0021] Although natural cork stoppers are expensive, it has been calculated that it is possible to produce a composite stopper with a reconstituted cork body and a natural cork disc on the end at which it is actually required, or on both ends, at a cost less than that of a stopper made entirely of natural cork.

[0022] A machine according to the invention can also cut cork discs intended for uses other than that of the production of composite stoppers.

[0023] The invention will be understood better from a reading of the following detailed description, given with reference to the appended drawings, provided by way of non-limiting example, in which:

Figure 1 is a sectioned elevational view of a preferred embodiment of a machine according to the invention,

Figure 2 is a horizontal half-section through the machine, taken in the plane indicated II-II of Figure 1, on an enlarged scale,

Figure 3 is a horizontal half-section through the machine, taken in the plane indicated III-III in Figure 1, on an enlarged scale,

Figure 4 is a section through the portion included in the area indicated by the broken line IV in Figure 1, on an enlarged scale,

Figure 5 is a partially-sectioned plan view taken in the plane indicated V-V in Figure 1, on an enlarged scale, and

Figures 6A and 6B are schematic representations which illustrate a cutting sequence performed by the machine.

[0024] With reference to Figures 1 to 3, a machine according to the invention comprises two associated structures, indicated 10 and 12, respectively.

[0025] The structure 10 is stationary and the other structure 12 is driven and rotates about a vertical axis A, as indicated by the arrow F1 in Figure 3.

[0026] The stationary structure 10 comprises a framework 14 with a circular upper table 16.

[0027] On the table 16 there is a pair of circular rotating blades 18 situated in diametrally opposed peripheral positions and supported by the framework 14 of the stationary structure 10.

[0028] A cutting plane common to the blades 18 is indicated P in Figure 1.

[0029] The axes of rotation B of the two circular blades 18 are vertical and parallel to the axis A of rotation of the rotary structure 12.

[0030] The two circular blades 18 can be driven so as to rotate continuously as indicated by the arrows F2 (Figures 2 and 3) by an electric motor 20, by means of a belt transmission 22 which rotates both of the blades 18, in a manner not shown.

[0031] The table 16 supports a pair of support tracks 24 (Figure 2) each of which extends between the two disc blades 18 along an arcuate path concentric with the axis of rotation A of the rotary structure 12.

[0032] The function and the configuration of the tracks 24 will be explained further in the description with reference to Figures 6A and 6B.

[0033] The table 16 of the stationary structure 10 also supports a circular cam 26 which is concentric with the axis A and the function of which will be explained further in the description with reference to Figure 5, and elsewhere. The framework 14 of the stationary structure 10 also comprises a central pillar 28 which supports the rotary structure 12 rotatably and which extends above the structure 12.

[0034] The rotary structure 12 comprises a central sleeve 30 which surrounds an upper portion of the stationary pillar 28 on which it is mounted with the interposition of rolling-contact bearings 32.

[0035] An array of rigid radial arms 34 extends from the sleeve 30, there being sixteen arms 34 in the embodiment shown.

[0036] Each of these arms 34 supports a respective supply unit 36, the details of which will be described below with reference to Figure 4.

[0037] Inside the framework 14, there is a geared electric motor unit 38 which rotates the entire rotary structure 12 by means of the sleeve 30 and by means of a pair of gears 40.

[0038] The sleeve 30 supports the casing of a reduction unit 42 having gears with vertical axes.

[0039] A ring gear 44 keyed to a portion of the stationary pillar 28 situated above the sleeve 30 meshes with a sprocket 46 fixed to the input shaft of the reduction unit 42.

[0040] A toothed drive pulley 48 is keyed to the output shaft of the reduction unit 42.

[0041] Each supply unit 46 has an upper, driven toothed pulley 50.

[0042] As can best be seen in Figure 3, the drive pulley 48 is connected to all of the driven pulleys 50 by means of a toothed transmission belt 52 which extends around the entire circumference of the rotary structure 12.

[0043] When the rotary structure 12 is rotated, the reduction unit 42 rotates about the pillar 28 and its input sprocket 46 circulates about the ring gear 44 in a manner of a satellite. The drive pulley 48 thus rotates the inner portions (described further below) of all of the supply units 36 simultaneously, with a suitable ratio.

[0044] The rotary structure 12 also comprises a supply hopper 54 with a base wall 56 and a peripheral wall 58.

[0045] The hopper 54 is fixed for rotation with the sleeve 30 by means of a radial array of right-angled support arms 60.

[0046] Inside the hopper 54 there is a conical apron 62 provided with deflector fins 64.

[0047] The apron 62 is stationary, since it is keyed to an upper portion of the stationary pillar 28 by means of a central sleeve 66.

[0048] A plurality of tubular appendages 68 extending from the periphery of the base wall 56 act as downward ducts, each aligned precisely with a supply duct, which will be referred to further below, of a respective supply unit 36.

[0049] Cork stoppers (or other cylindrical cork elements) are loaded into the hopper 54, descend along the apron 62, and are mixed, so to speak, by the fins 64, finally falling into the downward ducts 68, descending in succession first through these ducts 68 and then through supply ducts which form part of the supply units 36, all of which will be explained further in the description with reference to Figures 6A and 6B.

[0050] The structure of one of the supply units 36 will now be described with particular reference to Figure 4.

[0051] The unit 36 comprises a bush 70 which is fixed by means of lugs 72 to a respective radial arm 34 (Figures 1 and 3) of the rotary structure 12.

[0052] A tube 76, to an upper end of which the respective driven toothed pulley 50 is keyed, is mounted in the bush 70 by means of rolling-contact bearings 74 so as to be rotatable about an axis C.

[0053] The axis C is parallel to the axes A and B and, in the embodiment shown, is also vertical.

[0054] A supply duct 78 mounted coaxially in the tube 76 is aligned with a respective downward duct 68 coming from the hopper 54 (Figure 1).

