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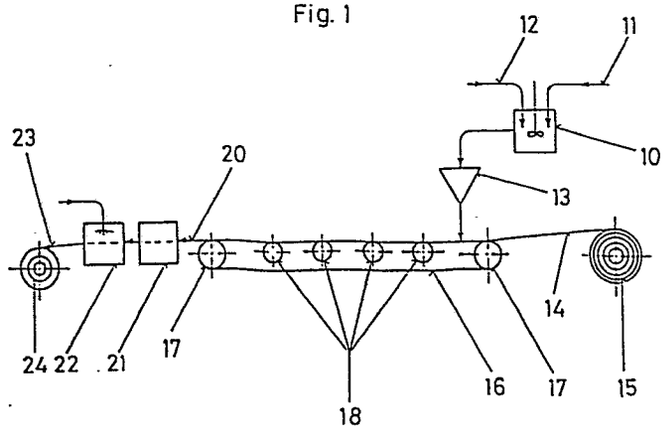
(54) **Method of re-using waste fibres.**

(57) Waste or other recovered fibrous material, for example fibres from waste or reject cigarette filters, filter rods and tows employed in making them, is converted into useful products by depositing the fibres 11, preferably dispersed in an aqueous medium 12, on an advancing screen 16 to form a fibrous web. The web is caused to adhere to a carrier or backing sheet 14, either during or after deposition, and the assembly 20 of fibres and carrier is sub-divided into portions for the manufacture of fibrous products, preferably after being dried in a ventilated drier 21. Plasticizer may be applied by an applicator 22 for the purposes of softening and bonding the fibres in subsequent stages of the production of the desired fibrous products. The divided portions of the assembly 20 can be used to form such products as cigarette filters or absorbent ink carrier elements for pens.

Fig. 1



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Method of re-using waste fibres

This invention relates to the re-use of waste or other recovered fibrous material and its conversion into useful products. It is especially, but not exclusively, concerned with the recovery and re-use of fibres from waste or reject cigarette filters, filter rods and tows employed in making them.

It is known to re-use waste fibrous material by breaking open articles containing such fibres, such as cigarette filters, separating off wrapping and other extraneous material, and utilising the fibres so recovered in various low-grade end uses, for example as a packing or stuffing material.

In US 3 615 997 it is proposed to re-use fibres recovered from waste cigarette filter material in the production of further filters, but by incorporating salvaged fibres with virgin fibre to the extent of 75 to 95% of the total, and subsequently carding the combined fibres and forming them into a tow and thence into a filter rod in the conventional manner.

The method of this invention is characterized in that the fibres are deposited in a substantially random manner on an advancing surface to form a fibrous web, the web is caused to adhere to a carrier or backing sheet, either during or after deposition, and the assembly of fibres and carrier is subdivided into portions for the manufacture of fibrous products.

The resulting portions of the assembly can be treated in a variety of ways to produce a final product. Many of such products may rely on the filtration or capillary capabilities of the fibrous web, supported or indeed enclosed by the carrier sheet. For example, the assembly may be divided longitudinally and rolled transversely into a rod of indefinite length, the carrier sheet being sealed to itself along the length of the rod to enclose the fibres. Alternatively, portions of the assembly, divided transversely and/or longitudinally can be rolled up to form rod structures of helical section. Either type of rod structure can be cut into lengths to form such products as cigarette filters or absorbent ink carrier elements for pens.

The invention can be applied to a variety of fibres, for example, natural or synthetic fibres, cellulose acetate or polypropylene. In the case of thermoplastic fibres, a conventional plasticizer can be applied, either to the fibres or to the carrier sheet, to assist in bonding the fibres to one another or to the carrier sheet in the finished product. The fibres may also be crimped while held on the carrier sheet, for which purpose a disc crimper is preferred to minimize the risk of detachment of fibres from the carrier.

