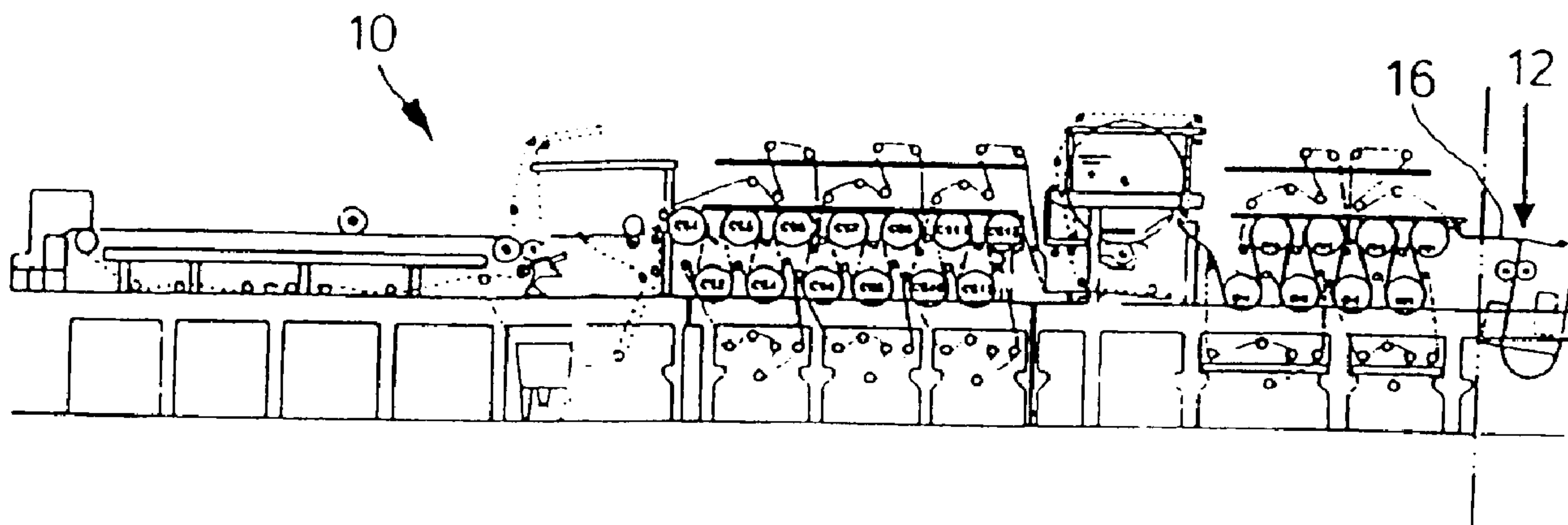




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(57) **Abrégé/Abstract:**

The invention relates to a method for producing paper, mat, laminate or similar material web using a binder feeding mechanism and by subsequent hardening. In this method, a water-dilutable acrylate in the form of a binder is fed to the material web at the binder feeding mechanism. The material web is then hardened by an electron beam, after the water content has been evaporated off. After feeding the binder, or after the impregnation process, the material web containing the noncrosslinked acrylate is dried and the water is evaporated from the binder, preferably an emulsion. The material web is then printed and crosslinkage or polymerization begun. After printing, a varnish is applied that is capable of being hardened by an electron-beam. The material or paper web can be pressure-impregnated with the acrylate.

ABSTRACT

The invention relates to a method for producing paper, mat, laminate or similar material web using a binder feeding mechanism and by subsequent hardening. In this method, a water-dilutable acrylate in the form of a binder is fed to the material web at the binder feeding mechanism. The material web is then hardened by an electron beam, after the water content has been evaporated off. After feeding the binder, or after the impregnation process, the material web containing the noncrosslinked acrylate is dried and the water is evaporated from the binder, preferably an emulsion. The material web is then printed and crosslinkage or polymerization begun. After printing, a varnish is applied that is capable of being hardened by an electron-beam. The material or paper web can be pressure-impregnated with the acrylate.

