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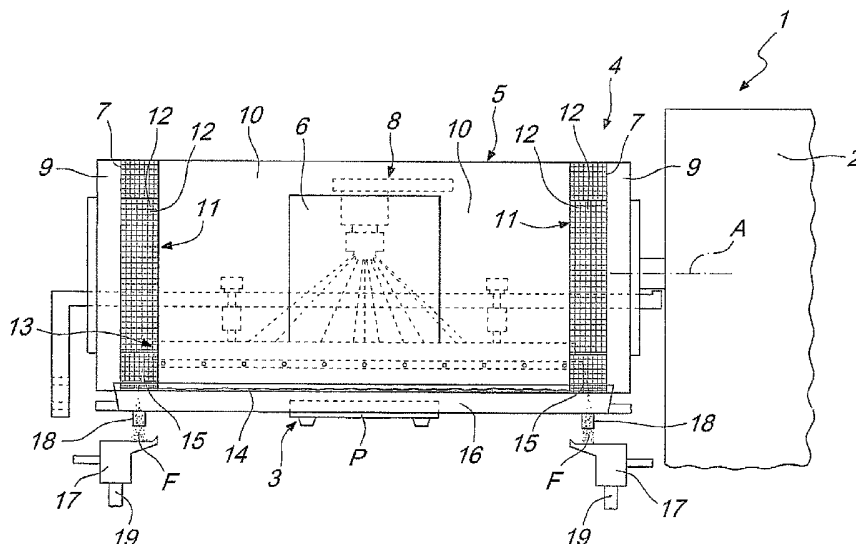
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ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: MACHINE FOR WET SCREEN PRINTING OF SUBSTANTIALLY FLAT ELEMENTS, PARTICULARLY
CERAMIC ARTICLES



(57) Abstract: A machine (1) for wet screen printing of substantially flat elements, particularly ceramic articles, comprising a supporting frame (2) which supports, above a surface for supporting substantially flat elements, particularly ceramic articles (P), a plate (4) which comprises a sheet (5), which is closed in a loop and provided with at least one portion, which is moved over the elements (P) and in which there is at least one net-like sector (6), which bears the pattern to be screen printed, and with two lateral edges (7), which are opposite and parallel with respect to the direction of motion, and means (8) for applying a printing fluid (F) to the elements (P) through the sector (6); the plate (4) comprising, at least at one of the edges (7), at least one band (11) which is external to the sector (6) and is provided with openings (12) for discharging the fluid (F).

MACHINE FOR WET SCREEN PRINTING OF SUBSTANTIALLY FLAT ELEMENTS, PARTICULARLY CERAMIC ARTICLES

Technical Field

The present invention relates to a machine for wet screen printing of
5 substantially flat elements, particularly ceramic articles.

Background Art

Machines for wet screen printing of substantially flat elements such as tiles are known in the ceramic sector and are substantially constituted by a supporting frame, which supports, above a line for conveying the elements
10 to be screen-printed, a net-like plate provided with one or more sectors bearing the pattern to be printed, said plate being moved with respect to the elements to be screen-printed, and means for applying a printing fluid (enamel, screen printing paste, etc) through the plate onto said elements.

The plate can be shaped like a cylindrical drum: in this case, it is
15 allowed to rotate about its own longitudinal axis, which lies on a plane which is substantially parallel to the plane of the conveyance line and is arranged substantially transversely thereto.

As an alternative, the plate can be shaped like a belt closed in a loop; in this case, it is moved so that at least one portion of its lower part travels
20 above the elements to be screen-printed in a direction that is substantially parallel to the direction of the advancement line.

In particular, machines for so-called spray screen printing are known in which the plate is supported above the elements to be screen-printed at a nonzero distance from them and in which the fluid application means are of
25 the spray type, suitable to force the fluid to pass through the plate in order to transfer it onto the underlying elements without contact between said elements and said plate.

This type of screen printing allows for example to apply uniformly the fluid to the entire surface of the elements even if said surface has
30 recesses or protrusions, and avoids damage to said elements by not applying

pressure to them.