[0055] The duct 78 is constituted by a tube of resilient material such as steel, the upper end of which is suspended in the tube 76.

[0056] This suspension is achieved by means of a grub screw 80 engaged in a peripheral groove 82 of the duct 78.

[0057] The duct 78 has a series of longitudinal slots 84 starting at a predetermined height and extending for a portion of the length of the duct 78 as far as a lower opening, indicated 86, of the duct or tube 78.

[0058] The slots 84 divide the duct 78 into a circular series of petals 88 (for example, six petals) which act as jaws, as will be explained below.

[0059] In the region of the opening 86, the petals 88 have respective outer enlarged portions 90 which together define a radially outer truncated cone converging towards the cutting plane P (Figures 1, 6A and 6B) of the circular blades 18.

[0060] The petals 88 are surrounded by a sleeve 92 mounted around the tube 76 so as to be slidable vertically.

[0061] The sleeve 92 has a lower frustoconical inner surface 94 which corresponds to the truncated cone defined by the enlarged portions 90.

[0062] A collar 96 is associated with the upper portion of the sleeve 92.

[0063] A rolling-contact bearing 98 fixes the sleeve 92 and the collar 96 for translation together whilst allowing the sleeve 92 to rotate about its axis C, relative to the collar 96 and together with the tube 76 and with the duct or tube 78.

[0064] As can easily be understood, when the sleeve 92 is raised by means of the collar 96, moving away from the cutting plane P (Figure 1, 6A, and 6B), the petals 88 are squeezed together in the manner of pincers, whereas when the sleeve 92 is allowed to descend as a result of a lowering of the collar 96, moving towards the cutting plane P, the pincer means constituted by the petals 88 are released.

[0065] The function of the pincer means 88 will be explained further in the course of the description with reference to Figures 6A and 6B.

[0066] The upward and downward movements of the sleeve 92 and of the collar 96 are brought about by the circular cam 26 of Figures 1 and 2.

[0067] This cam 26 has a face cam track which faces upwards and has raised portions 26a (Figure 2) in the region of the circular blades 18 and intermediate, recessed portions 26b, in order to perform the function which will be explained with reference to Figures 6A and 6B.

[0068] Figure 5 shows a linkage, generally indicated 100, which serves to impart the above-mentioned movements to the collar 96 and hence to the sliding sleeve 92.

[0069] The linkage 100, which is also visible in Figures 1 and 3, comprises a connecting rod with two arms 102. At one end, the two arms 102 are articulated, by means of a pin 104, to the central portion of the rotary structure constituted by the sleeve 30; at the other end, the two arms 102 of the connecting rod are articulated to the collar 96 by means of diametrally opposed pins 106 thereof.

[0070] A cross-member 108 constituted by two spaced-apart portions, between which a cam follower 110 in the form of a small wheel is engaged, extends between the two arms 102 of the connecting rod.

[0071] The wheel 110 is mounted rotatably on the two portions 108 of the cross-member by means of a pin 112 which extends radially relative to the machine.

[0072] The cam-follower wheel 110 is in engagement with the circular cam 26 and follows its profile in order to bring about the upward and downward movements of the collar 96 and of the sleeve 92 during the rotation of the rotary element 12.

[0073] The preferred operation of the machine and further characteristics thereof will now be described with reference to Figures 6A and 6B.

[0074] In Figures 6A and 6B, parts already described are indicated by the same reference numerals as in the previous drawings.

[0075] In Figures 6A and 6B, the direction of rotation of the rotary structure 12 of Figures 1 and 2 is again indicated F1 and, in the plan view of Figure 3, is assumed to be clockwise.

[0076] In Figures 6A and 6B, the supply units 36 which follow one another from right to left may be the various units 36 of the circular series shown in Figure 3 but, for simplicity of explanation, it will be assumed that it is a single unit which moves continuously from right to left in the direction F1 during the execution of a cutting cycle.

[0077] Positions of the unit are indicated S1, S2, S3, S4, S5 and S6, again from right to left, and are also shown in Figure 2.

[0078] To facilitate understanding, the position S4 is shown both in Figure 6A and in Figure 6B.

[0079] The cutting plane of the circular blades 18 is again indicated P.

[0080] The support tracks are again indicated 24.

[0081] The height of the support tracks 24 is adjustable in a manner not shown, so that the thickness of the discs to be cut from the stoppers, or from other cylindrical cork elements, which are stacked in succession in the duct 78, can be selected.

[0082] Preferably, according to the invention, each track 24 extends between an input region 24a and an output region 24b, which are also indicated in Figure 2.

[0083] With reference to the direction of rotation F1 of the rotary structure 12, the input region 24a immediately follows a circular blade 18 and the output region 24b immediately precedes a circular blade.

[0084] In Figures 6A and 6B, the stoppers or other cylindrical elements which are to be cut into discs and which are stacked in the supply duct 78 are indicated W; in the position S3, a disc of a predetermined thickness (for example 6 mm), already cut by means of one of the circular blades 18, is indicated R.

[0085] In positions S1 and S2, it is assumed that, as a result of previous cutting operations, a short section of stopper W_0 of a height or thickness greater than that of the disc R (for example 10 mm), from which it is still possible to cut a single disc R, remains at the lower end of the series or stack of stoppers W.

[0086] Preferably, according to the invention and as also shown in Figure 2, each support track 24 comprises an intermediate region 24c with an upward slope between the input region 24a and the output region 24b. The output region 24b is spaced from the cutting plane P of the blade by a distance H_1 equal to the thickness of the discs R to be cut; the input region 24a is spaced from the cutting plane P by a distance H_2 greater than the thickness H_1 and, in the case in question, greater the thickness or height of the remaining section W_0.

