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(54) **Multi-purpose silk-screen printing unit for turntable machines for the multi-colour silk-screen printing of containers with curved surfaces**

(57) A multi-purpose silk-screen printing unit for the multi-colour decoration of containers (4) having at least one cylindrical portion (40) and at least one coaxial frusto-conical portion (41), and being rotatably supported by a circumferential series of angularly equidistant radial mandrels (100) of a silk-screen printing machine of turntable type, this latter provided with stationary printing stations to which said containers are presented by said mandrels which at that moment are stationary, comprises at least one first screen (18) arranged to slide tan-

gentially to the circumferential path followed by the mandrels and to apply a decoration (180) to said at least one cylindrical portion (40) of the container (4), and at least one second screen (21) arranged to slide parallel to said at least one first screen and to apply a decoration (210) to said at least one frusto-conical portion (41) of the container simultaneously with the application of the relative decoration by said at least one first screen, the travel strokes of which govern the travel strokes of said at least one second screen.

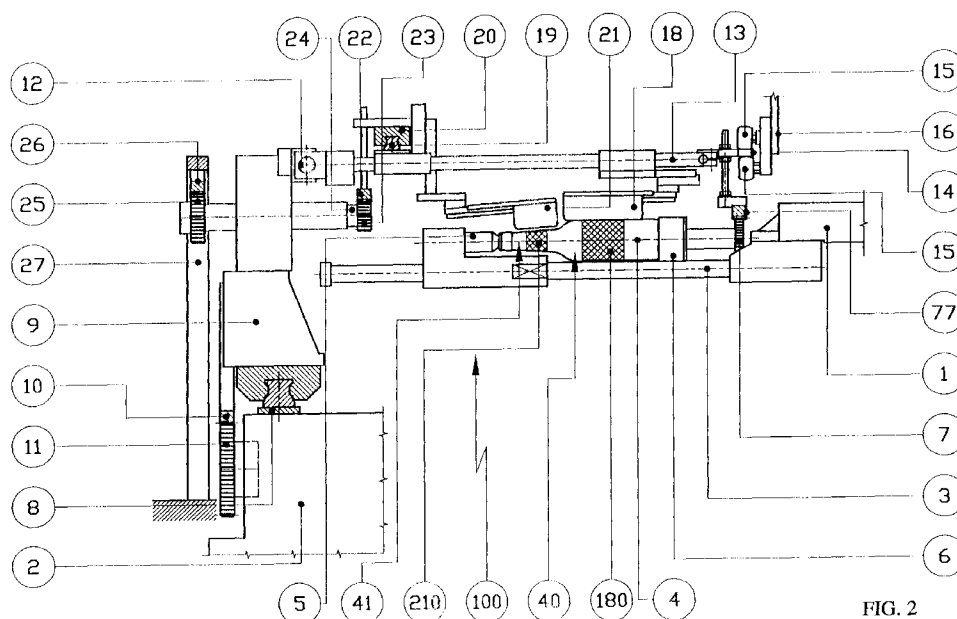


FIG. 2

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Description

[0001] This invention relates generally to silk-screen printing machines for containers with curved surfaces, and in particular to multi-colour silk-screen printing machines of turntable type.

[0002] More specifically, the invention relates to a silk-screen printing unit able to be associated with similar printing machines of turntable type, a typical but not exclusive use of which is in decorating glass containers of cylindrical or conical shape.

[0003] With particular reference to cylindrical glass containers, silk-screen printing machines of turntable type are known comprising a loading table for the containers to be decorated, a series of printing stations and a discharge station for the decorated containers, in which said stations are angularly equidistant along a horizontally extending circular path tangential to which the screens of the printing stations can slide, and along which an equal number of radial mandrels each arranged to support a coaxial container are rotated with a stepwise movement of angular width equal to the width of distribution of said stations.

[0004] In a widely used embodiment, such known machines comprise four printing stations, hence six stations in total which are angularly spaced apart by 60°, in which all or part of said printing stations can be used depending on the number of component colours of the decoration.

