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(54) **Pulper and method for the recovery of paper production waste**

Stofflöser und Verfahren zur Rückgewinnung von produktionsbedingten Papierabfällen

Pulpeur et procédé pour la récupération des cassés de papier

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Description

Technical field

[0001] The present invention relates to a device for recovery of paper production waste in paper mills for the continuous production of paper webs, in particular but not exclusively of so-called "tissue" paper. More particularly, the invention relates to a pulper to be combined with a yankee drier in a continuous paper production machine, for the recovery and recycling of processing waste from the drier itself.

[0002] The invention also relates to a method for recovery and recycling of the production waste.

State of the art

[0003] In the production of paper, and in particular in the production of tissue paper, typically used as toilet paper, multipurpose drying paper and for other uses, a slurry of cellulose fibers and water is distributed from a head box onto a forming wire or onto a felt for forming a web. By means of successive passes, during which the water content in the slurry is gradually reduced, the web is conveyed to a section of the production line where it is more or less dried. Various systems may be used for drying. One of the most widespread systems consists of a so-called yankee drier, i.e. a large-diameter cylinder which is heated internally and around which the wet web is conveyed. When in contact with the cylinder, the web dries and is separated from the cylinder by a doctor blade which also performs crêping of the paper.

[0004] Examples of plants for the production of paper of this type are described in US-A-4,448,638, US-A-5,514,523, US-A-6,379,496 and in other patents cited therein.

[0005] During the continuous production of the paper web, breakages of the web with consequent waste production may occur. Moreover, the edges of the web are cut with the formation of trimmings since they have irregularities which would be unacceptable in the finished product. This waste and these trimmings must be recovered and recycled.

[0006] At present, the waste which is produced underneath the yankee drier or other equivalent drying system is recovered manually and conveyed away for recycling by means of operations which are very labor-intensive. In addition to the cost which this represents, the presence of production waste around the machines constitutes a serious danger, since the cellulose fibers are highly inflammable.

[0007] US-A-3,417,933 discloses a pulper according to the preamble of claim 1, which performs a method according to the preamble of claim 20. This known pulper includes a container, adjacent the bottom of which a rotating shaft is arranged. The shaft rotates one or more breaker plates which break the paper scraps falling within the pulper. In addition, water nozzles are arranged along the slanting walls of the container.

[0008] Similar pulpers are disclosed in WO-A-00/01884 and US-A-2,667,106. A device using high pressure water jets or nozzles to break a continuous web of paper is disclosed in US-A-5,582,686.

Objects and summary of the invention

[0009] According to a first aspect, an object of the present invention is to provide a device which avoids the abovementioned drawbacks and is particularly suitable for the recovery of waste, trimmings or other paper scrap, especially that which is produced around the yankee drier.

[0010] These and further objects and advantages, which will become clear to those skilled in the art from reading of the text which follows, are obtained essentially with a pulper device for waste paper material according to claim 1.

[0011] A device thus designed may be arranged below the yankee drier or other equivalent assembly in the paper production line, for collecting the waste, scrap and paper trimmings and recycling them automatically, without the need for storing them and transporting them manually away from the working zone. The jet produced by the water nozzle under pressure destroys at least partially the structure of the waste paper material, separating the fibers from each other as the first stage in the recovery process. The cellulose fibers may then be reintroduced into the production cycle, for example directly or indirectly into the head box which produces the layer of slurry for formation of the paper web.

[0012] According to a first practical embodiment of the invention, in order to obtain effective demolition of the fiber structures forming the scrap or waste paper material, a first series of pressurized water nozzles and a second series of pressurized water nozzles are envisaged. Moreover, the nozzles are oriented so that the jets produced by the nozzles of the first series and the jets of the nozzles produced by the second series have trajectories which intersect in a zone where the waste or scrap falls. In this way, the scrap is struck by jets oriented in the incident directions, said jets exerting an efficient cutting, pulling and/or breaking action on the fiber structure. This facilitates the subsequent reintroduction, into the cycle, of the fibers at least partially individualized, i.e. separated from each other.

[0013] The nozzles may have trajectories with inclinations which are different from each other. Moreover, advantageously, it is possible to envisage that two inclined surfaces for guiding the jets produced by the nozzles may be associated with the first series and the second series of nozzles. The surfaces, which are for example flat surfaces, may be varyingly inclined, but are preferably inclined approximately with the same orientation of the axis of the jets produced by the nozzles. Said surfaces terminate in edges which delimit a passage for

conveying the water and the refuse paper material toward the bottom of the container.