[0087] In Figures 6A and 6B, the pincer means are indicated conventionally by the reference numeral 88 which, in Figure 4, indicates the petals; the opening of the supply duct 78 is again indicated 86, as in Figure 4.

[0088] In position S1, the opening 86 of the duct 78 is already facing the input region 24a of the track 24 and the pincer means 88 are released, allowing the first cylindrical element of the series, constituted by the portion W_0, to bear on the track 24.

[0089] Whilst the unit 36 continues its movement in the direction F1, the section of cork W_0 slides on the rising portion 24c of the slope 24, whilst the pincer means 88 are released, this section of cork going back into the opening 86 by a distance such that a portion thereof having a thickness substantially equal to H_1 projects beneath the opening 86 (position S2).

[0090] At this point, the follower 110 passes over the raised portion 26a of the cam 26 (Figure 2), causing the pincer means 88 to be tightened around the portion W_0 which can then leave the support track 24 without falling, supporting the entire stack of stoppers W contained in the duct 78.

[0091] In the next position S3, the opening 86 is situated wholly in a region in which it is entirely facing the circular blade 18.

[0092] At this point, the circular blade 18 cuts from the section W_0 a slice or disc R which falls into a suitable underlying container (not shown).

[0093] As the rotary structure 12 continues to rotate, the duct 78 leaves the blade 18 (position S4) whilst the pincer means 88 remain tightened, still holding the section W_0.

[0094] The duct 78 then reaches position S5 (Figure 6B) in which the pincer means 88 are released. The stack of stoppers W then descends by gravity and the remainder W_R of the section W_0 comes to rest on the input region 24a of the next support track, being arranged entirely below the level of the pincer means 88.

[0095] The remaining section W_R is completely free and, since it is no longer dragged along, it remains substantially where it is on the track 24, from which it can be expelled by an arriving stopper W or section of stopper W_0.

[0096] The remaining section W_R finally falls into another suitable container, other than that which collects the discs R, in order then to be retrieved, for example, in order to be transformed into granules for the production of reconstituted stoppers.

[0097] With the removal of the remaining section W_R, the first, lowermost stopper W_1 of the series (position S6) can descend until it bears on the track 24 in order then to be sliced into discs R in accordance with the sequence described, starting from position S1.

[0098] Preferably, as indicated by the arrows F3 in Figure 3, the duct 78 and its pincer means 88 of each group 36 are rotated in the same direction F2 as the circular blades 18 but so as to have a relative tangential shearing velocity substantially equal to the sum of the tangential velocities of the stoppers W and of the blades 18.

[0099] In practice, it has been found that, in these conditions, the cutting of the discs R takes place more cleanly. However, opposite directions of rotation are not excluded.

[0100] In the embodiment described with reference to the drawings, the structure 10 which carries the circular blades 18 is stationary and the structure 12 which carries the supply units 36 rotates, but a machine according to the invention could be formed with the structure which carries the rotary blades being rotated and the structure which carries the supply units being kept stationary.

[0101] Moreover, the foregoing description refers to an arrangement, which is considered most advantageous, in which all of the axes of rotation A, B, C are vertical and the force which tends to cause the stoppers or other cylindrical elements to descend in the ducts is the force of gravity.

[0102] In a machine according to the invention, the axes of rotation could also have an orientation other than vertical, for example, a horizontal orientation. In this case, the supply of the stoppers or other cylindrical elements in the respective ducts such as 76 would be achieved under a force other than that of gravity.

[0103] Moreover, the drawings show a machine which comprises two circular, driven blades 18 and a plurality of supply ducts 78 and respective pincer means 88, but a machine according to the invention could also comprise only one driven circular blade such as 18 and a single supply duct such as 78 with the respective pincer means such as 88, or more than two circular blades.

Claims

1. A machine for producing cork discs (R), characterized in that it comprises:

- two associated structures (10, 12), one stationary and the other driven and rotating about an axis (A),
- at least one driven, rotary, circular blade (18) supported in a peripheral position by one of the structures (10) and having its axis of rotation (B) parallel to the axis of rotation (A) of the rotary structure (12),
- supply means (36) supported by the other structure (12) and comprising at least one supply duct (76) in which a series of cylindrical cork elements (W, W_0, W_1) are disposed and are caused to progress in succession, and which has an axis (C) parallel to the axis of rotation (A) of the rotary structure (12) and an opening (86) which, upon each revolution of the rotary structure (12), is positioned wholly in a region in which it entirely faces the circular blade (18), the cylindrical elements (W, W_0, W_1) in the duct being subject to a force tending to cause them to progress and to emerge through the opening (86) of the duct (76) one by one,
- a support track (24) supported by the structure (10) which supports the circular blade (18) and situated in a position opposite the opening (86) of the duct (76), with reference to the cutting plane (P) of the circular blade (18), and in a space not occupied by the blade, in order to stop a first cylindrical element (W_0, W_1) of the series, which projects from the opening (86), in a position such that the blade (18) subsequently cuts a disc (R) of predetermined thickness from the element, and
- pincer means (88) associated with the opening (86) of the duct (76) and operated in synchronism with the rotation of the rotary structure (12) on each occasion in order to hold the first cylindrical element (W_0, W_1) of the series whilst it is cut by the circular blade (18) and to release the element after the cutting has been performed and before the next cutting operation so that the portion of the cylindrical element (W_0, W_1) which has not yet been cut progresses until it engages the track (24) for the cutting of a subsequent disc (R).

2. A machine according to Claim 1, characterized in that the track (24) is arcuate and concentric with the axis of rotation (A) of the rotary structure (12) and extends between an input region (24a) and an output region (24b) adjacent the circular blade (18).