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DESCRIPTIONMethod of producing paper

The invention concerns a method of producing paper, paper mat, laminate or the like web of material with a binding agent feed device and
10 with subsequent hardening - in particular a splitting-resistant web of material which is subjected to further treatment by means of a lacquering process - and to which a water-dilutable acrylate in the form of a binding agent is fed at the binding agent feed device, wherein the web of material treated in that way is hardened after evaporation of the water content by
15 an electron beam.

Such a method is described in DE 44 13 619 C2 which discloses that it is known to produce finish foils by the lacquering of substrates, such foils being used in particular as cover foils for producing a coating which is resistant to abrasion, scratching and chemicals, for the wood material
20 industry. They are referred to as cleavage-resistant or splitting-resistant paper and are produced within the production of paper in the paper machine by virtue of the use of hardenable mixtures of condensation resins based on melamine and urea as well as acrylate dispersions in a glue press which serves as a binding agent feed device. Such resin mixtures are
25 hardened by heat means. In order to have to handle smaller proportions of water and in order to be able to reduce the drying capacities involved, DE 44 13 619 C2 proposes the use, on the glue press of the paper machine, of a system comprising a water-dilutable, electron beam-hardenable acrylate in the form of a dispersion, emulsion or solution. After evaporation of the
30 water content, hardening is effected by use of the electron beam technology, either directly in the paper machine or outside it.

The inventor set himself the object of further improving the method as described in the opening part of this specification and in particular increasing the capacity for printing thereon and the deformation capability, and proposes the teaching of the independent claim as the way
5 of attaining that object; the appendant claims set forth advantageous developments of the invention.

In accordance with the invention, after the feed of the binding agent - in particular after the acrylate impregnation operation - the web of material is dried and in that operation the water is evaporated out of
10 the binding agent. The product from that step in the method contains non-crosslinked acrylate and - possibly after calendering on one side, that is to say smoothing by way of a roller - it is subsequently printed upon; after the printing operation, a lacquer which can be hardened with an electron beam (an EB-hardenable lacquer) is advantageously applied as a
15 cover layer and then cross-linking or polymerization is initiated.

The impregnation operation - which is preferably implemented by means of pressure impregnation - is to be effected with polyester, epoxy, urethane or full acrylate at ambient temperature, in particular at between 200 and 400 m/min conveyor speed, and the web of material is to be contact-
20 dried on a roller which is heated - advantageously affording a chromium-plated surface - ; the drying is from between about 20 to 25% water proportion to between 2 and 4% water proportion.

The non-crosslinked web of material is printed upon with the advantage of good wettability and a smooth surface, by virtue of the
25 calendering operation, for example using an intaglio printing process; the polymers enhance the flexibility and deformability/fulling capability of the web of material and promote a clean print configuration. The flaws which occur with a paper produced in a hitherto conventional manner, in intaglio printing, together with a reduction in the precision or fidelity
30 of the reproduction - for example when printing with a wood pattern - no longer occur here.

It will be clear that quite generally more flexible manufacturing and use properties can be achieved.

A point of particular significance is the use of the emulsion; the polymers present in non-crosslinked paper residues or the emulsion, dispersion or solution can equally well be returned to the binding agent feed device, in particular to the glue press, like the excess polymer-bearing emulsion originating from the impregnation process.

The non-crosslinked paper residues are broken down into cellulose and pigments on the one hand and the emulsion of polymer and water on the other hand, whereupon the emulsion is returned to the impregnation process.

Accordingly, in one aspect, there is provided a method of producing paper, paper mat, laminate or the like web of material with a binding agent feed device in a paper machine and with subsequent hardening, and to which a water-dilutable acrylate in the form of a binding agent is fed at the binding agent feed device, wherein the web of material treated in that way is hardened after evaporation of the water content by an electron beam, wherein the web of material which after the feed of the binding agent contains the acrylate in non-crosslinked form is dried with evaporation of the water out of the binding agent, the non-crosslinked web of material is then printed upon, after the printing operation a lacquer which can be hardened with an electron beam is applied and then cross-linking or polymerisation is initiated.

In one embodiment, the impregnation operation may be effected with between 10 g and 20 g of acrylate and between 10 g and 20 g of water content.