[0014] According to an advantageous embodiment of the invention, the container has an elongated longitudinal extension such that the inlet opening has an extension approximately equivalent to the axial extension of the yankee drier, for collecting the refuse, waste or other scrap along the whole of the front of the paper web being formed. In this case, parallel to the elongated upper opening of the container, the first and second series of nozzles extend.

[0015] In order to obtain improved separation of the fibers of the scrap paper material, according to the present invention it is envisaged that a so-called chopper pump is used. "Chopper pump" is generally understood as meaning a pump equipped with parts which are able to cut, break, tear or fragment parts or solid bodies contained in the liquid flow sucked by the pump. These pumps are known per se. They usually consist of centrifugal pumps, the rotor of which is integral with cutting members. Examples of chopper pumps are described in US-A-4,402,648, US-A-4,640,666, US-A-4,519,904, US-A-4,778,336.

[0016] In order to permit better use of the water in the plant and in order to facilitate circulation of the mixture of water and fibers obtained by the destruction of the scrap or waste paper material, according to an advantageous embodiment of the invention a recirculation duct is envisaged between the chopper pump, or other equivalent pumping means, and the container. By means of the recirculation duct, a part of the flow sucked in by the pump is recirculated into said container in a direction such that as to favor suction of the refuse by the pump itself. For this purpose, the outlet of the recirculation duct is situated in a position approximately opposite the inlet mouth of the pump suction duct. Basically, if the container has an elongated extension, the outlet of said recirculation duct and the intake opening of said pump are arranged approximately at the ends of the elongated longitudinal extension of said container.

[0017] Still with the aim of favoring the outflow of refuse paper material from the container and the suction thereof by the chopper pump, according to an advantageous embodiment of the invention, the bottom of the container is inclined from the top downward and from the outlet of the recirculation duct toward the intake opening of the pump.

[0018] In order to facilitate the entry of the scrap, waste or other residual paper material into the device, according to a preferred embodiment of the invention, the container is connected to a suction duct which sucks air from the inside of said container. In this way, multiple advantages are obtained.

[0019] Firstly, entry of the waste which is in the form of pieces of paper is facilitated. Moreover, the vacuum which is produced inside the container results in the formation of an air flow from the outside toward the inside of the container, which sucks into the container also the waste in the form of dusts or fibers or cellulose particles suspended in the atmosphere. These dusts are formed in large quantities owing to the action of the doctor blade which separates the web from the yankee drier. Efficient removal thereof is a guarantee of improved hygienic/sanitary conditions inside the warehouse where the plant is situated, in addition to greater safety against fire hazards. Thirdly, the fibers which are sucked inside the container owing to the vacuum are at least partly intercepted by the pressurized water jets and then automatically introduced into a water flow with the possibility of being recycled together with the fibers of the larger size structures which form the main waste produced by the yankee drier. A combined filtering and fiber-recovery effect is thus obtained.

[0020] In order to obtain an optimized circulation of air inside the container, which does not interfere with correct operation of the pressurized water nozzles, according to an advantageous embodiment of the invention, the suction duct has suction openings arranged underneath at least one of said two inclined surfaces.

[0021] The air flow sucked from inside the container may convey water droplets in suspension form due to the atomization produced by the pressurized water nozzles, Moreover, despite elimination performed by the water jets, dusts or fibers may also be entrained in the air stream. In order to eliminate these solid or liquid suspensions, according to an advantageous embodiment of the invention, it is envisaged that the suction duct may be connected to a separator in order to separate the air from the solid and/or liquid particles entrained in the air flow. For this purpose, a cyclone separator or an equivalent may be used for example.

[0022] The water flow, containing the fiber or residual matter resulting from the collection of scrap or waste paper material, removed from the collection container, has a very low quantity of solid. It is in principle possible to introduce this flow of water and fibers directly into the paper production cycle, for example into the head box. However, this could lead to an excessive water content in the cellulose slurry, i.e. to a cellulose content which is too low.