3. A machine according to Claim 2, characterized in that, between its input region (24a) and its output region (24b), the track comprises a sloping intermediate region (24c), the output region (24b) being spaced from the cutting plane (P) of the blade (18) by a distance (H_1) equal to the thickness of the discs (R) to be cut and the input region (24a) being spaced from the cutting plane (P) by a distance (H_2) greater than the thickness of the discs (R) to be cut, and in that the pincer means (88) are operated in synchronism so as to perform the following operating sequence:

- when the opening (86) of the duct (76) and the input region (24a) of the track (24) come to face one another, the pincer means (88) are released to allow the first cylindrical element (W_0, W_1) of the series to bear on the track (24);
- when the output region (24b) of the track (24) and the opening (86) of the duct (76) come to face one another, the pincer means (88) are tightened, clamping the cylindrical element (W_0, W_1) in the opening (86) with a portion of this element equal to the thickness (H_1) of the disc (R) to be cut projecting therefrom;
- the pincer means (88) remain clamped from the moment at which the cylindrical element (W_0, W_1) ceases to engage the output region (24b) of the track, during the cutting of a disc (R) by means of the circular blade (18), and up to the moment at which the circular blade ceases to engage the cylindrical element (W_0, W_1) from which the disc (R) has been cut,
- when the opening (86) of the duct (76) and the input region (24a) of the track face one another again, the pincer means (88) are released to allow the first cylindrical element (W_1) of the series to bear on the track (24), and so on.

4. A machine according to any one of the preceding claims, characterized in that the duct (76) and the pincer means (88) are rotated about their axis (C).

5. A machine according to Claim 4, characterized in that the duct (76) and the pincer means (88) are rotated in the same direction of rotation as the circular blade (18).

6. A machine according to any one of the preceding claims, characterized in that, in order to form the pincer means,

- the duct (76) is constituted by a tube made of resilient material such as steel, which has a series of longitudinal slots (84) extending for a portion of its length as far as the opening (86) of the duct (76) so as to divide the duct (76) into a circular series of petals (88) acting as jaws,

- in the region of the opening (86) the petals (88) have respective outer enlarged portions (90) which together define a radially outer truncated cone converging towards the cutting plane (P), and

- the petals (88) are surrounded by a sliding sleeve (92) with a frustoconical inner surface (94) which corresponds to the truncated cone so as to squeeze the petals (88) together when the sleeve (92) is moved away from the cutting plane (P) and to release the petals (88) when the sleeve (92) is moved towards the cutting plane (P),
  and in that it comprises a circular cam (26) which is supported by the same structure (10) that supports the circular blades (18) and which imparts the above-mentioned movements to the sliding sleeve (92) by means of a linkage (100).

7. A machine according to Claim 6, characterized in that the circular cam (26) is a cam with a face cam track, supported by the respective structure (10) in an intermediate position between a central portion (30) of the other structure (12) and the sliding sleeve (92), the sliding sleeve (92) has a collar (96) fixed for translation with the sleeve and rotatable relative thereto, and the linkage is constituted by a connecting rod (102) articulated by one end to the central portion (30) and by the other end to the collar (96), and carrying an intermediate follower (112) engaged with the track of the circular cam (26).

8. A machine according to any one of the preceding claims, characterized in that one of the structures (10) supports two or more equiangularly spaced circular blades (18) alternating with a corresponding number of support tracks (24) and the other structure (12) supports a plurality of supply means (36) with respective ducts (76) and respective pincer means (88).

9. A machine according to any one of the preceding claims, characterized in that the or each circular blade (18) and the or each support track (24) are supported by the stationary structure (10) and the or each duct (76) and the respective pincer means (88) of the supply means (36) are supported by the rotary structure (12).

10. A machine according to any one of the preceding claims, characterized in that the axes of rotation (A, B, C) are vertical and the force which tends to cause the cylindrical elements (W, W_0, W_1) to emerge from the duct (76) is the force of gravity.

FIG. 1

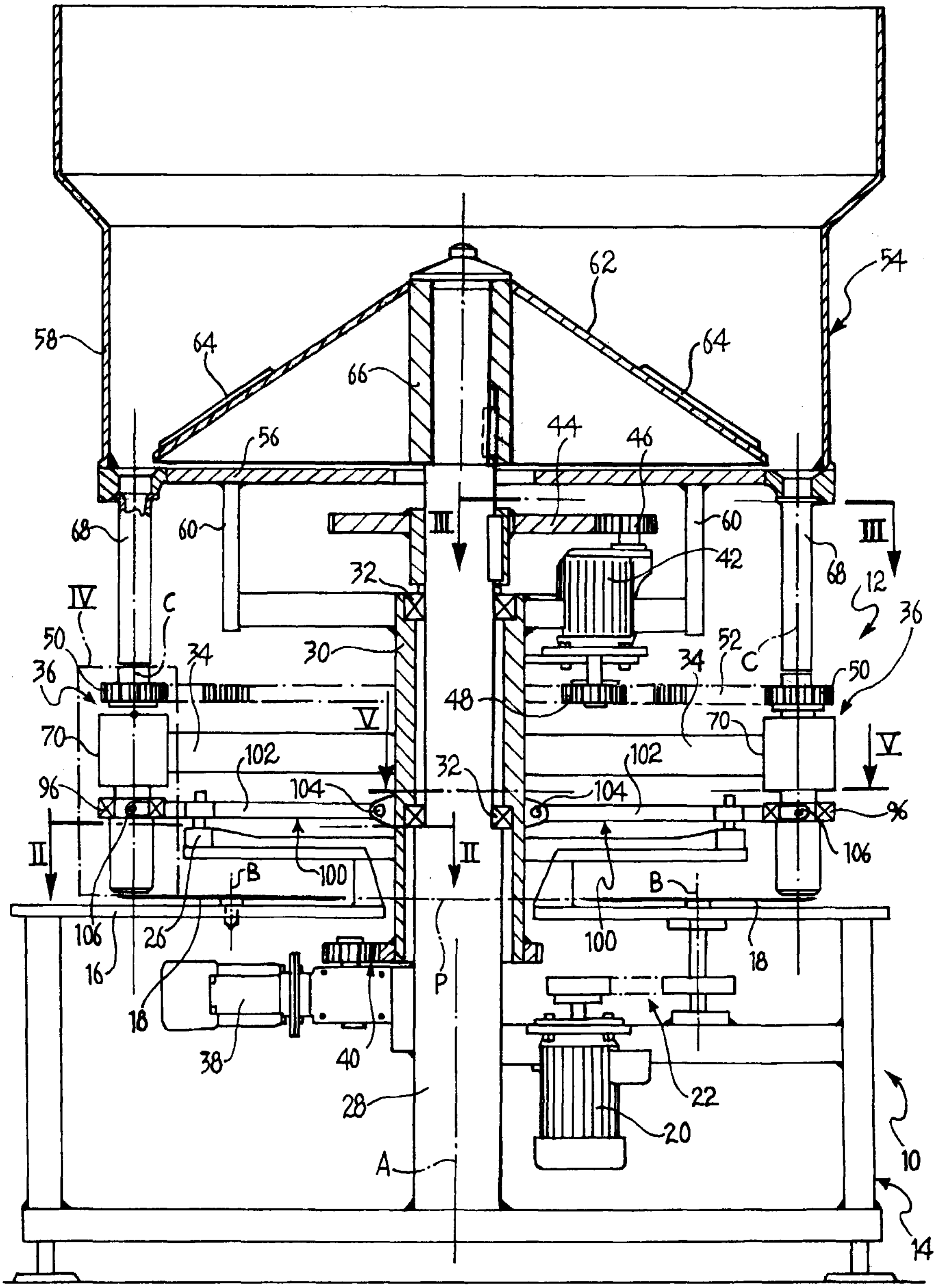
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FIG. 2