Further advantages, features and details of the invention will be apparent from the following description of preferred embodiments and with reference to the drawing in which the Figures are each a diagrammatic illustration. In the drawing:

Figure 1 is a diagrammatic view of a paper machine for the manufacture of paper with integrated glue press, and

Figure 2 is a detailed portion in the region of the glue press.

A paper machine 10 for the manufacture of paper or paper fleece or mat - for example of a weight of 45 g/cm^2 - includes a glue press 12 with, in this case, two rollers 14 for impregnating the paper web 16 as it passes through the machine, with acrylate. In the glue press 12 the paper web 16 is pressure-impregnated between the rollers 14; the acrylate penetrates in the form of a pre-polymer into the pores in the paper or between the fibers.

The impregnation step can be effected for example for each square meter with 15 g of acrylate - for example polyester, epoxy, urethane or full acrylate - and about 15 g water content per square meter with a speed of movement of the paper web 16 through the machine of about between 200 and 400 m/mm, at ambient temperature. The total water content of the impregnated paper produced in that way is between about 20 and 25%.

In a subsequent drying operation the water is evaporated out of the emulsion; the acrylate is not yet cross-linked. That drying operation is

effected by contact drying on a steam-heated and chromium-plated roller, in which case the water content falls to between 2 and 4%. The pre-polymers are not influenced thereby. Then, a smoothing operation is effected over a further roller (calendering on one side).

5 The non-crosslinked end product can then be printed upon - for example using an intaglio printing process - ; as the paper web 16 affords a smooth compact surface with good wettability, in particular in relation to aqueous systems, the result is a neat and clean print.

10 Particularly when using single-color printing, the print cylinder is designed as part of the coating installation, for example for wood reproduction, in the line.

After the printing operation a cover lacquer which can be hardened by means of an electron beam, referred to as an EB-hardenable lacquer, is applied to the paper web 16 by applicator rollers. It is only thereafter
15 that cross-linking or polymerization is effected, preferably at about 170 kV with a depth of penetration of about 150 micrometers.

The cross-linked web product produced in the above-described manner then appears for example in the following form: disposed on a subjacent, impregnated paper layer of about 60 g/m^2 weight is a - possibly multi-layer
20 - layer of color or ink, of a thickness of up to 2 micrometers, of between about 1 and 2 g/m^2 , thereupon the cover layer consisting of EB-hardenable lacquer measuring between 10 and 12 micrometers and of between 10 and 12 g/m^2 . That end product can then be pressed, with the addition of adhesive, for example with wood material panels, for example chipboard panels, plywood, medium-density fiber panels (MDF) or high-density fiber panels
25 (HDF).

The point of significance above all is that the described method, with a condensation resin-free and formaldehyde-free dispersion, suspension or solution, makes it possible to achieve very good product properties.

30 The method according to the invention also permits recycling of polymers or polymer-bearing dispersions, emulsions or solutions in paper residues; the production of paper gives rise to paper residues to an extent

of up to about 10% of the total yield, in particular non-crosslinked paper residues at the end of the smoothing operation or the printing operation.

As shown in Figure 2, at the glue press or size press 12, an overflow 18 for unneeded binding agent, for example an emulsion (acrylate/water) is returned into a binding agent supply container 20; that therefore involves a pure binding agent cycle in a closed circuit.

The feed means 24 of the supply container 20, the feed means 24 including a quantitative control valve 22, is connected to a mixing chamber 26 for raw materials, while the bottom discharge 28 is connected to a filter 30 which a return line 32 connects to the glue or size press 12.

The non-crosslinked paper residues are broken up and separated into:

- celluloses and pigments, and
- binding agents (for example emulsion; water and polymer),

wherein the binding agent is recycled, as described.

While in accordance with the invention the material that is not required is passed back into the binding agent cycle, hitherto the paper residue containing condensation resin had to be disposed of as special refuse, with the high level of costs that this involved.

