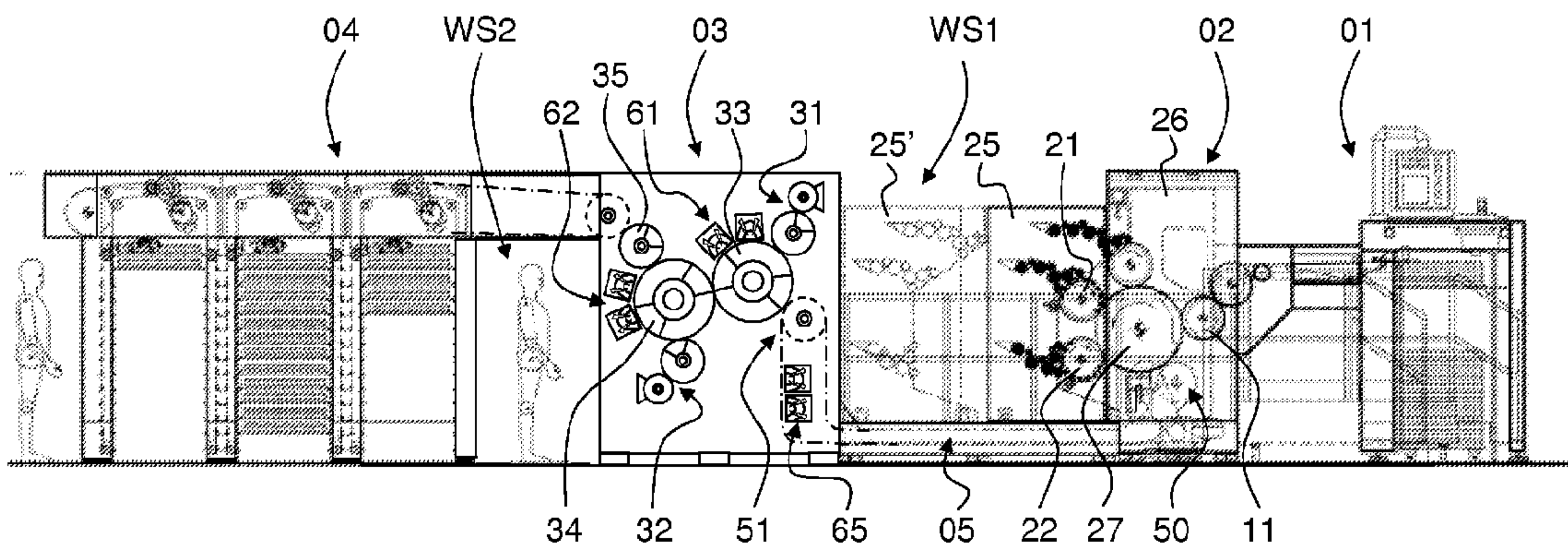




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 (54) Title: PRINTING PRESS FOR NUMBERING AND VARNISHING OF SECURITY DOCUMENTS, INCLUDING BANKNOTES



(57) **Abrégé/Abstract:**

There is described a sheet-fed or web-fed printing press for numbering and varnishing of security documents, including banknotes, comprising : - a numbering group (02) comprising at least one numbering unit (21, 22) for numbering printed material in the form of individual sheets or successive portions of a continuous web carrying multiple security imprints; and - a varnishing group (03; 03*) located downstream of the numbering group (02) for applying varnish onto recto and verso sides of the printed material, the varnishing group (03; 03*) comprising at least a first varnishing unit (31) disposed above a path of the printed material to apply varnish on the recto side of the printed material and at least a second varnishing unit (32) disposed below the path of the printed material to apply varnish on the verso side of the printed material.

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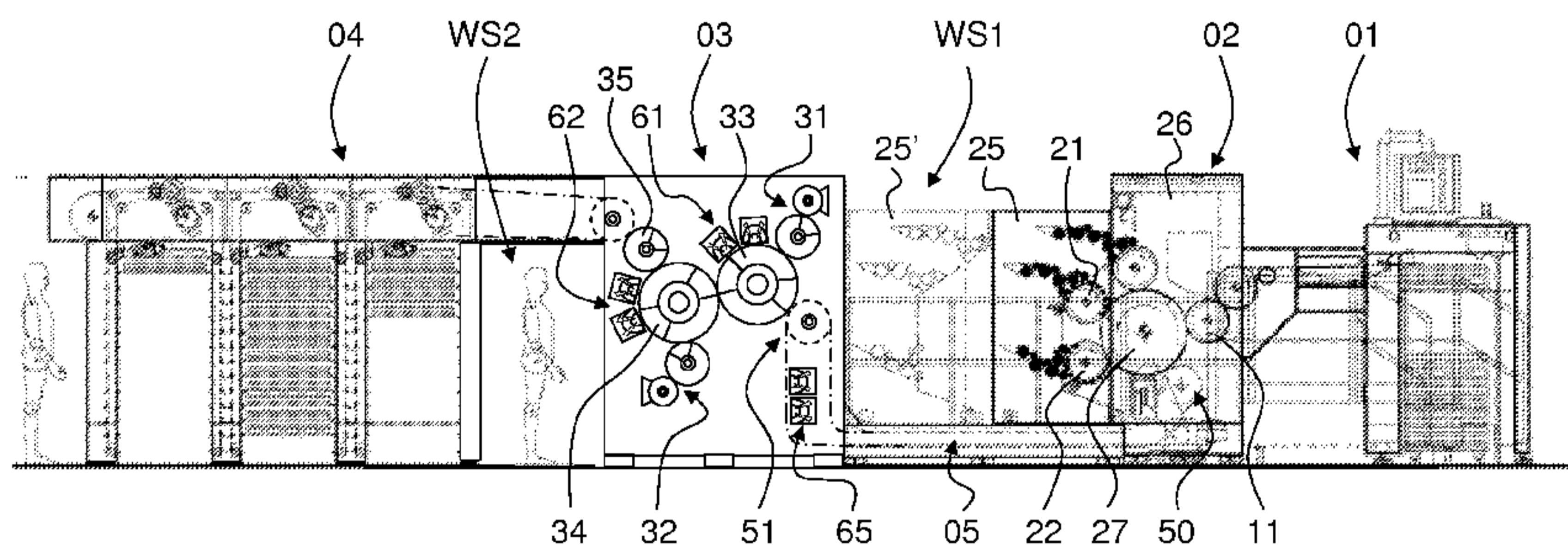