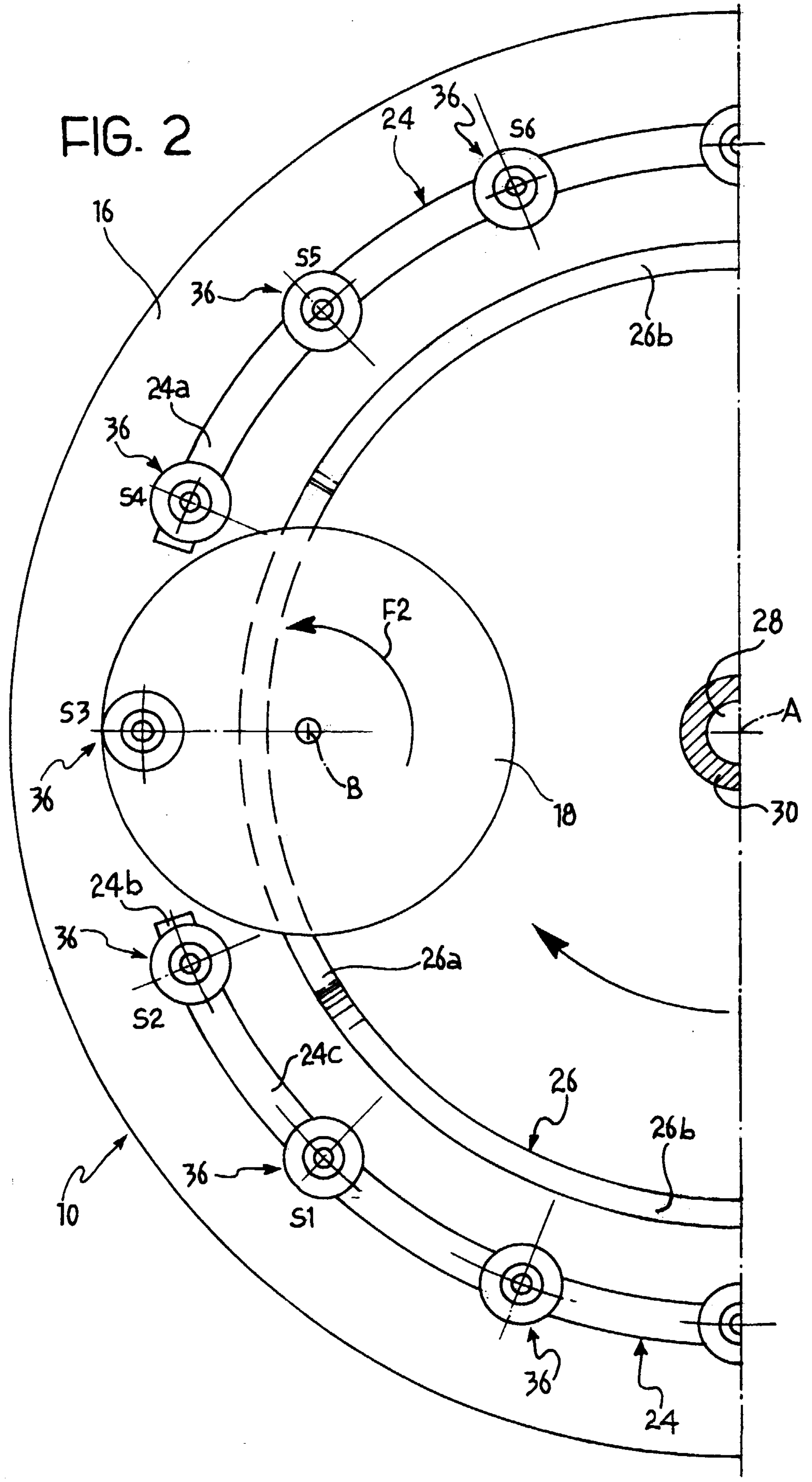
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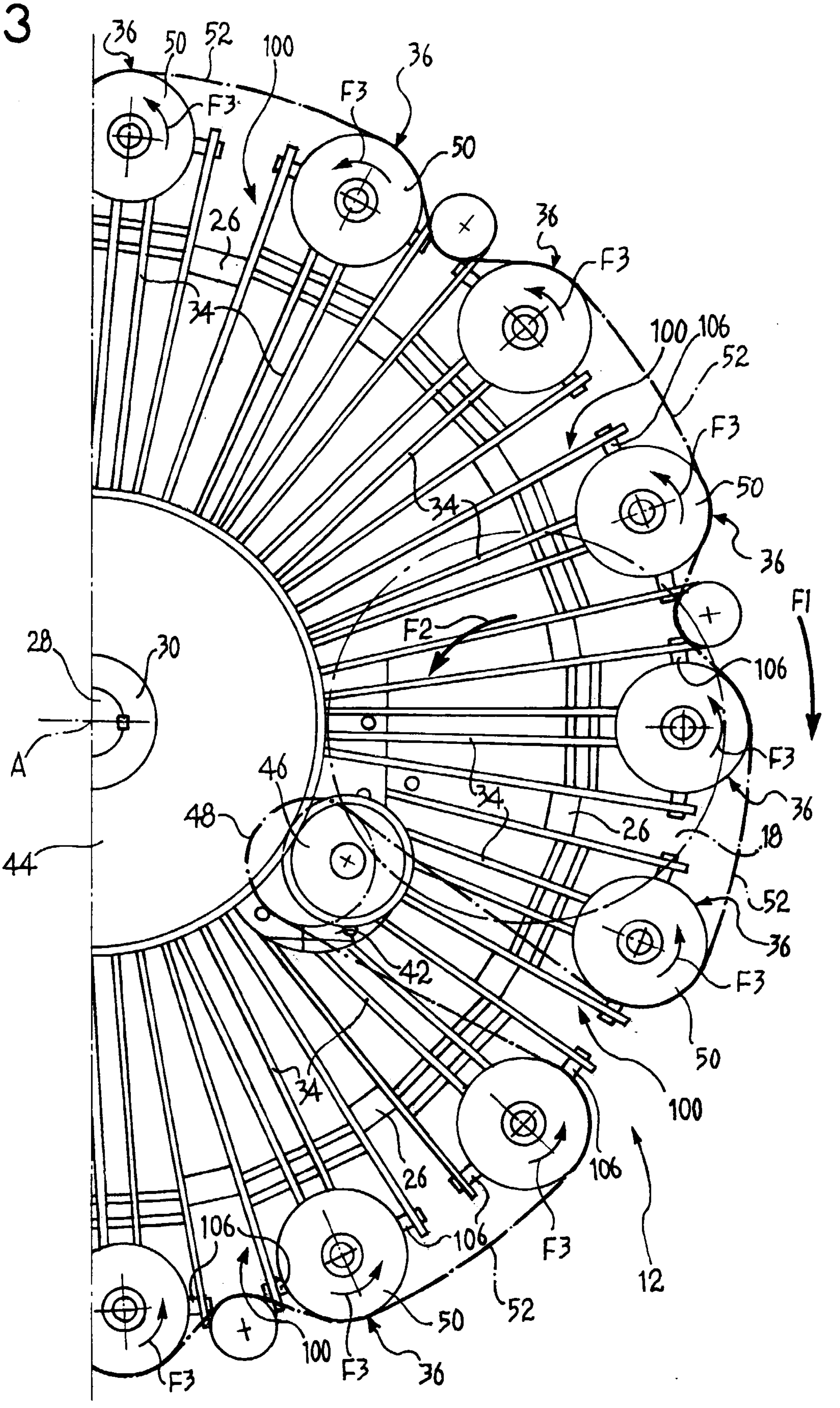
FIG. 3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100
36
F3
F3
50
26
36
F3
34
100
106
52
F3
50
34
36
F1
F2
106
28
30
F3
A
46
34
36
48
26
18
44
52
36
42
F3
50
34
100
26
106
106
106
F3
12
52
50
100
F3
36
F3