[0005] As stated, such known turntable machines are suitable for decorating containers with curved surfaces, for example glass bottles with a cylindrical body and plastic bottles with a conical body, but notwithstanding attempts made up to the present time for this purpose there is as yet no silk-screen printing machine of turntable type available which is able in one and the same silk-screen printing operation to decorate at least two curved portions of different type present on one and the same container, for example a cylindrical portion and a conical portion, as is often the case for example with glass bottles.

[0006] Hence in this sector there is a deeply felt need for means which enable a silk-screen printing machine of turntable type to effect such operations.

[0007] The main object of this invention is to provide, within the context of a simple, rational and reliable construction, means which are able to effect such operations and which can be defined as of universal type by being suitable for association with most of currently available multi-colour silk-screen printing machines of turntable type.

[0008] According to the invention said object is attained by a silk-screen printing unit to be positioned along the circular path followed by the radial mandrels of a multi-colour silk-screen printing machine of turntable type, and comprises at least two screens arranged to slide parallel to each other tangentially to said circular path, of which one is intended to apply a decoration to

a respective cylindrical portion of the container, and the other is intended to apply a decoration to a respective frusto-conical portion of the same container, said applications being made simultaneously.

[0009] Preferably said at least two screens are connected together by a linkage in such a manner that the sliding of one of them, at a linear speed equal to the peripheral speed of that portion of the container to be decorated, results in the sliding of the other at a linear speed equal to the peripheral speed with which the respective container portion to be decorated rotates.

[0010] The characteristics and the constructional and functional merits of the invention will be more apparent from the ensuing description given with reference to the figures of the accompanying drawings, which illustrate a particular preferred embodiment thereof by way of non-limiting example.

[0011] Figure 1 is a plan view of the invention from above, with parts cut away to show parts which would otherwise not be visible.

[0012] Figure 2 is a section on the line II-II of Figure 1.

[0013] Figure 3 is a view in the direction III of Figure 1.

[0014] Firstly, for reasons of clarity and simplicity, hereinafter unless otherwise indicated, the terms "radial" or "radially" and "tangential" or "tangentially" mean directions along a radius or or a tangent to the circular path followed by the mandrel carrier ring of a turntable machine.

[0015] Said figures, and in particular Figure 2, show a peripheral portion of a circular ring 1 rotatably mounted on a stationary vertical shaft (not shown) pertaining to a multi-colour silk-screen printing machine of turntable type.

[0016] The essential characteristics of a machine of this type have already been indicated in the introduction, hence a detailed description will be given hereinafter of a silk-screen printing unit according to the invention, which can be associated with such a machine.

[0017] For completeness, it should be noted that along the outer peripheral edge of said circular ring 1 there is positioned a circumferential series of angularly equidistant radial mandrels 100, for example six in number, so that the circular ring 1 is rotated by a stepping motor with an angular step of 60°.

[0018] This is achieved by a known mechanism housed in the machine base 2, where the drive means for the unit of the invention are also located.

[0019] As can be seen in Figures 1 and 2, said radial mandrels 100 each consist of two horizontal, parallel cylindrical bars 3 which extend beyond the peripheral edge of the ring 1, and on which a fixing centre 5 and a seat 6 are positioned, with the facility for adjusting their position apart on the basis of the dimensions of the containers 4 being processed.

[0020] In the illustrated example, said containers 1 consist of bottles, with their mouth engaging said fixing centre 5 and their base engaging said seat 6.

[0021] In particular the body of said bottles is cylindri-

cal, hereinafter called the cylindrical portion and indicated by 40, between the body and mouth there being provided a frusto-conical part, hereinafter known as the frusto-conical portion and indicated by 41.

[0022] With the seat 6 there is associated an interchangeable pinion 7, between said seat 6 and the ring 1 there being provided usual means for retracting and advancing said seat 6 to release and lock the container 4 respectively.

[0023] As can be seen, along the outer horizontal edge of the base 2 there is a series of equidistant tangential horizontal guides 8, they being four in number in this example seeing that six mandrels 100 are assumed to be provided.

[0024] With each guide 8 there is associated a unit of the invention, this unit comprising a slider 9 which is engaged with said guide 9, faces the free ends of said bars 3, and is arranged to undergo one complete outward and return travel stroke each time the ring 1 halts after rotating through one step.