Spray application means can be constituted for example by a spray gun or, as an alternative, by a pressurized atomizing jet, or by a jet of compressed air, a film of fluid being applied beforehand to the plate.

5 During the operation of those machines, it is necessary to clean periodically their plate in order to remove the residues of fluid that accumulate in the meshes of the screen, in order to prevent them from dripping onto the underlying elements and dirtying them, or from obstructing said meshes, altering the pattern to be printed.

10 The plate can be cleaned manually by assigned operators by using sponges or mechanically by means of dedicated devices.

With particular reference to machines for spray screen printing, cleaning devices are known which comprise a jet of water or other solvent, which is located outside the plate and directed toward it, and a tank for
15 collecting the used washing water, which is located inside the plate and at the jet, and a blower for drying air, which is arranged outside the plate and is directed toward it.

Cleaning devices are also known which comprise an aspirator, which is located inside and/or outside the plate and is suitable to extract the
20 residues of fluid from the meshes of the screen.

Further, known devices can cooperate with one or more scrapers for scraping the surface of the plate.

These known machines are not free from drawbacks, including the fact that they are provided with cleaning devices that are structurally and
25 constructively very complicated and significantly costly.

Another drawback of known machines is that they do not allow to clean completely the plates, on which residues therefore remain which can drip onto the elements, dirtying them, or can obstruct the meshes of the screen. In this last case, extraordinary cleaning actions become necessary,
30 stopping the machine in order to disassemble, wash and reassemble said

plate, with consequent waste of time, slowing of production and onerous use of labor.

Disclosure of the Invention

The aim of the present invention is to eliminate the drawbacks noted
5 above of known machines, by providing a machine for wet screen printing of substantially flat elements, particularly ceramic articles, which allows to clean the plate simply, completely and accurately, eliminating every residue of fluid from it.

Within this aim, an object of the present invention is to provide a
10 machine that is simple, relatively easy to provide in practice, safe in use, effective in operation, and has a relatively low cost.

This aim and this object are achieved by the present machine for wet screen printing of substantially flat elements, particularly ceramic articles, which comprises a supporting frame which supports, above a surface for
15 supporting substantially flat elements, particularly ceramic articles, a plate which comprises a sheet, which is closed in a loop and provided with at least one portion, which is moved over said elements and in which there is at least one net-like sector, which bears the pattern to be screen printed, and with two lateral edges, which are opposite and parallel with respect to the
20 direction of said motion, and means for applying a printing fluid to said elements through said sector, characterized in that said plate comprises, at least at one of said edges, at least one band which is external to said sector and is provided with openings for discharging said fluid.

This aim and this object are also achieved by the present plate for wet
25 screen printing of substantially flat elements, particularly ceramic articles, which comprises a sheet which is closed in a loop and is provided with at least one portion which is suitable to be moved over substantially flat elements, particularly ceramic articles, to be screen printed, in which there is at least one net-like sector, which bears the pattern to be screen printed, and
30 with two lateral edges, which are opposite and parallel with respect to the

direction of said motion, characterized in that it comprises, at at least one of said edges, at least one band which is external to said sector and is provided with openings for discharging said fluid.

This aim and this object are also achieved by the present kit for
5 machines for wet screen printing of substantially flat elements, particularly ceramic articles, which comprises a plate which comprises a sheet, which is closed in a loop and is provided with at least one portion, which is suitable to be moved over substantially flat elements, particularly ceramic articles, to be screen printed, in which there is at least one net-like sector, which bears
10 the pattern to be screen printed, and with two lateral opposite edges, which are parallel to the direction of said motion, at least one band which is external to said sector and is provided with openings for discharging said fluid being formed at at least one of said edges, and a cleaning unit, which comprises a frame for supporting at least one blade which is substantially
15 transverse with respect to the direction of said motion, skims the internal face of said sheet, and is provided with at least one end that reaches said band.