FIG. 4

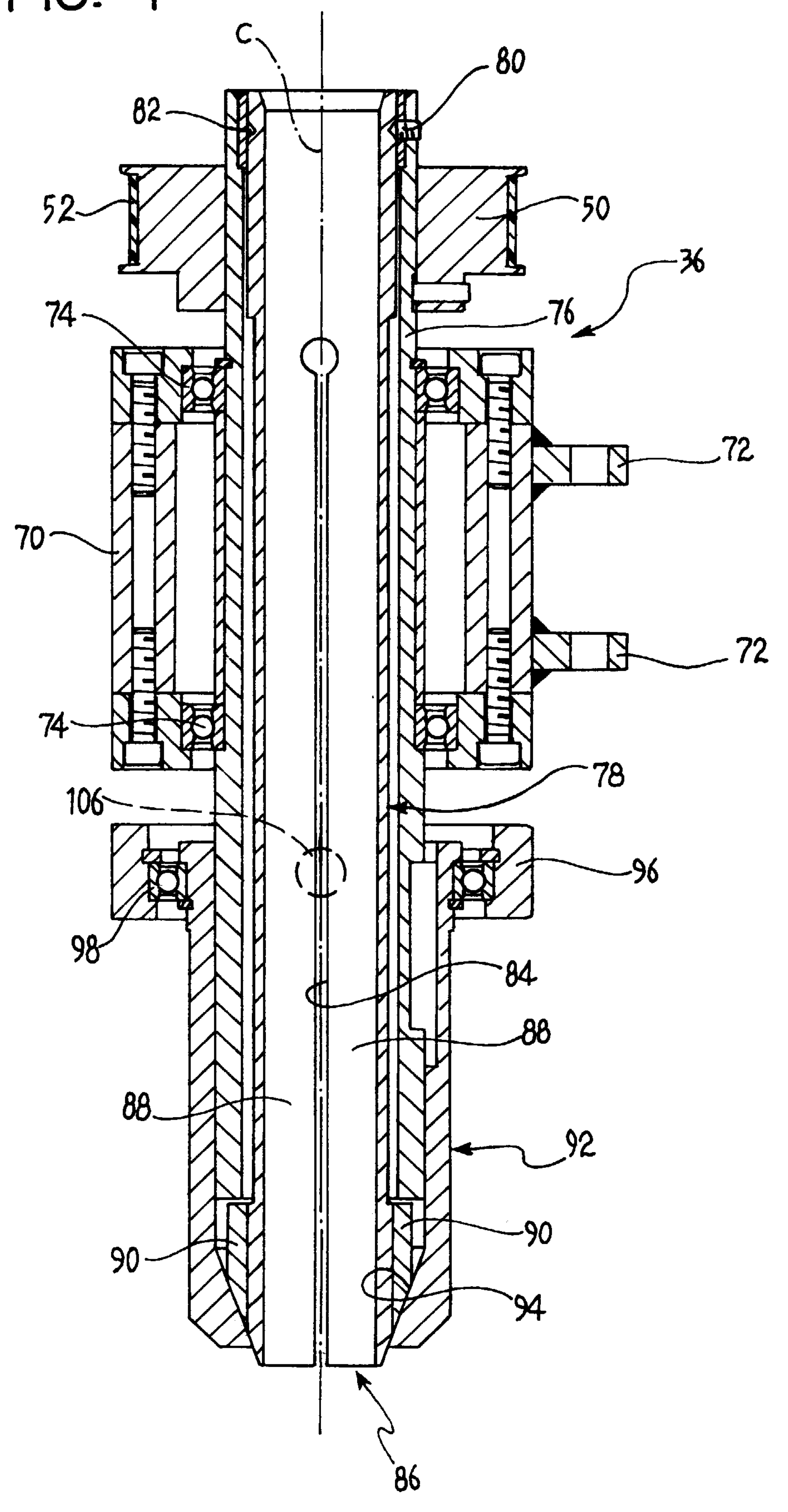


FIG. 5