[0025] Said travel stroke is effected by a radial horizontal rack 10 fixed in a height-adjustable manner to the base on the outside of said slider 9.

[0026] Said rack 10 is constantly engaged by an underlying interchangeable pinion 11 of radial horizontal axis which is rotatably supported by said base 2.

[0027] As can be seen, on that side facing the ring 1 the slider 9 is provided with a tangential horizontal shaft 12 which is height-adjustable and on which a flat frame 13 is hinged.

[0028] In an opposite position to said shaft 12, said frame 13 comprises a tangential horizontal plate 14 lying between two opposing idle wheels 15 of radial horizontal axis.

[0029] The two wheels 15 are fixed to a salient vertical rod 16, the rod 16 being height-adjustable and driven with to-and-fro vertical rectilinear motion, their purpose being described hereinafter.

[0030] An interchangeable horizontal screen 18 is removably fixed in a height-adjustable manner below that part of the frame 13 which is close to said plate 14.

[0031] Said screen is provided to silk-screen print the cylindrical portion 40 of the container 4, with it there being upperly associated an inking brush 118 visible in Figure 1.

[0032] Said brush 118 is able to independently adjust its height for the reasons explained hereinafter.

[0033] Below said rack 13 there is also positioned in a height-adjustable manner an interchangeable tangential horizontal rack 77 facing the circular path followed by the underlying pinions 7.

[0034] As shown particularly in Figures 1 and 2, on the opposite side of said frame 13 there is fixed a tangential horizontal guide 19 with which there is engaged a slider 20 which extends below the frame 13 where it supports a screen 21 which is inclined downwards from the horizontal and can be adjusted in terms both of height and of inclination.

[0035] As shown particularly in Figure 2, said screen 21 is intended to silk-screen print the frusto-conical portion 41 of the container 4, and hence is correspondingly inclined to the longitudinal axis of this latter.

[0036] Again in this case there is provided a respective inking brush 121, visible in Figure 1, which is able to move independently for the reasons stated hereinafter.

[0037] The ink contained in said screen 21 can be of the same colour as that contained in the screen 18, or not.

[0038] In addition said slider 20 supports in a height-adjustable manner an underlying tangential horizontal rack 22 constantly engaged with an interchangeable drive pinion 23.

[0039] Finally, said pinion 23 is keyed onto the inner end of a radial horizontal shaft 24, said shaft 24 being rotatably mounted on said slider 9, the outer end of said shaft 24 carrying keyed thereon a second interchangeable pinion 25, said second pinion 25 being constantly engaged with an overlying interchangeable tangential horizontal rack 26, said rack 26 being supported in a height-adjustable manner by a vertical flat frame 27 lowerly secured to the machine base 2.

[0040] It should be noted that the pitch circle diameter of the pinion 7 controlling the seat 6 is equal to the outer diameter of the cylindrical portion of the containers 4 (Figure 2).

[0041] Moreover the pitch circle diameters of the pinions 23 and 25 are chosen so that the absolute tangential speed at which the screen 21 slides, given by the combination of the tangential motion of the frame 13 relative to the base 2 and the tangential motion of the screen 21 relative to the frame 13, is equal to the peripheral rotational speed of the central point of the longitudinal development of the decoration 210 to be applied to the frusto-conical portion 41 of the container 4.

[0042] Said pinions 7, 23, 25 and 11 are changed, wholly or partly, if the dimensions of the containers 4 change.

[0043] The invention operates in the following manner.

[0044] During the rotation of the ring 1 through one step, the pinion 11 is stationary and the frame 13 is slightly raised from the shown position because of the raised position of the rod 16, hence the screens 18 and 21 are spaced from the cylindrical portion 40 and frusto-conical portion 41 of the containers 4, and the brushes 118 and 121 are spaced from the respective screens 18 and 21.