The carrier sheet may be of a variety of materials, for example, paper or plastics film. Alternatively, the carrier sheet may take the form of a continuous array or web of other fibres, previously formed before application to the deposited web of waste fibres. Such an array or web may be constituted by continuous filaments or staple fibres, depending on the properties required of the carrier sheet in the finished product. The sheet should have properties appropriate to the method of application as well as to the end-uses envisaged. Thus, if the fibres are to be deposited on the carrier sheet in dispersion in a liquid and the liquid drained off through a screen supporting the sheet, the sheet should be permeable by the liquid. Moreover, if the assembly is to be removed from the screen before being dried, the sheet should have sufficient wet strength to resist damage. If the fibrous web is applied to the sheet after draining, the sheet may be impermeable, and is after drying, then it need not have a high wet strength. It is thus possible to select carrier sheets that will have desirable properties in the final product, for example impermeability or, as the case may be, permeability as a filter wrap in tobacco smoke filters of different kinds, or impermeability or resistance to ink media in the case of pen elements.

The invention will be further described, by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 is a diagrammatic side elevation of apparatus for carrying out the method of the invention.

Figs. 2A and 2B show in plan view two modifications of the method illustrated by Fig. 1 and subsequent Figs; and

Figs. 3 and 4 are views corresponding to Fig. 1 of further examples of the practice of the invention.

In the system shown in Fig.1, waste fibres, for example waste or reject cigarette filters or tow after opening and separation of wrapper and other extraneous material, are chopped and dispersed in an aqueous medium in a chopper/mixer 10, to which the fibres are supplied at 11 and water at 12.

The resulting dispersion is then deposited continuously by a slurry applicator 13 on an advancing carrier or backing sheet 14 supplied from a roll 15 and supported by a moving endless fine-mesh screen 16 guided by rollers 17. Suction is progressively applied to the underside of the upper run of the screen as indicated at 18 to draw off as much liquid as possible from the substantially random fibrous web laid down on the sheet 14, for which reason it is preferred in this case that the sheet should be permeable. The fluffiness of the final web and, in the case of use in cigarette filters, the resistance to draw (RTD) of the final filter depend on the degree of suction applied.

At the end of the upper run of the screen, the assembly 20 of sheet and fibrous web is removed and transferred to a ventilated drier 21. It is desirable at this stage that the carrier sheet should retain much of its strength when wet, in order to avoid damage to the assembly when removed from its support.

When the assembly has been dired, it may be passed through a plasticizer applicator 22, in which a fine spray of plasticizer composition can be applied to the fibrous web for the purposes of softening and bonding the fibres in subsequent stages of the production of fibrous products, in a manner analogous to the use of plasticizer in conventional filter production.

Finally, the completed fibre backing sheet assembly 23 can be assembled on a take-up roll 24 for transfer to processes and plant for the manufacture of final products. Where these involve the formation of fibrous rods by rolling up divided portions of the assembly, the assembly may be slit longitudinally into strips having a width corresponding either to the periphery of the desired rod, when the strip is to be rolled transversely and possibly continuously, or to the length of the desired rod, when

the strip is to be cut transversely and rolled longitudinally.

In Figs. 2A and B are shown two modifications of the screen area in the systems shown in the other Figures. Where the assembly 23 of the fibres and carrier sheet is eventually to be split longitudinally into continuous strips, the fibrous web can be deposited correspondingly in spaced strips on the screen, or on the carrier sheet as the case may be. In Fig. 2A is shown a plan view of portion of the screen 16, to which is fitted a series of spaced longitudinal walls or partitions 25, dividing the area of the screen into longitudinal zones 26. The fibre slurry is deposited in strips defined by the walls and forms spaced longitudinal portions of fibrous web on the carrier sheet 14, whether this is passed over the screen as in Fig. 1, or applied later, as in Figs. 3 and 4. The walls 25 may be of sufficient thickness to leave bare zones on the carrier sheet, which may facilitate subsequent splitting of the sheet and provide an edge region for the resulting strips which can be used to overlap and adhere to the sheet at opposite edge of the strip when the strip is rolled transversely to form a continuous enclosed fibrous rod.