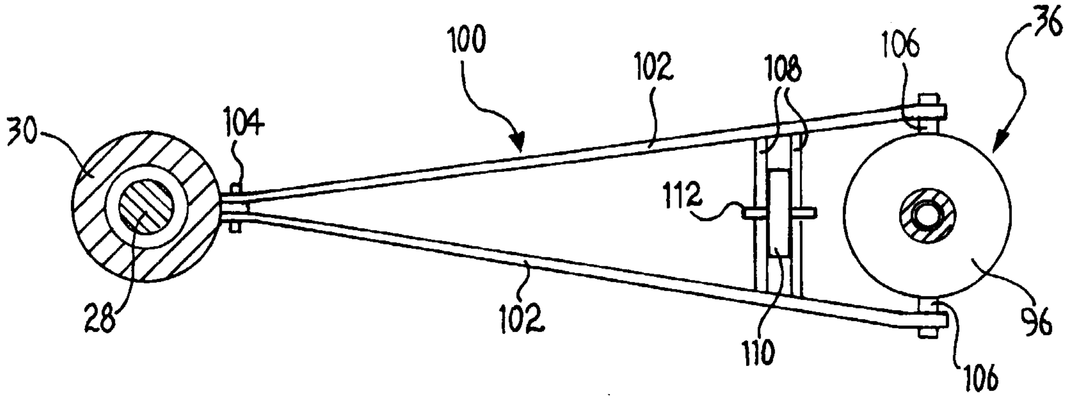
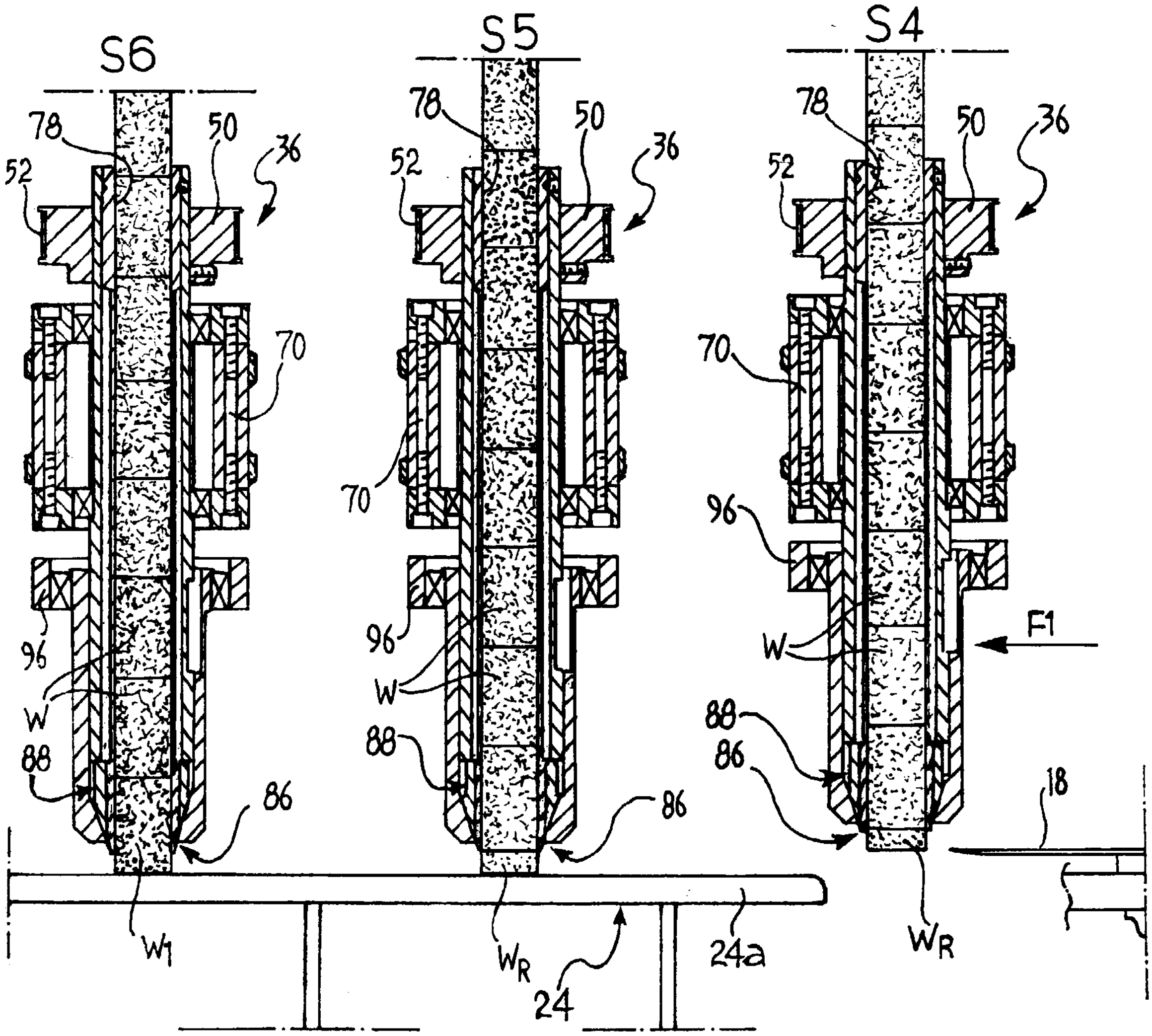