Fig. 1

(57) Abstract: There is described a sheet-fed or web-fed printing press for numbering and varnishing of security documents, including banknotes, comprising : - a numbering group (02) comprising at least one numbering unit (21, 22) for numbering printed material in the form of individual sheets or successive portions of a continuous web carrying multiple security imprints; and - a varnishing group (03; 03*) located downstream of the numbering group (02) for applying varnish onto recto and verso sides of the printed material, the varnishing group (03; 03*) comprising at least a first varnishing unit (31) disposed above a path of the printed material to apply varnish on the recto side of the printed material and at least a second varnishing unit (32) disposed below the path of the printed material to apply varnish on the verso side of the printed material.

PRINTING PRESS FOR NUMBERING AND VARNISHING
OF SECURITY DOCUMENTS, INCLUDING BANKNOTES

PREAMBLE - TECHNICAL FIELD

The present invention generally relates to a sheet-fed or web-fed printing press for numbering and varnishing of security documents, including banknotes.

BACKGROUND OF THE INVENTION

Numbering presses for numbering sheets of securities, or as the case may be a continuous web of securities, are known in the art. International
5 Publications Nos. WO 2006/129245 A2 and WO 2007/060624 A1, both in the name of the present Applicant,

for instance disclose such numbering presses.

Varnishing of banknotes was and is especially carried out to increase the durability and life-cycle of banknotes put into circulation. Information about the
10 varnishing of banknotes can for instance be found in the following papers :

[Buitelaar1999] :

Tom Buitelaar, De Nederlandsche Bank NV, Amsterdam, the Netherlands, "Effects of Banknote varnishing", Currency Conference CSI, Sydney 1999 ;

15 [deHeij2000] :

Hans A.M. de Heij, De Nederlandsche Bank NV, Amsterdam, the Netherlands, "The design methodology of Dutch banknotes", IS&T/SPIE's 12th International Symposium on Electronic Imaging, Optical Security and Counterfeit
20 Deterrence Techniques III, San José, California, USA (January 27-28, 2000), Proceedings of SPIE vol. 3973, pp. 2-22 ;

[Wettstein2000] :

25 Frank Wettstein, Cash Division, Swiss National Bank, Berne and Hubert Lieb, Environmental Unit, Swiss National Bank, Zurich, "Life cycle assessment (LCA) of Swiss banknotes",

Quarterly Bulletin 3/2000 of the Swiss National Bank,
September 2000 ;

[Buitelaar2003] :

5 Tom Buitelaar, De Nederlandsche Bank NV, Amsterdam, the
Netherlands, "Circulation Fitness Management", Banknote
2003 Conference, Washington DC, February 3, 2003 ;

Further information about the varnishing of banknotes and like security
documents might be found in European Patent Publications Nos.
EP 0 256 170 A1, EP 1 932 678 A1 and International Publications Nos.
10 WO 01/08899 A1, WO 02/094577 A1, and WO 2006/021856 A1.

Varnishing presses for varnishing sheets or a continuous web of
securities are also known in the art. International Publications Nos.
WO 02/051638 A1 and WO 2010/023598 A1, and European Patent Publication
No. EP 0 976 555 A1 for instance disclose such varnishing presses.

15 WO 02/051638 A1 specifically discloses a stand-alone flexographic
printing press which can be used for varnishing of banknotes comprising at
least a first flexographic unit disposed above the path of the sheets for
cooperation with a recto side of the sheets and at least a second flexographic
unit disposed downstream of the first flexographic unit and below the path of the
20 sheets for cooperation with a verso side of the sheets. According to
WO 02/051638 A1, the two flexographic units are separated by at least two
intermediate cylinders and the second flexographic unit is offset in height with
respect to the first flexographic unit.

EP 0 976 555 A1 specifically discloses a sheet-fed coating system
25 consisting of multiple coating units disposed one after the other along the path
of the sheets, the coating units being located both above and below the path of
the sheets. According to EP 0 976 555 A1, such coating system can be coupled
directly after a conventional offset printing group or combined with additional
offset printing units. There is however no disclosure or suggestion in this
30 document regarding the coupling of the coating system to a numbering group.

All of the configurations envisaged in EP 0 976 555 A1 share a generally
similar configuration with multiple printing or coating towers disposed one after

the other along the path of the sheets, which configuration is similar to that of conventional printing presses used for non-security applications and requires a rather considerable footprint. More precisely, all these configurations make use of a series of transfer cylinders against the circumference of which the recto and
5 verso sides of the sheets are alternately brought into contact, which solution thus necessitates intermediate drying of the sheets after each printing operation, before the sheets are transferred to the downstream located transfer cylinder. Such solution is inadequate for the application of oxidative solvent-based inks as drying times are too short with such configurations for the
10 oxidative solvent-based inks to be dried before transfer of the sheet to the downstream located transfer cylinder.

SUMMARY OF THE INVENTION

A general aim of the invention is to provide a sheet-fed or web-fed printing press that suitably combines numbering and varnishing in a single pass.

A further aim of the invention is to provide such a printing press that is as
15 compact as possible, while still ensuring ease of maintenance of and proper accessibility to the various components of the numbering and varnishing groups.

Yet another aim of the invention is to provide such a printing press that is suitable for varnishing printed material which is numbered with oxidative
20 solvent-based inks and UV-curable inks.

These aims are achieved thanks to the printing press defined in the claims.

There is accordingly provided a sheet-fed or web-fed printing press for numbering and varnishing of security documents, including banknotes,
25 comprising :

- a numbering group comprising at least one numbering unit for numbering printed material in the form of individual sheets or successive portions of a continuous web carrying multiple security imprints ; and
- a varnishing group located downstream of the numbering group for
30 applying varnish onto recto and verso sides of the printed material, the varnishing group comprising at least a first varnishing unit disposed above a

path of the printed material for applying varnish on the recto side of the printed material and at least a second varnishing unit disposed below the path of the printed material for applying varnish on the verso side of the printed material.