Brief description of the Drawings

Further characteristics and advantages of the present invention will
20 become better apparent from the following detailed description of a preferred but not exclusive embodiment of a machine for wet screen printing of substantially flat elements, particularly ceramic articles, illustrated by way of non-limiting example in the accompanying drawings, wherein:

25 Figure 1 is a schematic front view of the machine according to the invention;

Figure 2 is a schematic side view of the machine according to the invention.

Ways of carrying out the Invention

30 With reference to the figures, the reference numeral 1 generally

designates a machine for wet screen printing of substantially flat elements, particularly ceramic articles such as for example tiles P.

The machine 1 comprises a supporting frame 2, which is shown only partially and supports, above a surface for supporting the tiles P constituted
5 by an advancement line 3 of the known belt type, a printing plate 4.

The plate 4 comprises a sheet 5, which is closed in a loop and is provided with at least one portion, which is moved over the tiles P and in which there are one or more net-like sectors 6, provided with the pattern to be screen printed, and with two opposite lateral edges 7, which are parallel
10 to the direction of motion designated by the line T.

The frame 2 further supports means 8 for applying a printing fluid F to the tiles P through the sectors 6; the fluid F can be for example a ceramic enamel or a screen printing paste.

The plate 4 can be of the cylindrical drum type, as shown in the
15 accompanying figures; in this case, the sheet 5 can be supported by a framework which comprises end rings 9, by means of which it is tensioned and fitted, so that it can rotate about an axis A which is transverse to the advancement line 3, to the frame 2; the drum is turned by motor means, which are not shown, and the direction T is determined by the direction of
20 the tangential speed of the drum at its lower generatrix.

In a possible alternative embodiment, which is not shown, the plate 4 can be of the type of a belt, in which case the sheet 5 is wound around two or more rollers, at least one of which is a driving roller, so that at least one portion of its lower part is substantially parallel to the advancement line 3,
25 i.e., to the tiles P; the direction T is determined by the direction of the advancement speed of said portion.

As it is known, the plate 4 is currently obtained from a sheet 5 which has a net-like weft and on which a film of a gelatinous photosensitive emulsion is applied, such emulsion obstructing the meshes of the plate by
30 drying; the fabric thus "closed" is then subjected to a photoengraving

process, by means of which only the meshes of certain sectors 6 are reopened and, as a whole, form the pattern to be screen printed.

The portions of fabric 10 that are external to the sectors 6 have closed meshes.

5 The plate 4 according to the invention comprises, at least at one of edges 7, at least one band 11, which is external both to the sectors 6 and to the portions 9 and in which there are openings 12 for discharging the fluid F.

10 The bands 11 can have, for example, a net-like structure in which the meshes form the openings 12; in particular, such structure can be obtained by protecting corresponding portions of the sheet 5 proximate to the edges 7 from the photosensitive emulsion or, in the opposite situation, by subjecting to photoengraving said portions in order to reopen all or part of the meshes therein.

15 However, alternative embodiments of the band 11 and of the openings 12, which can be for example of the slot type, are also possible.

20 The machine 1 further comprises a unit 13 for cleaning the plate 4, which in turn comprises at least one blade 14 arranged substantially transversely to the direction of motion T, is supported so as to skim the internal face of the sheet 5, and has opposite ends 15 that extend until they reach the bands 11.

25 As an alternative, instead of having a single blade 14, it is possible to have, depending on whether one or two bands 11 are provided, one or two blades, which in this case are mutually aligned, each blade being arranged outside the sectors 6 and lying along the corresponding portion 10 so as to reach the respective band 11.

 The blade 14 removes the residues of fluid F that are present on the portions 10 and/or on the sectors 6, making them flow out toward the bands 11, from the openings 12 of which they are discharged.

30 The cleaning unit 13 further comprises a first tank 16, which is

supported transversely to the direction T and is arranged at the outer face of the sheet 5 downstream of the application means 8 along the direction of motion of the plate 4.