In the alternative, as illustrated in Fig. 2B, walls 25 are omitted and the fibres are deposited across the whole surface of the screen 16 to form a single continuous web extending from side to side of the screen.

Figs. 3 and 4 show further embodiments of the invention, corresponding items of the apparatus or materials being indicated by the same reference numerals as in Fig. 1.

In the example of Fig. 3, the fibres in slurried form are deposited directly on the screen 16 and the web is taken up on the carrier sheet 14 as it leaves the screen, the sheet being passed round a guide roll 28 adjacent to the discharge end of the screen. Drying and plasticizer application follow as before, but it is necessary in this case that the sheet 14 should retain ample strength after coming into contact with the wet fibrous web.

In the embodiment of Fig. 4, the fibrous web is formed in the absence of a carrier sheet, but is carried on the screen 16 through the drier 21 and only comes into contact with the sheet 14 after it has been dried. The carrier sheet passes over a guide roll 28 at the discharge end of the screen. A plasticizer applicator 22 may be mounted over the screen, as shown, to apply plasticizer to the dried web while still on the screen, and a further applicator 27 may be provided to apply plasticizer to a face of the sheet 14 before it contacts the web. Plasticizer can be applied at either or both of these stations, as desired. Alternatively, a plasticizer applicator could be provided downstream of the guide roll 28 in a position analogous to that in Fig. 3.

The invention affords a number of advantages over other possible methods of recycling waste fibres.

For filtration purposes, random orientation of fibres gives a much more efficient filter than a longitudinal disposition for a given quantity of fibre, and can readily be achieved by the method of the invention. In the case of cigarette filters, this random orientation enables a filter of high efficiency to be produced having a low resistance to draw (RTD).

The carrier sheet not only serves to support and strengthen the web during fabrication of the final product, but also contributes to the structure and the performance of the product. Thus, in the case of cigarette filters, it can function as the filter plug wrap surrounding the filter body in the finished cigarette, and may have any desired degree of permeability as may be needed for a particular design of filter. The provision of a plug wrap in this manner is particularly advantageous when the fibre/sheet assembly is slit longitudinally and rolled transversely, as described.

CLAIMS

1. A method of re-using waste or other recovered fibre material in which the fibres are dispersed and incorporated into a newly formed fibrous structure, characterized in that the fibres are deposited in a substantially random manner on an advancing surface to form a fibrous web, the web is caused to adhere to a carrier or backing sheet, either during or after deposition, and the assembly of fibres and carrier is subdivided into portions for the manufacture of fibrous products.

2. A method according to claim 1, characterized in that the divided assembly portions are formed into cylindrical products.

3. A method according to claim 2, characterized in that the assembly is divided longitudinally into strips, which are rolled transversely and the carrier sheet sealed to itself to form a fibrous cylinder totally enclosed by the sheet.

4. A method according to claim 3, characterized in that the fibres are deposited on the surface in longitudinal zones corresponding to the strips into which it is to be divided.

5. A method according to claim 2, characterized in that the fibres are subjected to a crimping operation while on the carrier sheet.

6. A method according to any of claims 2 to 5, characterized in that the cylindrical product is divided into lengths for use as tobacco smoke filters.

7. A method according to any preceding claim, characterized in that the fibres are deposited in dispersion in a liquid on a permeable carrier sheet supported on a screen adapted for removal of the liquid, the carrier sheet having a mechanical strength which is substantially maintained in the presence of the liquid or is restored by drying prior to removal of the assembly

from the screen.

8. A method according to any of claims 1 to 6, characterized in that the fibres are deposited in dispersion in a liquid directly on a permeable screen and are transferred to the carrier sheet after draining of liquid through the screen, the carrier sheet having a mechanical strength which is substantially maintained in the presence of the liquid or being applied to the fibrous web only after the latter has been dried.