According to a preferred embodiment of the printing press which is adapted for processing printed material in the form of individual sheets, the printing press further comprises:

- a sheet-feeder for feeding individual sheets in succession to the numbering group ; and
- a sheet-delivery system for collecting varnished sheets coming from the varnishing group,

the numbering group being coupled to the varnishing group by means of an intermediate sheet gripper system comprising endless chains and space-apart gripper bars mounted transversely to the path of the sheets, between the endless chains, for holding the sheets by a leading edge of the sheets and transporting the sheets from the numbering group to the varnishing group.

There is further provided a sheet-fed printing press for numbering and varnishing of security documents, including banknotes, comprising :

- a sheet-feeder for feeding in succession printed material in the form of individual sheets carrying multiple security imprints ;
- a numbering group comprising at least one numbering unit for numbering the sheets ;
- a varnishing group located downstream of the numbering group for applying varnish onto recto and verso sides of the sheets, the varnishing group comprising at least a first varnishing unit for applying varnish on the recto side of the sheets and at least a second varnishing unit for applying varnish on the verso side of the sheets ; and
- a sheet-delivery system for collecting varnished sheets coming from the varnishing group,

wherein the numbering group is coupled to the varnishing group by means of an intermediate sheet gripper system comprising endless chains and space-apart gripper bars mounted transversely to the path of the sheets, between the endless chains, for holding the sheets by a leading edge of the

sheets and transporting the sheets from the numbering group to the varnishing group.

According to an advantageous variant of the above printing presses comprising the intermediate sheet gripper system, the numbering group further
5 comprises a movable carriage, preferably a movable inking carriage, that can be retracted away from or be coupled to a stationary part of the numbering group. In such a case, the intermediate sheet gripper system advantageously runs below the movable carriage.

The printing presses of the invention are preferably designed in such a
10 way that numbering is carried out in the numbering group on a recto side of the printed material (the "numbered side") and that the numbered printed material is transferred directly to the varnishing group for varnishing of the recto side of the printed material by the at least first varnishing unit and, immediately after
15 varnishing of the recto side, for varnishing of the verso side of the printed material (the side opposite the "numbered side") by the at least second varnishing unit. This is especially advantageous in that intermediate drying of the recto side of the printed material (the "numbered side"), before the printed material is varnished, is not critical and may potentially be omitted. Indeed, the
20 numbered side is varnished first which in effect seals the surface of the printed material with a layer of varnish and thereby protects the numbering lying below the layer of varnish. Tests carried out by the Applicant have further demonstrated that contamination of the first varnishing unit by (still wet) oxidative solvent-based ink applied during the numbering operation does not occur thanks to the ink split that takes place at the first varnishing unit.

25 Further advantageous embodiments of the invention form the subject-matter of the dependent claims and are discussed below.

BRIEF DESCRIPTION OF THE DRAWINGS

Features and advantages of the present invention will appear more clearly from reading the following detailed description of embodiments of the invention which are presented solely by way of non-restrictive examples and are
30 illustrated by the attached drawings in which:

Figure 1 is a schematic side view of a printing press according to a preferred embodiment of the invention ;

Figure 2 is an enlarged schematic side view of the varnishing group of the printing press of Figure 1 ; and

5 Figure 3 is a schematic side view of a varnishing group according to another embodiment of the invention.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

A preferred embodiment of the invention will be described in reference to Figures 1 and 2 which illustrate a sheet-fed printing press. It shall however be understood that the present invention is equally applicable to web-fed printing
10 presses. The invention therefore applies to the processing of any printed material which is in the form of individual sheets or successive portions of a continuous web.

Figure 1 is a schematic side view of the preferred embodiment of the printing press which includes in this example a sheet-feeder 01 for feeding
15 individual sheets in succession, which sheets carry multiple security imprints that are typically arranged in the form of a matrix. These sheets are first fed to a numbering group 02 which comprises at least one numbering unit for numbering the sheets and then from the numbering group 02 to a downstream located varnishing group 03 for applying varnish onto recto and verso sides of the
20 sheets. To this end, the varnishing group 03 comprises at least a first varnishing unit 31 for applying varnish on the recto side of the sheets and at least a second varnishing unit 32 for applying varnish on the verso side of the sheets. The first and second varnishing units 31, 32 are respectively disposed above and below the path of the sheets.

25 Once varnished on the recto and verso sides, the sheets are transferred to a sheet-delivery system 04 known as such in the art which collects the varnished sheets coming from the varnishing group 03.

The numbering group 02 and varnishing group 03 are advantageously coupled to one another by means of an intermediate sheet gripper system 05
30 comprising space-apart gripper bars for holding the sheets by a leading edge thereof and transporting the sheets from the numbering group 02 to the

varnishing group 03. This intermediate sheet gripper system 05 consists of endless chains disposed between pairs of chain wheels located at upstream 50 and downstream ends 51, the endless chains being constantly driven during operation (in this example in the clockwise direction). Gripper bars (not shown) 5 are mounted transversely to the path of the sheets between the chains and at constant intervals to suitably take sheets away from the numbering group 02 to deliver those to the downstream-located varnishing group 03.

An advantage of the intermediate sheet gripper system 05 resides in the fact that the freshly printed side (hereinafter referred to as being the recto side) 10 of the sheets which have been numbered in the numbering group 02 is not brought into contact with any surface before being brought to varnishing group 03, thereby avoiding any smearing or like printing quality issues.

The numbering group 02 is as such identical to the numbering group disclosed in International Publications Nos. WO 2006/129245 A2 and 15 WO 2007/060624 A1, both in the name of the present Applicant.