The first tank 16 collects the residues of fluid F forced by the blade 14 to flow both through the openings 12 of the bands 11 and, if the blade 14 also reaches the sectors 6, through the meshes thereof, in order to prevent said fluid from falling back onto the tiles P that advance along the line 3.

The cleaning unit 13 further comprises one or two second tanks 17, which are supported longitudinally to the direction T at the outer face of the sheet 5 and at the bands 11.

The second tanks 17 collect the residues of fluid F that are forced by the blade 14 to flow through the openings 12 of the bands 11; the second tanks 17 can be arranged below the discharges 18 of the first tank 16 from which they receive the fluid F collected thereby.

The second tanks 17 are provided with discharge outlets 19, which are connected, in a known manner, to a circuit for recovering and recirculating the fluid F.

Finally, the cleaning unit 13 comprises a cleaning roller 20, which is supported so that it can rotate about an axis B which is substantially transverse with respect to the direction T and is in contact with the outer face of the sheet 5; the cleaning roller 20 is arranged upstream of the application means 8 along the direction of motion of the plate 4.

The cleaning roller 20 cooperates with a pusher blade 21, which is supported, so that it is substantially parallel to the axis B, inside the plate 4 and substantially skims the inner face of the sheet 5, so as to force the residues of fluid F to pass through the plate 4 to be then removed by the cleaning roller 20.

In particular, the machine 1 can be of the spray screen printing type; in this case, the plate 4 is supported at a nonzero distance above the tiles P and the application means 8 are of the spray type and can be constituted by a

spray gun or by a jet for atomizing under pressure the fluid F (in the absence of air) or also by a jet of air; in this last case, a film of fluid F is applied to the plate 4.

The bands 11 of the plate 4 allow to discharge all residues of fluid F removed from the blade 14 both from the sectors 6 and from the portions 10; the fluid F thus collected is conveniently recovered and recirculated.

The first tank 16 and the second tanks 17 allow to collect the fluid F discharged both through the sectors 6 and through the bands 11.

The cleaning roller 20, in cooperation with the pusher blade 21, finishes the cleaning of the plate 4 performed by the blade 14 and by the bands 11.

The plate 4 is thus cleaned of any residue of fluid F simply, quickly and completely.

In practice it has been found that the described invention achieves the intended aim and object.

The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

All the details may further be replaced with other technically equivalent ones.

In practice, the materials used, as well as the shapes and the dimensions, may be any according to requirements without thereby abandoning the scope of the protection of the appended claims.

The disclosures in Italian Patent Application No. MO2004A000222 from which this application claims priority are incorporated herein by reference.

CLAIMS

1. A machine for wet screen printing of substantially flat elements, particularly ceramic articles, comprising a supporting frame which supports, above a surface for supporting substantially flat elements, particularly ceramic articles, a plate which comprises a sheet, which is closed in a loop and provided with at least one portion, which is moved over said elements and in which there is at least one net-like sector, which bears the pattern to be screen printed, and with two lateral edges, which are opposite and parallel with respect to the direction of said motion, and means for applying a printing fluid to said elements through said sector, characterized in that said plate comprises, at least at one of said edges, at least one band which is external to said sector and is provided with openings for discharging said fluid.

2. The machine according to claim 1, characterized in that said plate comprises a respective said band at both of said edges.

3. The machine according to claim 1, characterized in that said band has a net-like structure.

4. The machine according to one or more of the preceding claims, characterized in that it comprises a unit for cleaning said plate.

5. The machine according to one or more of the preceding claims, characterized in that said cleaning unit comprises at least one blade which is substantially transverse with respect to the direction of said motion, skims the inner face of said sheet, and has at least one end that reaches said band.

6. The machine according to one or more of the preceding claims, characterized in that said cleaning unit comprises a first tank for collecting the fluid forced by said blade through said plate, which is arranged transversely to the direction of said motion and is arranged, at the outer face of said sheet, downstream of said application means along the direction of motion of said portion.

7. The machine according to one or more of the preceding claims,

characterized in that said cleaning unit comprises at least one second tank for collecting the fluid forced by said blade through said plate, which is arranged longitudinally to the direction of said motion and is arranged at the outer face of said sheet.