[0045] When the ring 1 stops, the rod 16 firstly lowers the frame 13 to position the inking plates of the screens 18 and 21 at a very small distance from the cylindrical portion 40 and frusto-conical portion 41 of the underlying container 4, after which the brushes 118 and 121 are lowered to create linear (radial) contact between said screens and said portions 40 and 41, the drive pinion 11 then receiving the command to undergo a rotation, for

example in the (anticlockwise) direction indicated by the arrow A in Figure 3, the extent of which depends both on the dimensions of the container 4 and on the type of decorations 210 and 180 (see Figure 2) to be applied to the cylindrical portion 40 and frusto-conical portion 41 of the container 4.

[0046] Specifically, during said rotation of the pinion 11 in the direction A, the slider 9 and screen 18 slide rigid with each other in the direction B (see Figures 1 and 3), the pinions 25 and 23 rotate in the direction C (clockwise, see Figure 3), and the screen 21 slides in the direction D relative to the frame 13 (Figure 1), ie in the opposite direction to that of the screen 18.

[0047] On termination of the printing stage, firstly the inking brushes 118 and 121 are raised, then the frame 13 is raised, then the ring 1 undergoes a further step while simultaneously the drive pinion 11 undergoes a rotation of an extent equal but opposite to the preceding, to return the entire arrangement into the initial starting configuration for printing, while awaiting the next container 4.

[0048] The invention is not limited to that illustrated and described, but includes all technical equivalents of the described means and their combinations, if implemented within the context of the following claims.

[0049] For example in the illustrated example the screens 18 and 21 move in phase opposition because the frusto-conical portion 41 which is to receive the decoration 210 has an average diameter less than the diameter of the cylindrical portion 40, but it is evident that they could be made to slide in a single direction, typically if the diameter of said frusto-conical portion 41 is greater than the diameter of the cylindrical portion 40.

[0050] It is also evident that during the printing stage the container 4 can undergo a rotation of less than, equal to, or greater than one revolution, in the first case the decoration having for example the form of a narrow longitudinal strip, in the second case the form of a complete circumferential band, and in the third case the form of a helical band or stripe.

Claims

1. A multi-purpose silk-screen printing unit for the multi-colour decoration of containers (4) having at least one cylindrical portion (40) and at least one coaxial frusto-conical portion (41), and being rotatably supported by a circumferential series of angularly equidistant radial mandrels (100) of a silk-screen printing machine of turntable type, this latter provided with stationary printing stations to which said containers are presented by said mandrels which at that moment are stationary, characterised by comprising at least one first screen (18) arranged to slide tangentially to the circumferential path followed by the mandrels and to apply a decoration (180) to said at least one cylindrical portion (40) of

the container (4), and at least one second screen (21) arranged to slide parallel to said at least one first screen and to apply a decoration (210) to said at least one frusto-conical portion (41) of the container simultaneously with the application of the relative decoration by said at least one first screen, the travel strokes of which govern the travel strokes of said at least one second screen.

2. A unit as claimed in claim 1, characterised in that one (21) of said at least two screens is slidably mounted on the support structure of the other screen (18), said structure being slidably mounted on a fixed part (2) of the machine.

3. A unit as claimed in claim 2, characterised in that said structure comprises a flat attachment frame (13) for said one screen (18), said frame (13) presenting:

- on one side a tangential horizontal shaft (12) for its hinging to a slider (9) which is slidably mounted on a fixed part (2) of the machine, and which is provided with a rack (10) constantly engaged with a drive pinion (11) arranged to subject said slider to one complete stroke of to-and-fro travel during the printing stage, and
- on the opposite side a tangential horizontal rack (77) arranged to engage with and disengage from a pinion (7) associated with the mandrels (100) by virtue of a tangential horizontal plate (14) which is coupled, by an engagement which enables it to slide parallel to itself, with a vertically movable retention member (15).

4. A unit as claimed in claim 2, characterised in that said other screen (21) is located, in a manner such that its operating position can be adjusted, on a respective slider (20) supported by said attachment frame (13) for said one screen (18).

5. A unit as claimed in claim 2, characterised in that said at least two screens are connected together by a linkage such that the translational movement of said other screen (21) is derived from the translational movement of said one screen (18).

6. A unit as claimed in claim 5, characterised in that said linkage comprises two pinions (25, 23) which are keyed on a rotatable radial shaft (24) mounted on said slider (9) of said screen-carrying structure, and of which one (25) is constantly engaged with a tangential horizontal rack (26) secured to a fixed point (27) of the machine, and the other (23) is constantly engaged with a tangential horizontal rack secured to said slider (20) of said other screen (21).