100
102
108
106
36
30
104
112
28
102
110
96
106

FIG. 6B


S6
S5
S4
78
50
52
36
70
96
W
88
86
F1
18
W1
WR
24a
24

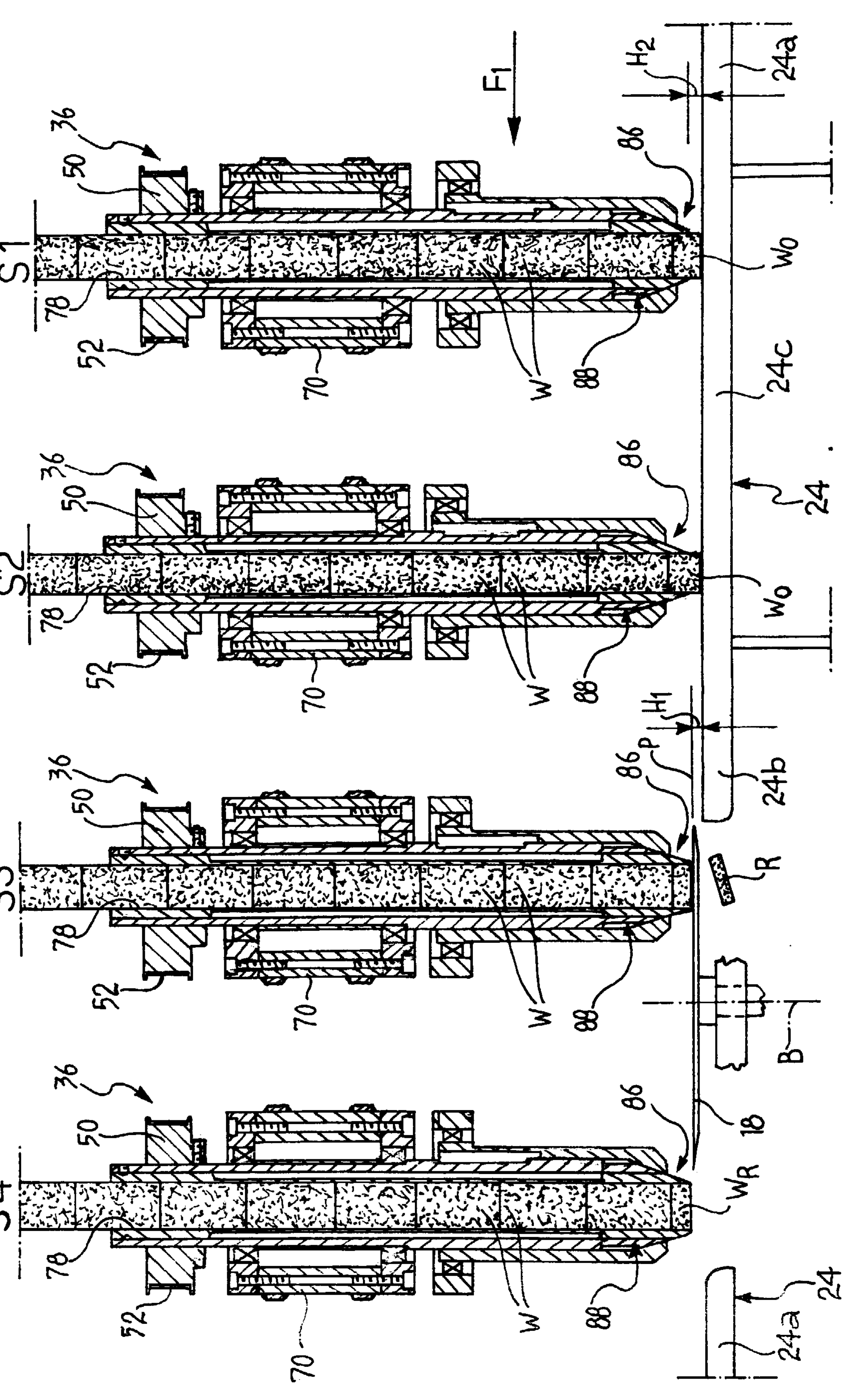


FIG. 6A