The configuration of the numbering group 02 will not therefore be described in detail here as one can refer to the above-listed International Publications. It suffices to understand that this numbering group 02 comprises a stationary part 26 (or printing unit) housing in 20 particular a transport cylinder 27 (or impression cylinder) which transports the sheets being supplied from the sheet-feeder 01 by an upstream located transfer cylinder (or drum as the case may be) 11. The transport cylinder 27, which rotates in this example in the counter-clockwise direction, transports the sheets past first and second numbering units 21, 22. An optional printing unit (not 25 referenced) is provided upstream of the first printing unit 21. Once numbered, the sheets are taken away from the transport cylinder 27 at the upstream end 50 of the intermediate sheet gripper system 05. Numbering takes place in the numbering group 02 by way of typographic (or letterpress) printing using oxidative solvent-based inks or UV-curable inks.

30 As illustrated in Figure 1, the numbering group 02 preferably comprises a mobile carriage 25 (which acts in this case as an inking carriage) that can be retracted away from or be coupled to the stationary part 26 of the numbering

group 02. Reference numeral 25 designates the mobile carriage (which is depicted in continuous lines in Figure 1) in a working position, i.e. coupled to the stationary part 26, while reference numeral 25' designates the mobile carriage (which is depicted in dashed lines in Figure 1) in a maintenance position, i.e. retracted away from the stationary part 26.

It will be appreciated that Figure 1 shows that the intermediate sheet gripper system 05 runs below the movable carriage 25, 25' which ensures that maintenance operations and access to the numbering group 02 are not compromised. Indeed, space is provided between the numbering group 02 and the varnishing group 03 to ensure that the movable carriage 25 can be retracted to its maintenance position 25'.

The numbering group 02 and varnishing group 03 are preferably constructed as modular groups that can easily be decoupled from one another. Even more preferably, transfer of a sheet from the intermediate sheet gripper system 05 to the varnishing group 03 is performed at a location which corresponds in height to a location where the sheet is transferred from the transfer cylinder or drum 11 to the transport cylinder 27 of the numbering group 02. In this way, the varnishing group 03 can potentially be coupled directly to the sheet in-feed system (i.e. downstream of the transfer cylinder 11) should it be needed to omit the numbering group 02. The varnishing group 03 is accordingly designed and configured as an independent module which can potentially be used independently of the numbering group 02.

Figure 2 illustrates in greater detail the varnishing group 03 of the printing press of Figure 1. It shows in particular a first cylinder or drum 33 located below the path of the sheets and cooperating with the first varnishing unit 31 which is disposed above the path of the sheets. It further shows a second cylinder or drum 34 located above the path of the sheets and cooperating with the second varnishing unit 32 which is disposed below the path of the sheets, which second cylinder or drum 34 is located immediately after the first cylinder or drum 33 to ensure direct transfer of the sheets from the first cylinder or drum 33 to the second cylinder or drum 34. As illustrated, the first and second cylinders or

drums 33, 34 are preferably designed as two-segment cylinders or drums, similarly to the impression cylinder 27 of the numbering group 02.

The first and second varnishing units (and additional varnishing units that may be provided if necessary) are preferably flexographic units consisting of an
5 anilox roller 310, respectively 320, which is inked by an associated ink chamber (not referenced) and which cooperates with an associated forme cylinder 311, respectively 321, that carries a flexographic printing plate. This printing plate can be designed to apply varnish over substantially all of the corresponding side of the sheets or, as the case may be, to apply varnish only on selected areas of
10 the sheets, in which latter case the flexographic printing plate is provided with corresponding ink transferring areas.

A transfer cylinder or drum 35 is provided to suitably transfer the sheets from the second cylinder 34 to the sheet-delivery system 04, which sheet-delivery system 04 transports the sheets in the clockwise direction in this
15 example. This transfer cylinder or drum 35 may be omitted should the sheet-delivery system 04 be designed to transport the sheets in the counter-clockwise direction, or additional transfer cylinders or drums may be provided if necessary (as shown for instance in Figure 3). These transfer cylinders or drums, including the transfer cylinder or drum 35, may for instance be used to carry out
20 inspection of the recto and/or verso sides of the printed material. In addition, one or more transfer cylinders or drums may be designed as chill rollers to cool down the temperature of the printed material which is typically heated as a result of the action of drying units.

At least a first drying unit 61 is further provided for drying the recto side of
25 the sheets following varnishing by the first varnishing unit 31 and prior to transfer of the printed material to the second cylinder or drum 34. Similarly, at least a second drying unit 62 for drying the verso side of the sheets following varnishing by the second varnishing unit 32 is provided. These drying units 61, 62 preferably include UV-curing units in case of varnishing using UV-curable
30 varnishes, which type of varnish is preferably used in the context of the present invention.

An intermediate UV-curing unit 65 (shown in Figures 1 and 2) is also provided along the path of the sheets between the numbering group 02 and varnishing group 03 for curing the sheets which have been numbered on the numbering group 02 in case numbering is carried out using UV-curable inks.

5 Such intermediate UV-curing unit 65 may however be omitted.

Figure 3 illustrates another embodiment of a varnishing group, designated generally by reference numeral 03*, that could be used in lieu of the varnishing group 03 of Figures 1 and 2. Such varnishing group 03* similarly includes first and second cylinders or drums 33, 34 respectively located below and above the path of the sheets and cooperating respectively with first and second varnishing units 31, 32 of the same type as in Figures 1 and 2. The orientation of the first and second cylinders or drums 33, 34 has been adapted to allow for the provision of fourth and fifth varnishing units 31*, 32* (each comprising an anilox 310*, 320* inked by an associated ink chamber and a flexographic forme cylinder 311*, 321* carrying a flexographic plate) cooperating respectively with the first and second cylinders or drums 33, 34 as illustrated. In other words, two varnishing units 31, 31*, respectively 32, 32* are provided for varnishing each side of the sheets.

Such solution allows for greater flexibility in terms of varnishing. For instance, one varnishing unit (e.g. unit 31 or 32) could be used to apply a primer, while the second varnishing unit (e.g. unit 31* or 32*) could be used to apply a layer of varnish on top of the primer. The two varnishing units on each side could furthermore be used to apply two different types of varnishes or to apply invisible features, such as fluorescent features. Such solution could in particular be convenient in the context of the application disclosed in International Publication No. WO 2010/023598 A1.