The embodiments of the present invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method of producing paper, paper mat, laminate web of material with a binding agent feed device in a paper machine and with subsequent hardening, and to which a water-dilutable acrylate in the form of a binding agent is fed at the binding agent feed device, wherein the web of material treated in that way is hardened after evaporation of the water content by an electron beam, wherein the web of material which after the feed of the binding agent contains the acrylate in non-crosslinked form is dried with evaporation of the water out of the binding agent, the non-crosslinked web of material is then printed upon, after the printing operation a lacquer which can be hardened with an electron beam is applied and then cross-linking or polymerisation is initiated.
2. A method as set forth in claim 1, wherein an emulsion as the binding agent which is fed in a glue press.
3. A method as set forth in claim 1 or claim 2, wherein polymers present in non-crosslinked paper residues or the polymer-bearing emulsion are returned to the binding agent feed device.
4. A method as set forth in claim 1 or claim 3, wherein the web of material or paper is impregnated with the acrylate using pressure.
5. A method as set forth in any one of claims 1 to 4, wherein the impregnation process is carried out with polyester, epoxy, urethane or full acrylate at ambient temperature at a conveyance speed of between 200 and 400 m/min.

6. A method as set forth in claim 4 or claim 5, wherein the impregnation operation is effected with between 10 g and 20 g of acrylate, and between 10 g and 20 g of water content, per m² of web of paper of a weight of between 30 g and 60 g.
7. A method as set forth in claim 6, wherein the impregnation operation is effected with about 15 g of acrylate and about 15 g of water content.
8. A method as set forth in claim 6 or 7, wherein the impregnation operation is effected with paper of a weight of 45 g.
9. A method as set forth in any one of claims 1 to 8, wherein the web of paper is contact-dried on a heated roller.
10. A method as set forth in claim 9, wherein the roller has a chromium-plated surface.
11. A method as set forth in claim 1, 9 or 10, wherein the web of paper is dried from between about 20 to 25% water content to between 2 and 4% water content.
12. A method as set forth in claim 1, wherein the web of paper is calendered prior to the printing operation.
13. A method as set forth in any one of claims 1 to 12, further comprising application of pigmented or transparent electron beam-hardenable lacquer after the printing operation.
14. A method as set forth in claim 13, wherein the lacquer is EB-hardenable lacquer.

15. A method as set forth in any one of claims 1 to 14, wherein the cross-linked web of paper is produced with a subjacent impregnated paper layer, thereover a coating of ink or colour, and a cover layer covering same and consisting of EB-hardenable lacquer.

16. A method as set forth in claim 15, wherein the coating is a multi-layer coating.

17. A method as set forth in claim 15 or 16, including a paper layer of about 60 g/m², a layer of ink or colour of up to about 2 micrometers and a cover layer of between 10 and 12 g/m².

18. A method as set forth in claim 1 or claim 3, wherein excess binding agent from the impregnation process is recycled.

19. A method as set forth in claim 18, wherein acrylate emulsion is recycled.

20. A method as set forth in claim 1, claim 3, claim 15 or claim 16, wherein the non-crosslinked paper residues are broken up into cellulose and pigments on the one hand and the emulsion of polymer and water on the other hand, whereupon the emulsion is recycled to the impregnation process.

21. A method as set forth in any one of claims 1 to 20, wherein the binding agent or the emulsion is recycled through at least one filter.

22. A method as set forth in any one of claims 1 to 21, wherein emulsion coming from a mixing container is mixed with the binding agent or the emulsion.