5 8. The machine according to one or more of the preceding claims, characterized in that said cleaning unit comprises at least one cleaning roller, which is arranged substantially transversely to the direction of said motion in contact with the outer face of said sheet and upstream of said application means along the direction of motion of said portion.

10 9. The machine according to one or more of the preceding claims, characterized in that said cleaning unit comprises a pusher blade, which is arranged so as to skim substantially the internal face of said sheet at said roller and is substantially parallel thereto.

 10. The machine according to one or more of the preceding claims,
15 characterized in that said plate is of the belt type.

 11. The machine according to one or more of the preceding claims, characterized in that said plate is of the cylindrical drum type.

 12. The machine according to one or more of the preceding claims, characterized in that said application means are of the spray type and
20 comprise a spray gun or a jet for atomizing under pressure said fluid or a jet of air, a film of fluid being applied to said plate.

 13. A plate for the wet screen printing of substantially flat elements, particularly ceramic articles, comprising a sheet which is closed in a loop and is provided with at least one portion, which is suitable to be moved over
25 substantially flat elements, particularly ceramic articles, to be screen printed, in which there is at least one net-like sector that bears the pattern to be screen printed, and with two opposite lateral edges, which are parallel to the direction of said motion, characterized in that it comprises, at least at one of said edges, at least one band which is external to said sector and is
30 provided with openings for the discharge of said fluid.

14. The plate according to claim 13, characterized in that it comprises a respective said band at both of said edges.

15. The plate according to one or more of claims 13 to 14, characterized in that said band has a net-like structure.

5 16. The plate according to one or more of claims 13 to 15, characterized in that it is of the belt type.

17. The plate according to one or more of claims 13 to 16, characterized in that it is of the cylindrical drum type.

18. A kit for machines for wet screen printing of substantially flat
10 elements, particularly ceramic articles, comprising a plate which comprises a sheet closed in a loop and provided with at least one portion, which is suitable to be moved over substantially flat elements, particularly ceramic articles, to be screen printed, in which there is at least one net-like sector, which bears the pattern to be screen printed, and with two opposite lateral
15 edges, which are parallel to the direction of said motion, at least one band which is external to said sector and is provided with openings for the discharge of said fluid being formed at at least one of said edges, and a cleaning unit which comprises a frame for supporting at least one blade which is substantially transverse to the direction of said motion, skims the
20 internal face of said sheet, and has at least one end that reaches said band.

19. The kit according to claim 18, characterized in that said plate comprises a respective said band at both of said edges.

20. The kit according to one or more of claims 18 to 19, characterized in that said band has a net-like structure.

25 21. The kit according to one or more of claims 18 to 20, characterized in that said plate is of the belt type.

22. The kit according to one or more of claims 18 to 21, characterized in that said plate is of the cylindrical drum type.

23. The kit according to one or more of claims 18 to 22, characterized
30 in that said cleaning unit comprises a first tank for collecting the fluid