A UV-curing unit 61 is similarly provided to cure the UV-curable varnish(es) applied by varnishing units 31, 31* on the recto side of the sheets, before being transferred to the second cylinder or drum 34, a second UV-curing unit 62 being provided downstream of varnishing units 32, 32* in order to cure the UV-curable varnish(es) applied on the verso side of the sheets before these are taken away from the second cylinder or drum 34.

Operation of the varnishing group 03* of Figure 3 is similar to that of the varnishing group 03 discussed in reference to Figures 1 and 2, namely the printed sheets are transferred from the numbering group 02 to the first cylinder or drum 33 for varnishing of the recto side of the sheets (i.e. the side that was
5 numbered) and then immediately to the downstream located cylinder or drum 34 for varnishing of the verso side of the sheets.

Once varnished on the verso side, the sheets are transferred to a first transfer cylinder or drum 35 where the recto side can be inspected, if necessary, by means of an optional camera 101. In this other embodiment, two
10 additional (and optional) transfer cylinders or drums 36, 37 are interposed between the first transfer cylinder or drum 35 and the sheet-delivery system 04. The second transfer cylinder 36 can be used to carry out an inspection, if necessary, of the verso side of the sheets by means of an optional camera 102. The third transfer cylinder 37 is necessary to ensure proper transfer of the
15 sheets to the downstream located sheet-delivery system 04 and could be designed as a chill roller to cool down the sheets which have been processed in the varnishing group 03*.

According to the above-discussed embodiments of the invention, one will appreciate that numbering is preferably carried out in the numbering group 02
20 on a recto side of the printed material (i.e. the side facing upwards in the illustrations of Figures 1 to 3) and that the numbered printed material is transferred directly to the varnishing group 03, 03* for varnishing of the recto side of the printed material by the first varnishing unit 31 (and optional additional varnishing unit(s)) and, immediately after varnishing of the recto side, for
25 varnishing of the verso side (i.e. the side facing downwards in the illustrations of Figures 1 to 3) of the printed material by the second varnishing unit 32 (and optional additional varnishing unit(s)). In other words, the numbered side is varnished first, followed by the unnumbered side, and the numbered side is not brought into contact with any element or surface before varnishing thereof
30 which could negatively affect printing quality.

While intermediate drying of the numbering, before varnishing, is preferred, tests carried out by the Applicant have demonstrated that an

intermediate drying (or curing) is not critical and may be omitted as the numbering is covered by a layer of varnish which is immediately cured by the first drying unit 61. This is especially useful in case oxidative solvent-based inks are used for the numbering of the printed material. In case UV-curable inks are
5 used for the numbering of the printed material, the UV-curing unit 65 may however be convenient as this ensures that the UV-curable ink of the numbering will not interfere with or negatively affect the properties of the varnish applied on the sheets.

Indeed, thanks to the proposed configuration, at least one layer of
10 varnish can be applied on the numbered side of the sheets by means of the first varnishing unit 31. Thanks to the ink split that takes place between the forme cylinder 311 and the surface of the sheets that are transported by the first cylinder or drum 33, the numbered side is in effect sealed by the layer of varnish applied by the first varnishing unit 31 and no ink contamination takes
15 place.

One will further appreciate that, according to the above-discussed embodiments of the invention, the printing press is configured such that the varnishing units of the recto side (i.e. unit 31 in Figures 1, 2 and units 31, 31* in Figure 3) are accessible by an operator from a first working space WS1 located
20 upstream of the varnishing group 03, 03*, between the numbering group 02 and the varnishing group 03, 03*. The varnishing units of the verso side (i.e. unit 32 in Figures 1, 2 and units 32, 32* in Figure 3) are accessible by an operator from a second working space WS2 located downstream of the varnishing group 03, 03*. The configuration of the varnishing group 03, 03* is therefore such that
25 access to the relevant components of the varnishing group is facilitated and not compromised. Such access is further facilitated by the fact that the sheets are transported from the numbering group 02 to the varnishing group 03, 03* by means of the sheet gripper system 05 running along a floor part of the printing press.

30 Various modifications and/or improvements may be made to the above-described embodiments without departing from the scope of the invention as defined by the annexed claims. For instance, the invention is equally applicable

to the processing of printed material in the form of individual sheets or of successive portions of a continuous web.

In addition, the printing press may be modified to additionally include an inspection group placed upstream of the numbering group 02 for carrying out
5 inspection of the printed material and determining occurrence of defects affecting the quality of the printed material prior to numbering and varnishing. Such an inspection group may be an inspection group as disclosed in International Publication Nos. WO 2005/008605 A1 and WO 2005/008606 A1, both in the name of the present Applicant .

10 Additional printing or processing units may be provided, such as for instance a laser marking unit, which laser marking unit could be located upstream of the varnishing group for applying laser markings on the printed material prior to varnishing thereof or downstream of the varnishing group for applying laser markings through or into the layer or layers of varnish applied by
15 the varnishing group.

LIST OF REFERENCES USED IN THE FIGURES AND SPECIFICATION

	01	sheet-feeder
	02	numbering group
	03	varnishing group (Figures 1, 2)
	03*	varnishing group (Figure 3)
5	04	sheet-delivery system
	05	intermediate sheet gripper system comprising endless chains and space-apart gripper bars mounted transversely to the path of the sheets, between the endless chains, for holding the sheets by a leading edge thereof
10	11	sheet transfer cylinder or drum for transfer of successive sheets from sheet-feeder 01 to numbering group 02
	21	(first) numbering unit / cylinder of numbering group 02
	22	(second) numbering unit / cylinder of numbering group 02
	25	mobile (inking) carriage of numbering group 02 (in working position)
15	25'	mobile (inking) carriage of numbering group 02 (in retracted position for maintenance)
	26	stationary part (printing unit) of numbering group 02
	27	transport (impression) cylinder of numbering group 02
20	31	first varnishing unit (flexographic unit) for varnishing of recto side of the sheets
	32	second varnishing unit (flexographic unit) for varnishing of verso side of the sheets
	31*	fourth varnishing unit (flexographic unit) for varnishing of recto side of the sheets (Figure 3)
25	32*	fifth varnishing unit (flexographic unit) for varnishing of verso side of the sheets (Figure 3)
	33	first cylinder or drum cooperating with first varnishing unit 31
	34	second cylinder or drum cooperating with second varnishing unit
30	32	