23. A method as set forth in any one of claims 1 to 22, wherein the paper is a splitting-resistant web.

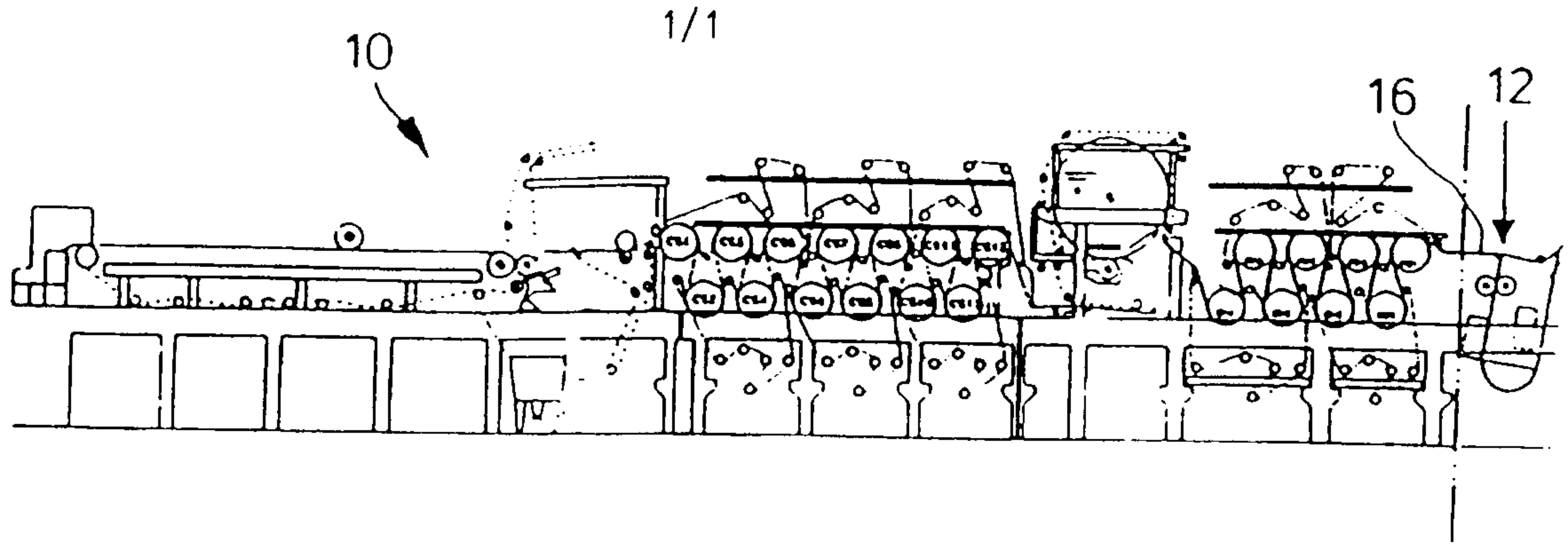