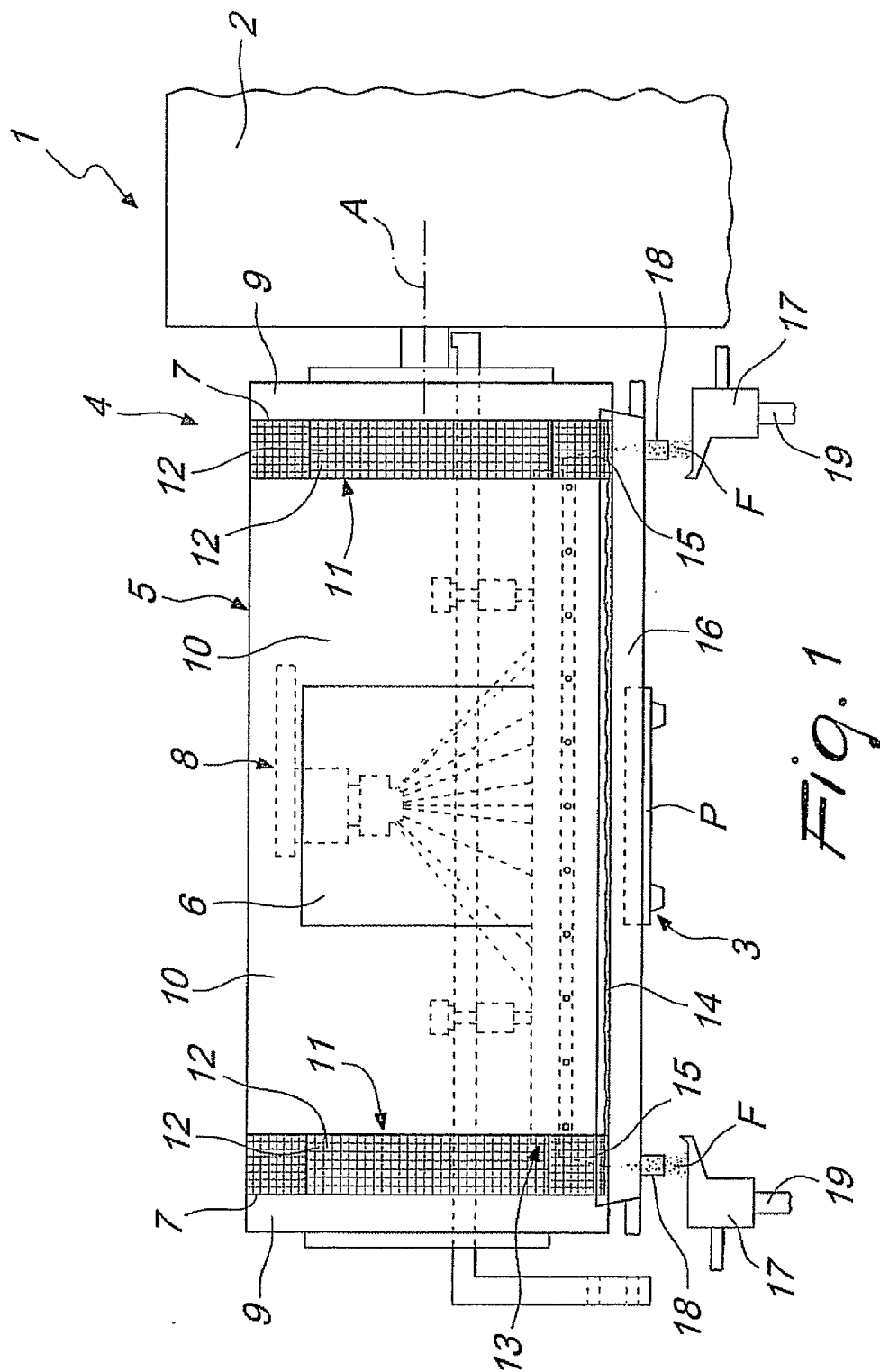
forced by said blade through said plate, which is arranged transversely to the direction of said motion and is located at the outer face of said sheet.