- 35 transfer cylinder for transferring of varnished sheets from second cylinder or drum 34 to sheet-delivery system 04 (and for optional inspection of recto side of the sheets or potentially designed as chill roller to cool down the sheets)
- 5 36 (optional) transfer cylinder or drum for transfer of the sheets to the sheet-delivery system 04 (e.g. for inspection of verso side of the sheets)
- 37 (optional) transfer cylinder or drum for transfer of the sheets to the sheet-delivery system 04 (potentially designed as chill roller to cool down the sheets)
- 10 50 upstream end of intermediate sheet gripper system 05 where the sheets are taken away from the numbering group 02
- 51 downstream end of intermediate sheet gripper system 05 where the sheets are delivered to the varnishing group 03
- 15 61 first drying unit (UV-curing unit) for drying/curing the recto side of the sheets following varnishing by the first varnishing unit 31 prior to transfer of the sheets to the second cylinder or drum 34
- 62 second drying unit (UV-curing unit) for drying/curing the verso side of the sheets following varnishing by the second varnishing unit 32
- 20 65 intermediate UV-curing unit for curing the sheets along the path of the sheets between the numbering group 02 and varnishing group 03 (in case of numbering with UV-curable inks)
- 101 camera (optional) for inspection of recto side of sheets (including numbering)
- 25 102 camera (optional) for inspection of verso side of sheets
- 310 anilox roller of first varnishing unit 31
- 311 forme cylinder of first varnishing unit 31
- 320 anilox roller of second varnishing unit 32
- 321 forme cylinder of second varnishing unit 32
- 30 310* anilox roller of fourth varnishing unit 31* (Figure 3)
- 311* forme cylinder of fourth varnishing unit 31* (Figure 3)
- 320* anilox roller of fifth varnishing unit 32* (Figure 3)

- 321* forme cylinder of fifth varnishing unit 32* (Figure 3)
- WS1 working space for access to first varnishing unit 31 (and optional additional varnishing unit(s))
- WS2 working space for access to second varnishing unit 32 (and optional additional varnishing unit(s))

5

CLAIMS

1. A sheet-fed printing press for numbering and varnishing of security documents, including banknotes, comprising :

- a sheet-feeder for feeding in succession printed material in the form of individual sheets carrying multiple security imprints ;

5 - a numbering group comprising at least one numbering unit for numbering the sheets ;

- a varnishing group located downstream of said numbering group for applying varnish onto recto and verso sides of said sheets, said varnishing group comprising at least a first varnishing unit for applying varnish on the recto
10 side of the sheets and at least a second varnishing unit for applying varnish on the verso side of the sheets ; and

- a sheet-delivery system for collecting varnished sheets coming from the varnishing group,

wherein said numbering group is coupled to said varnishing group by
15 means of an intermediate sheet gripper system comprising endless chains and space-apart gripper bars mounted transversely to the path of the sheets, between the endless chains, for holding the sheets by a leading edge of the sheets and transporting the sheets from the numbering group to the varnishing group.

20

2. The printing press as defined in claim 1, wherein said numbering group further comprises a movable carriage that can be retracted away from or be coupled to a stationary part of the numbering group.

25 3. The printing press as defined in claim 2, wherein said movable carriage is a movable inking carriage.

4. The printing press as defined in claim 2, wherein said intermediate sheet gripper system runs below said movable carriage.

30

5. The printing press as defined in claim 1, wherein said printing press is provided with at least one transfer cylinder or drum located between said varnishing group and said sheet-delivery system, which at least one transfer cylinder or drum is designed as chill roller to cool down the printed material or as inspection cylinder or drum for carrying out inspection of the recto or verso side of the printed material.

6. The printing press as defined in claim 1, wherein said numbering group and varnishing group are constructed as modular groups that are adapted to be decoupled from one another.

7. The printing press as defined in claim 1, wherein said numbering group and varnishing group are constructed as modular groups that are adapted to be decoupled from one another and wherein transfer of a sheet to the numbering group is performed by means of a sheet transfer cylinder or drum cooperating with a transport cylinder of said numbering group and wherein transfer of a sheet from the intermediate sheet gripper system to the varnishing group is performed at a location which corresponds in height to a location where the sheet is transferred from the transfer cylinder or drum to the transport cylinder of the numbering group.

8. The printing press as defined in claim 1, wherein numbering is carried out in said numbering group on a recto side of the printed material and wherein the numbered printed material is transferred directly to the varnishing group for varnishing of the recto side of the printed material by said at least first varnishing unit and, immediately after varnishing of the recto side, for varnishing of the verso side of the printed material by said at least second varnishing unit.

9. The printing press as defined in claim 8, wherein said numbering group is adapted to number the printed material on the recto side thereof with oxidative solvent-based inks and UV-curable inks.

10. The printing press as defined in claim 8, wherein the recto side of the printed material is varnished by said at least first varnishing unit in a state where ink applied by the numbering group is still fresh and undried.

5 11. The printing press as defined in claim 1, wherein said varnishing group comprises:

- a first cylinder or drum located below the path of said printed material and cooperating with said at least first varnishing unit which is disposed above the path of said printed material ; and

10 - a second cylinder or drum located above the path of said printed material and cooperating with said at least second varnishing unit which is disposed below the path of said printed material,

said second cylinder or drum being located immediately after said first cylinder or drum to ensure direct transfer of said printed material from the first
15 cylinder or drum to the second cylinder or drum.

12. The printing press as defined in claim 11, wherein said first and second cylinders or drums are two-segment cylinders or drums.

20 13. The printing press as defined in claim 11, wherein said varnishing group further comprises :

- a fourth varnishing unit which cooperates with said first cylinder or drum and is located immediately after the first varnishing unit, and

25 - a fifth varnishing unit which cooperates with said second cylinder or drum and is located immediately after the second varnishing unit.