9. A method according to any preceding claim, characterised in that the fibres are thermoplastic and that a plasticizer is applied to the fibrous web after deposition and drying and/or to the carrier sheet before application thereto of the dried web.

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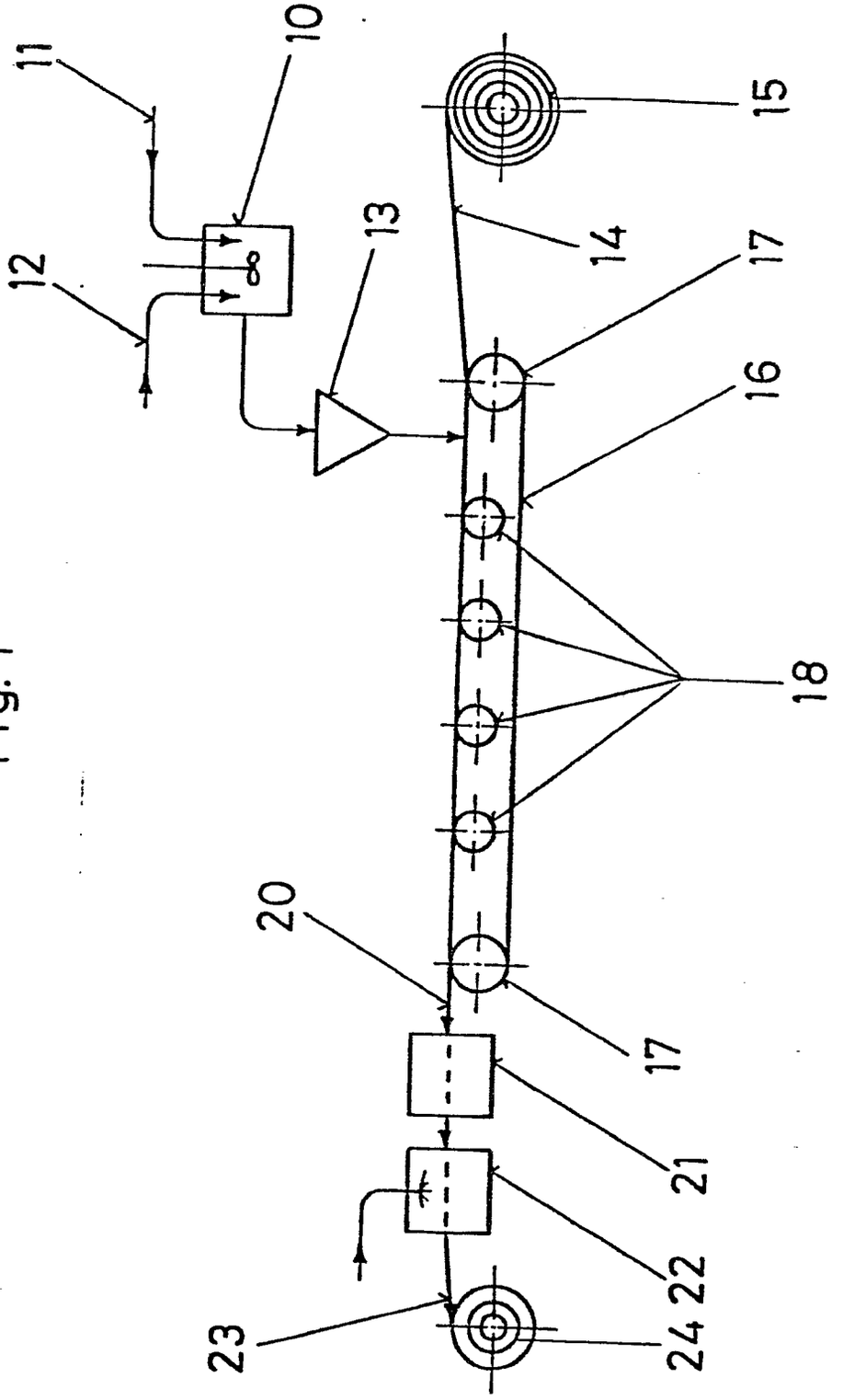