Fig.1

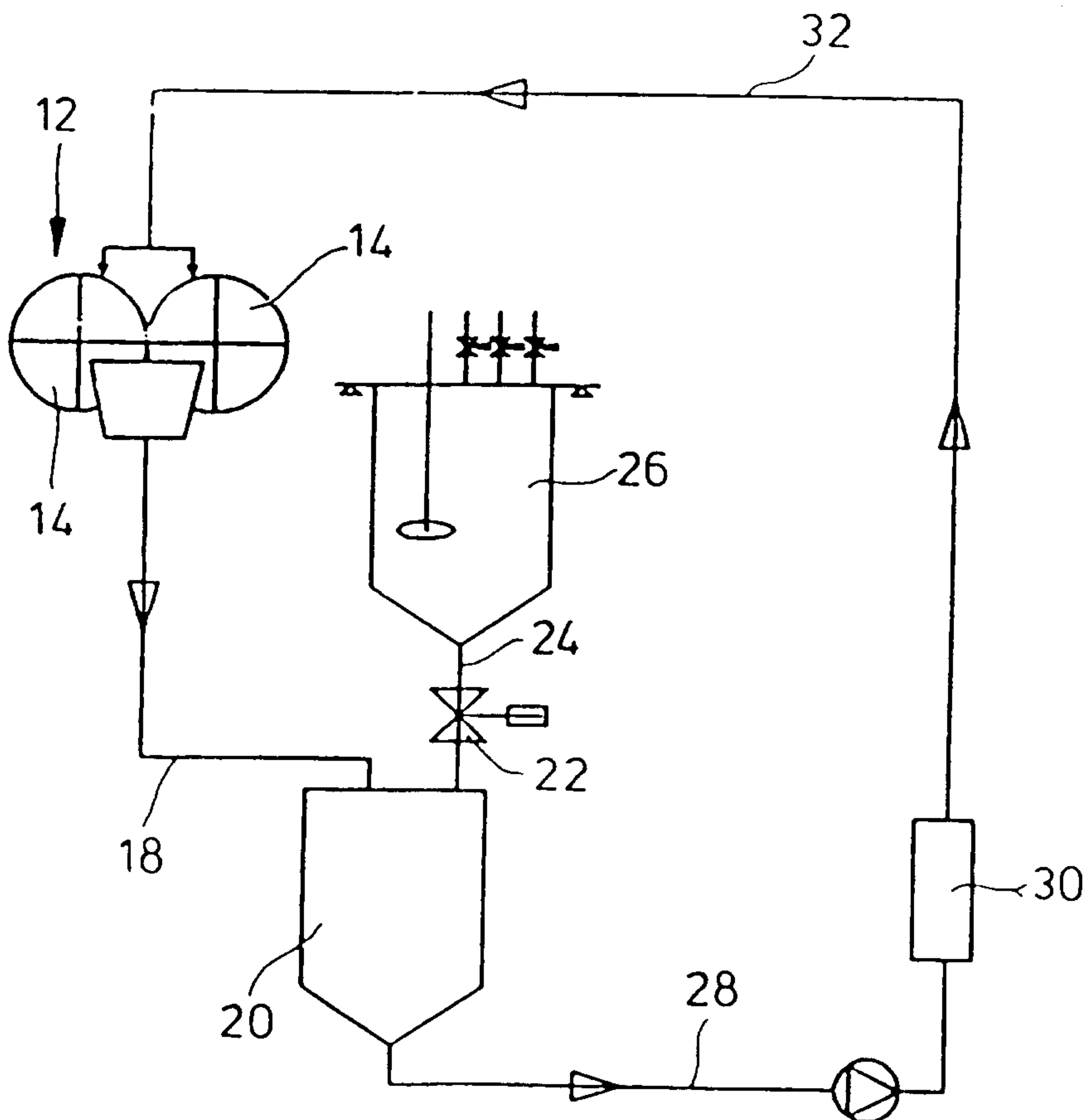
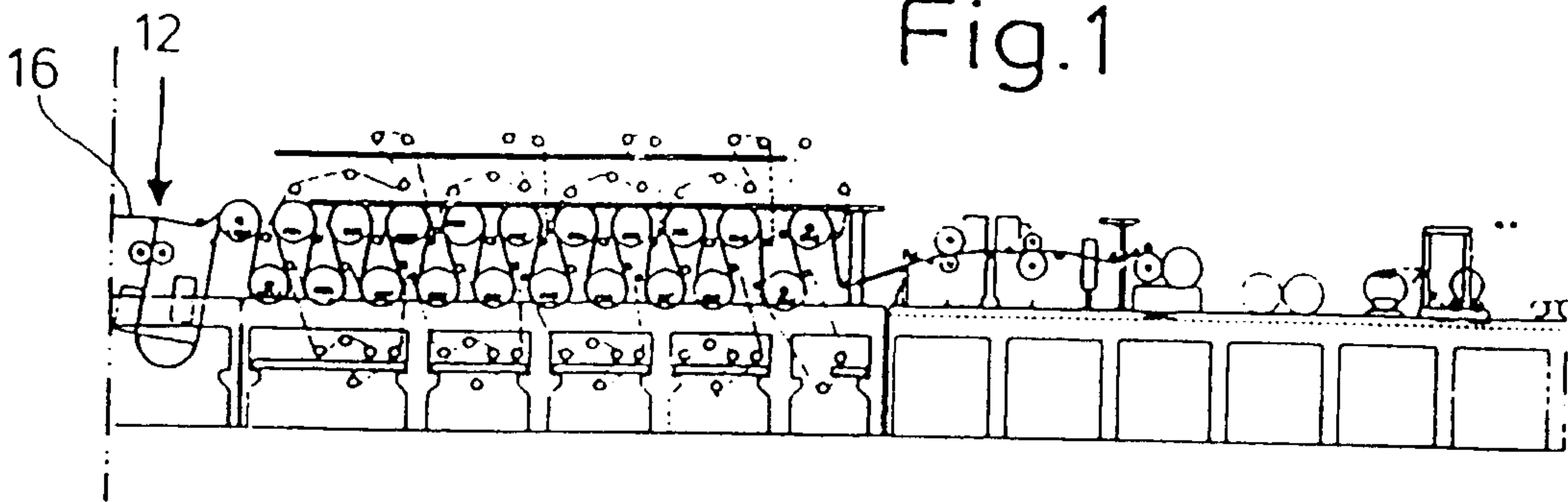


Fig.2

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