14. The printing press as defined in claim 11, further comprising at least a first drying unit cooperating with said first cylinder or drum for drying the recto side of the printed material following varnishing by said at least first
30 varnishing unit prior to transfer of the printed material to the second cylinder or drum and at least a second drying unit cooperating with said second cylinder or

drum for drying the verso side of the printed material following varnishing by said at least second varnishing unit.

15. The printing press as defined in claim 14, wherein said at least first
5 and second varnishing units are designed to apply UV-curable varnish on the recto and verso sides of the printed material and wherein said first and second drying units are UV-curing units.

16. The printing press as defined in claim 1, wherein said at least first
10 and second varnishing units are flexographic varnishing units each comprising an anilox roller inked by an associated ink chamber, which anilox roller cooperates with a flexographic forme cylinder.

17. The printing press as defined in claim 1, further comprising an
15 inspection group placed upstream of said numbering group for carrying out inspection of said printed material and determining occurrence of defects affecting the quality of said printed material prior to numbering and varnishing.

18. The printing press as defined in claim 1, further comprising an
20 intermediate UV-curing unit for curing the printed material, which intermediate UV-curing unit is located along the path of said printed material between the numbering group and varnishing group.

19. The printing press as defined in claim 1, wherein said printing
25 press is configured such that said at least first varnishing unit is accessible by an operator from a first working space located upstream of the varnishing group, between said numbering group and said varnishing group, and such that said at least second varnishing unit is accessible by an operator from a second working space located downstream of the varnishing group.