Fig. 1

Fig. 2b

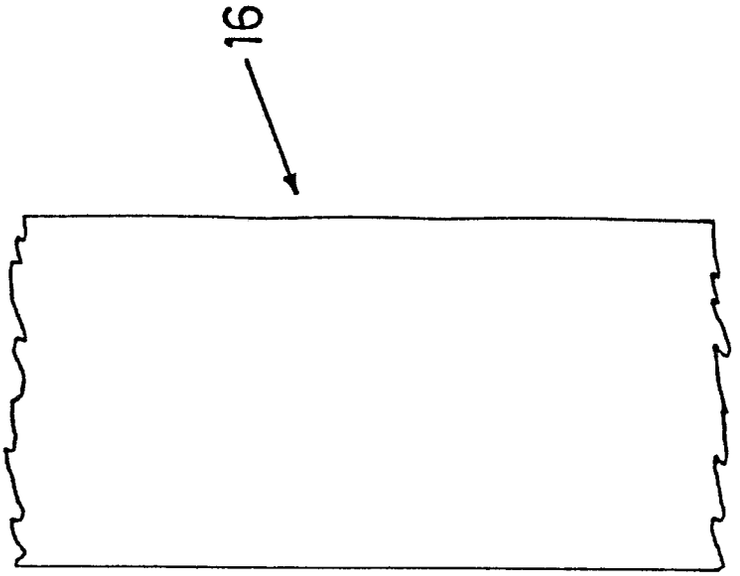
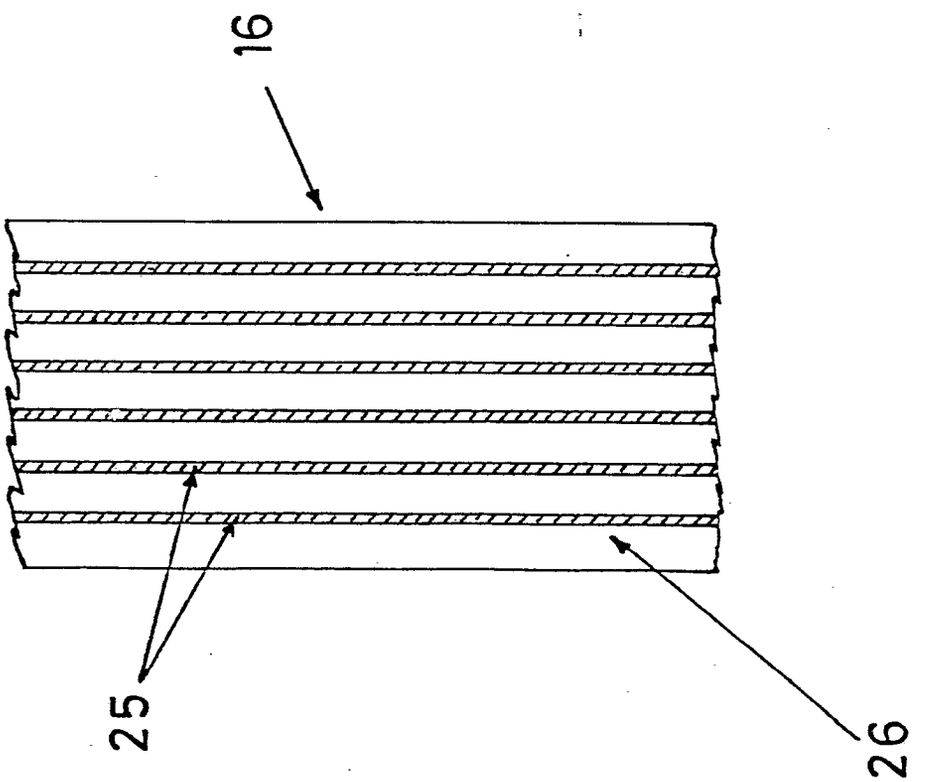