7. A multi-colour silk-screen printing machine of turn-

table type, comprising a circumferential series of angularly equidistant radial mandrels (100) provided to rotatably support the containers to be decorated and driven to travel with stepwise movement along a circular horizontal path in order to present said containers to a series of printing stations positioned tangential to said circular path, characterised in that said printing stations each consist of a unit claimed in claims 1 to 6.

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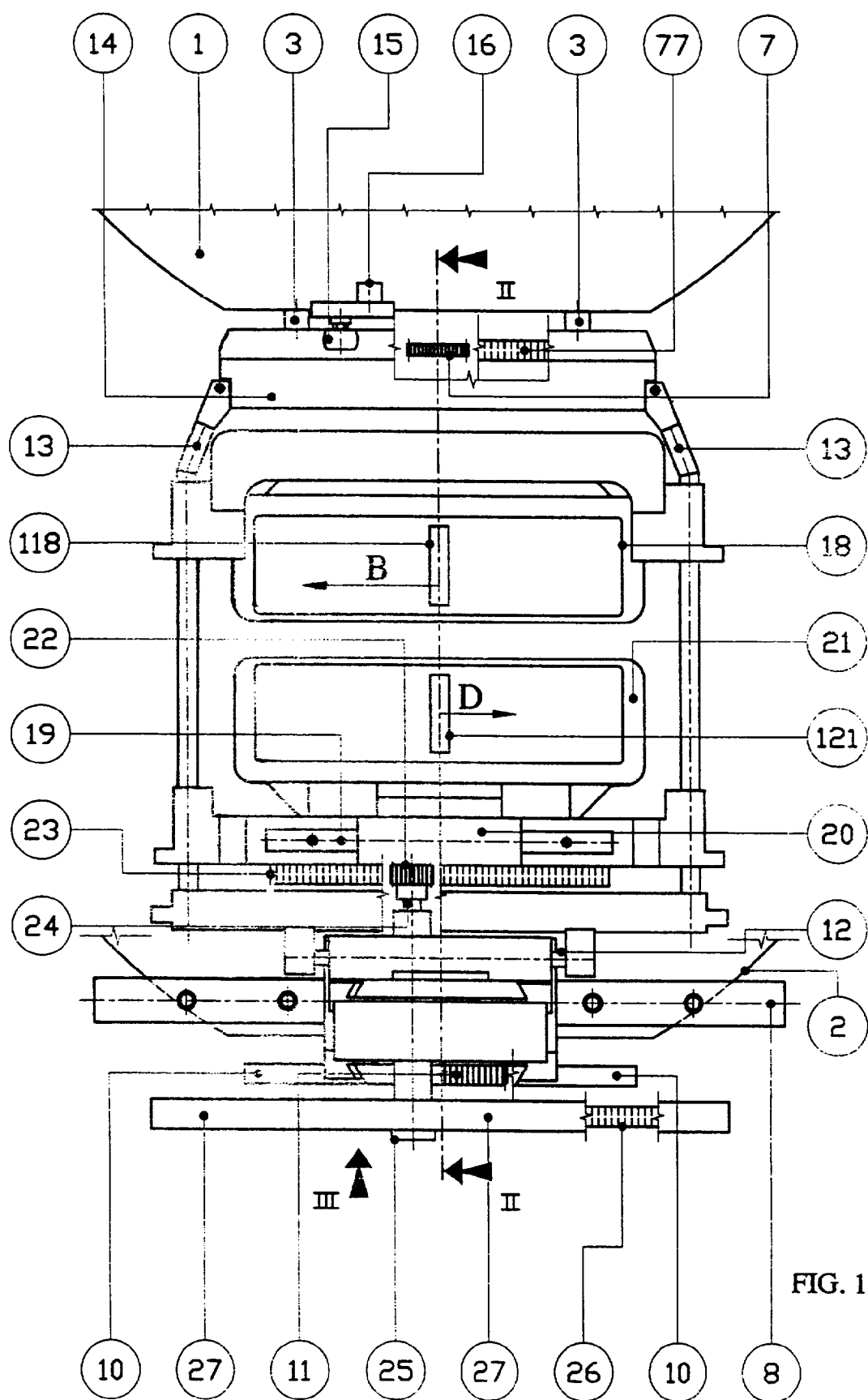
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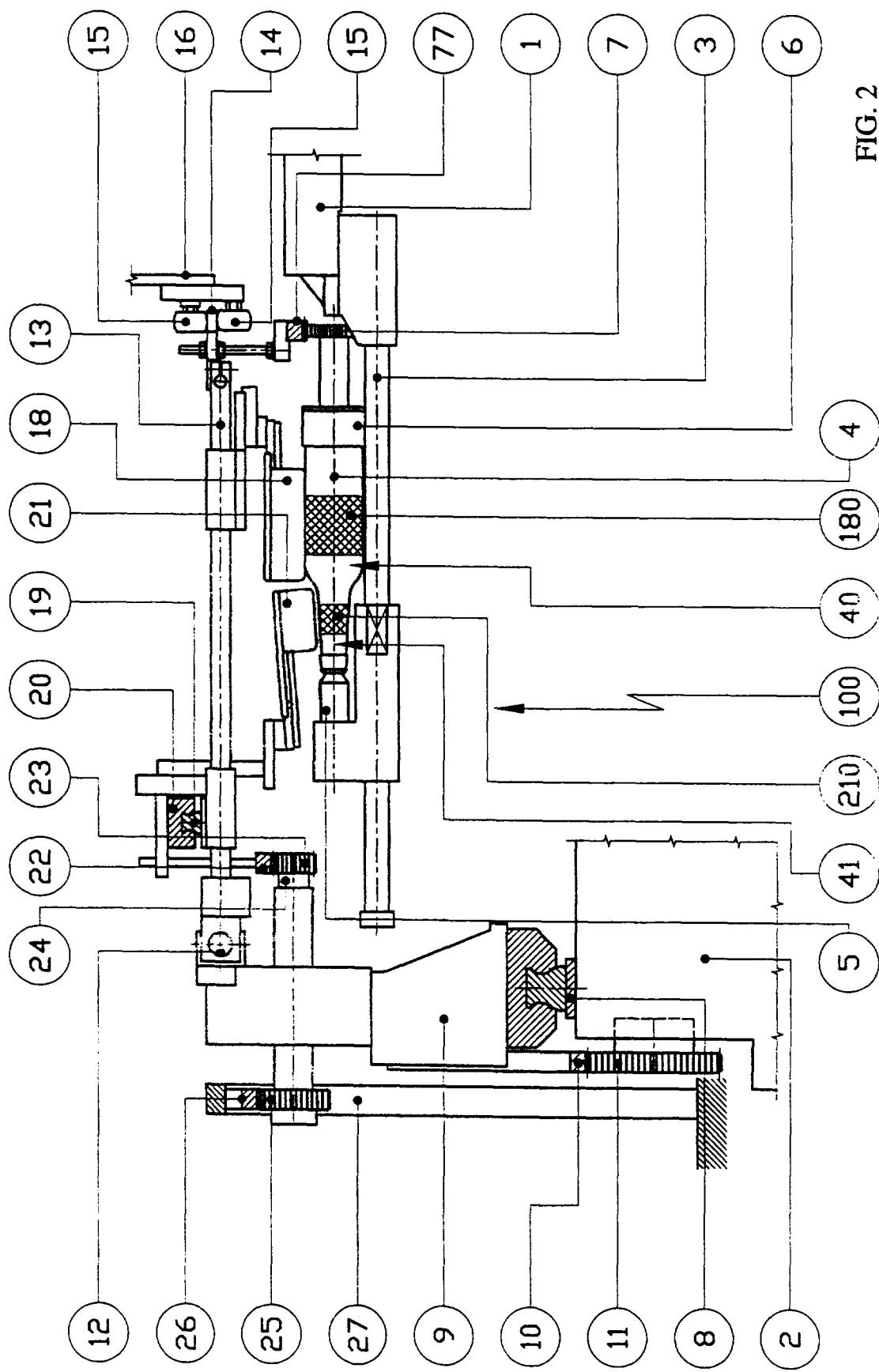
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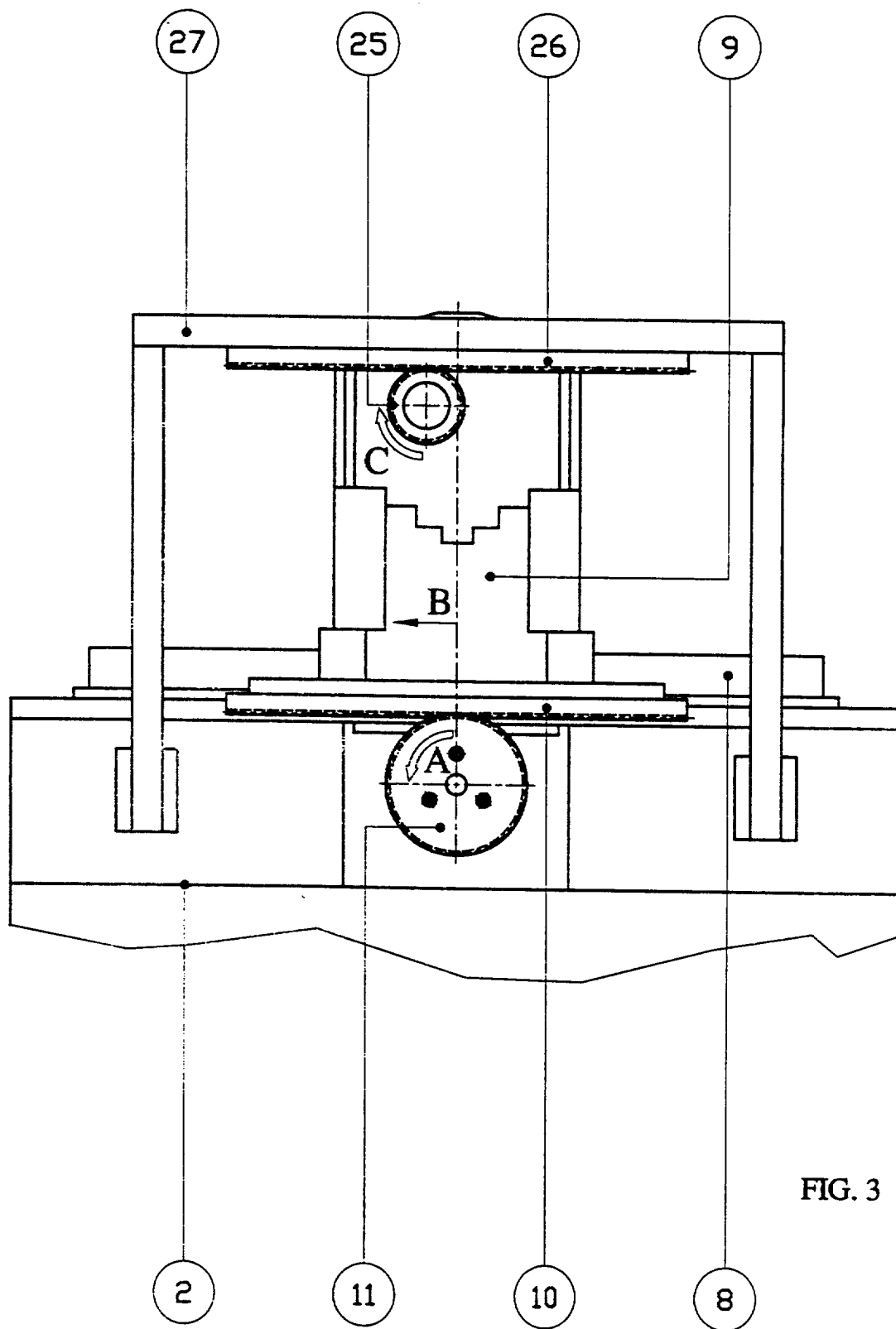
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Application Number
EP 99 20 0736

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THE HAGUE		17 June 1999	Madsen, P
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EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 99 20 0736

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