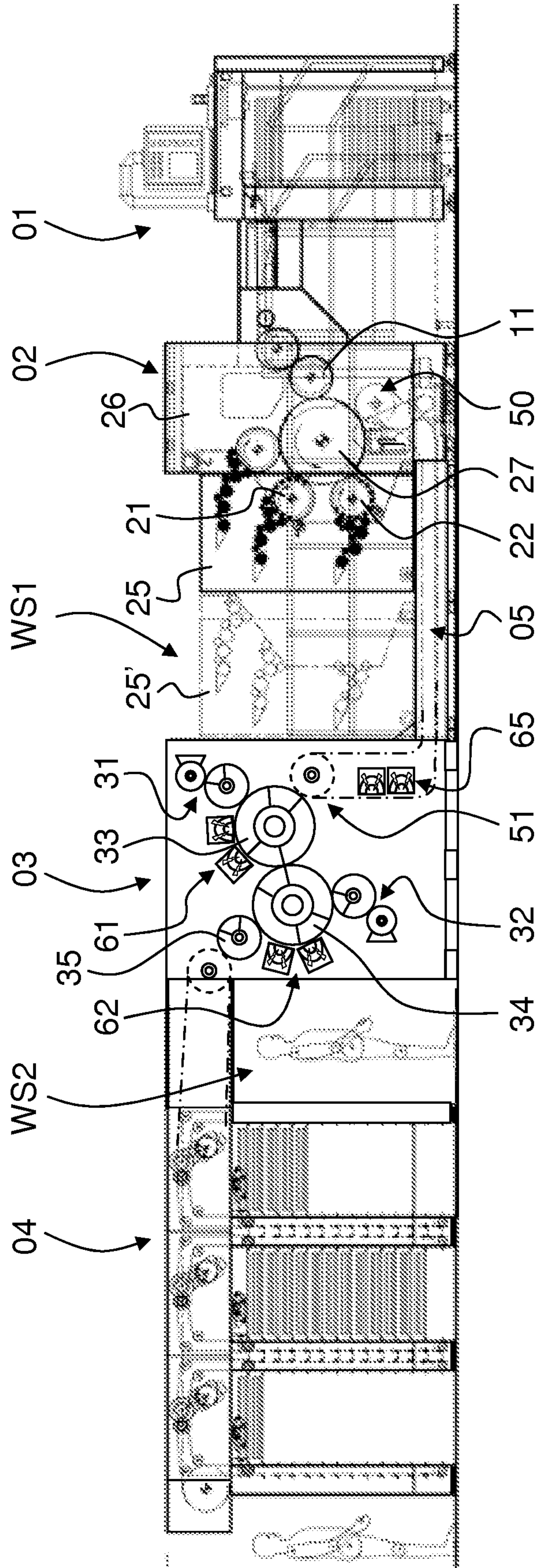


Fig. 1

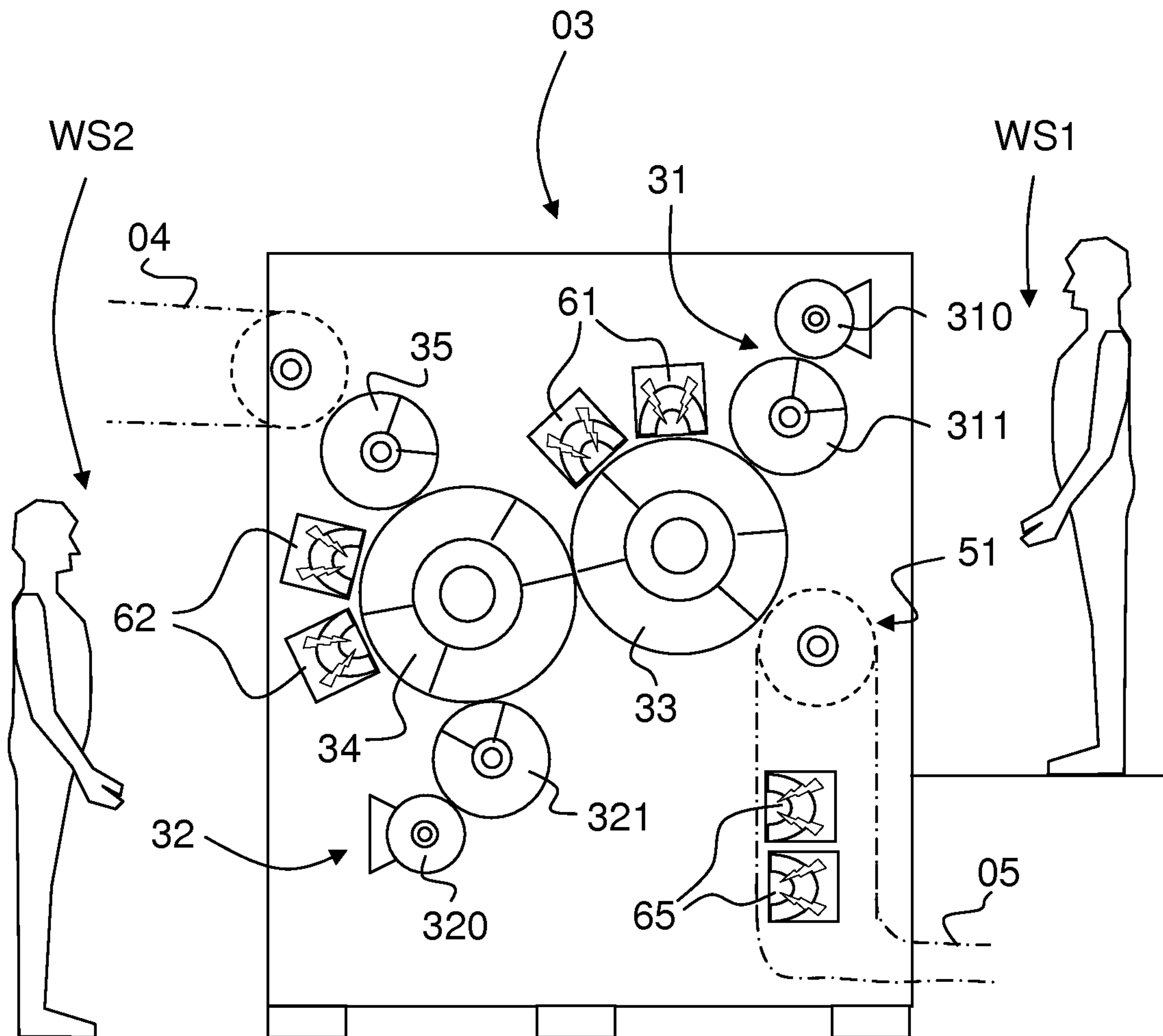


Fig. 2

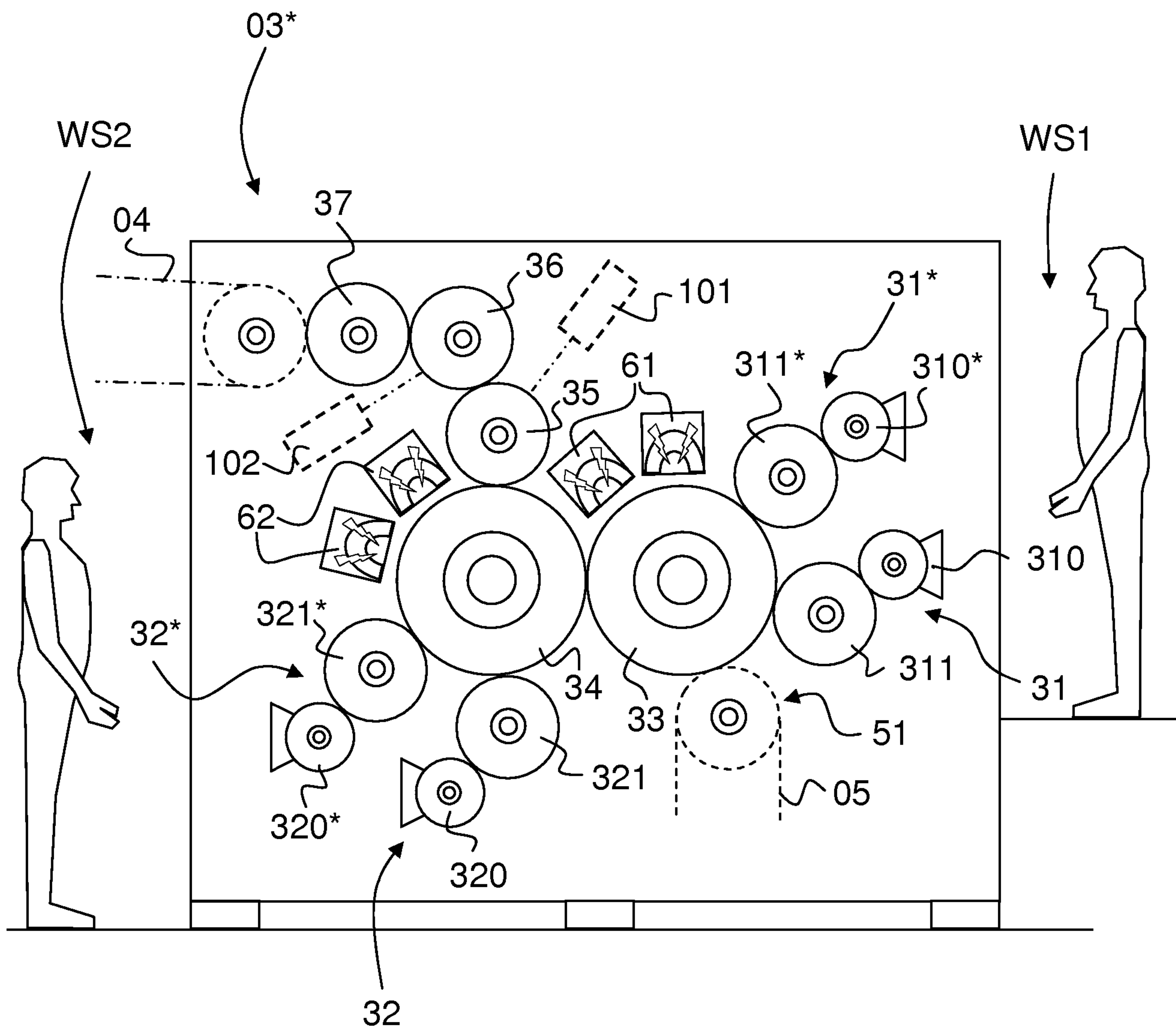


Fig. 3