Fig. 2a



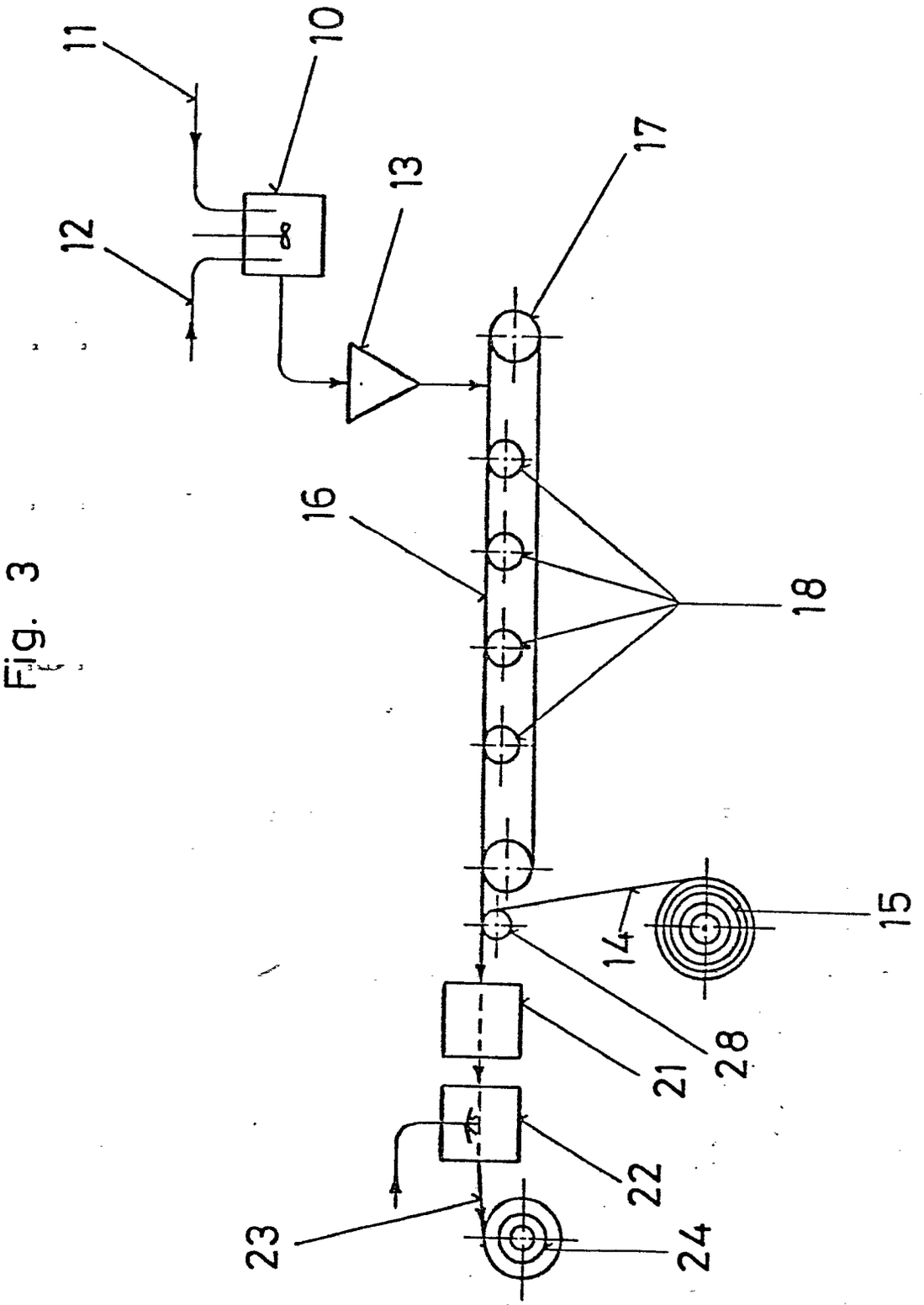