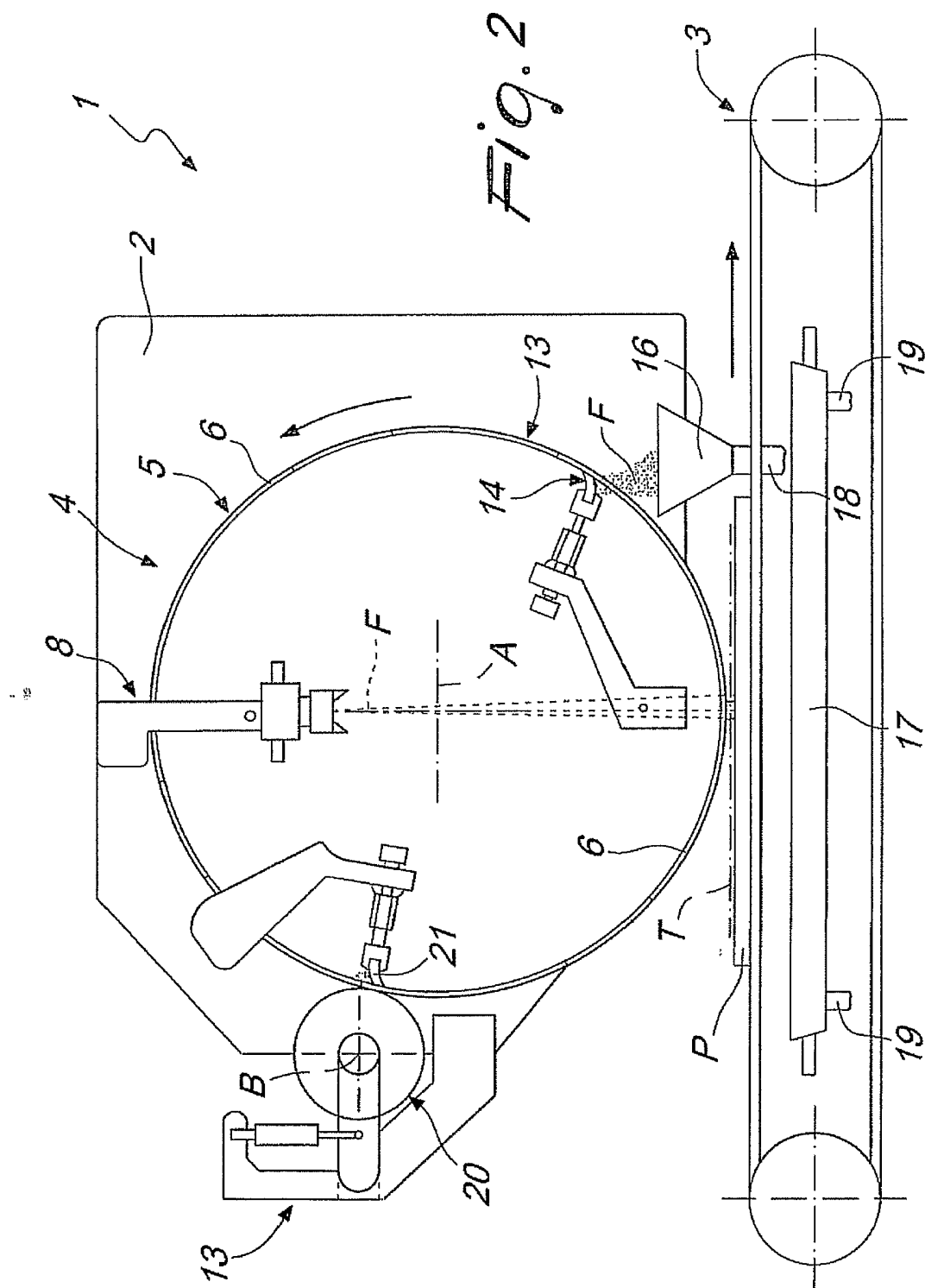
24. The kit according to one or more of claims 18 to 23, characterized in that said cleaning unit comprises at least one second tank for collecting
5 the fluid forced by said blade through said plate, which is arranged longitudinally to the direction of said motion at the outer face of said sheet.

25. The kit according to one or more of claims 18 to 24, characterized in that said cleaning unit comprises at least one cleaning roller, which is arranged substantially transversely to the direction of said motion in contact
10 with the outer face thereof.

26. The kit according to one or more of claims 18 to 25, characterized in that said cleaning unit comprises a pusher blade, which is arranged so as to skim substantially the internal face of said sheet at said roller and is substantially parallel thereto.

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	column 2, line 23 - line 46; figures 1,3	18,19, 22,23
Y	----- EP 1 336 480 A (GRUPPO CONCORDE S.P.A) 20 August 2003 (2003-08-20) paragraph '0042!; figure 7	18,19, 22,23
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2005/052868

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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