Fig. 3

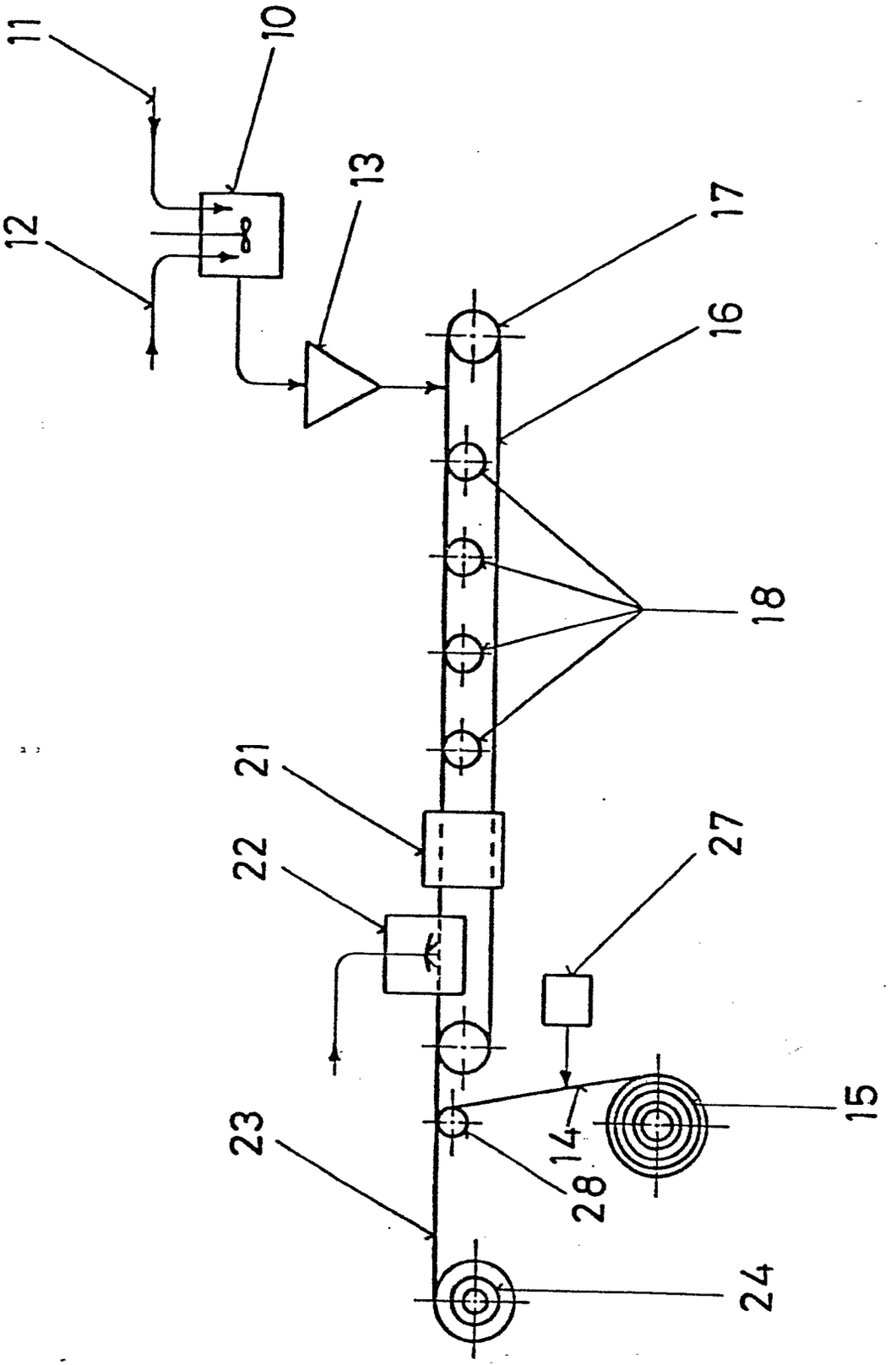


Fig. 4