[0023] In order to overcome this possible drawback, according to an advantageous embodiment of the invention, a thickening station is provided to which, at least partly, the mixture of water and waste paper material sucked by means of the pump from the container is conveyed. In the thickening station the solid content of the mixture is increased, eliminating therefrom a part of the water content. The water eliminated is used, however, in the production cycle, for example for supplying the water nozzles.

[0024] Thickening stations are known per se and used in paper production plants. Examples of thickening stations are described in US-A-5,021,151, US-A-5,186,791, US-A-4,501,040, US-A-4,686,005 and US-A-4,722,793.

[0025] Further advantageous features and embodi-

ments of the device according to the invention are indicated in the accompanying dependent claims.

[0026] According to a further aspect, an object of the present invention is to provide a method for recycling paper scrap, waste or trimmings, in particular formed around the yankee drier.

[0027] This and further objects and advantages, which will be clear to those skilled in the art from reading of the text which follows, are essentially obtained by means of a method for recovering and recycling waste paper material supplied from a paper production line, characterized in that said waste is subjected to a pulping action by means of at least one or more pressurized water nozzles so as to produce a mixture of water and waste paper material and in that said mixture is recycled. Advantageously, according to a possible embodiment of the method according to the present invention, the waste is reduced to pulp, not only by the action of said one or more pressurized water nozzles, but also by suction of a water flow containing said waste using a chopper pump.

[0028] Further advantageous features and embodiments of the method according to the invention are set forth in the accompanying dependent claims.

Brief description of the drawings

[0029] The invention will be better understood with reference to the description and the attached drawing, which shows a practical non-limiting embodiment of the invention. More particularly, in the drawings:

Fig. 1 shows a schematic side view of the terminal part of a paper production line in which in particular the yankee drier and the position of the pulper device according to the present invention are visible;
Fig. 2 shows a front view, along II-II, of Fig. 1 of the pulper device;
Figs 3 to 5 show two views and a cross section along the lines III-III, IV-IV and V-V of Fig. 2; and
Fig. 6 shows a diagram of the plant for recycling the waste processed by the pulper.

Detailed description of the preferred embodiment of the invention

[0030] Fig. 1 illustrates schematically the terminal part of the line for the production of a web or strip of paper, in particular tissue paper. 1 denotes the last wire or the last felt for conveying the partially dried layer of slurry formed in a manner known per se. The felt 1 is tangential to a yankee drier 3 so as to transfer the moist web from the external surface of the felt to the external cylindrical surface of the yankee drier 3 which is heated internally. The yankee drier 3 is embraced by the web over a wide contact arc, between the zone of tangential contact with the felt 1 and a doctor or separator blade 5. In a manner known per se the web V, which is dried owing to the heat exchange with the yankee drier 3, is separated from the cylinder and wound so as to form a reel B intended for further processing.

[0031] Below the yankee drier 3, and in particular in the zone where the doctor blade 5 is arranged, there is a device 7 for collection and recovery of the waste or scrap paper material produced by the yankee drier 3. The device 7 is shown in isolation and in greater detail in Figs 2 to 5.

[0032] Said device comprises a container 9 in the form of a tank or the like, which is elongated in the direction parallel to the axis of the yankee drier 3. The container 9 is provided at the top with an upwardly directed inlet opening 11 for collecting the scrap or waste paper material produced by the yankee drier 3. A first series of nozzles 13 and a second series of nozzles 15 for pressurized water are situated along the longitudinal edges of the opening 11. Essentially the two series of nozzles are formed by means of respective pressure ducts, along the axial extension of which the nozzles are distributed. The nozzles are oriented downward and toward the bottom of the container 9, with angles of inclination A and B relative to the horizontal which are different from each other. Parallel to the direction of the axis of the nozzles of the two series, and therefore substantially parallel to the axes of the two series of jets produced by the nozzles, two walls or surfaces 21, 23 extend, therefore being inclined downward with angles A and B relative to the horizontal. The two surfaces 21, 23 are formed, in the example shown, by two surfaces which extend from the respective series of nozzles 13 or 15 toward the inside of the container, terminating in edges 21A and 23A, respectively. A passage for conveying the water and the refuse paper material toward the bottom of the container 9 is defined between the two edges 21A, 23A.

[0033] The arrangement is such that the waste or scrap paper material which falls or is sucked inside the container 9 intercepts the two series of pressurized-air jets supplied by the two series of nozzles 13, 15. The highspeed water supplied by the nozzles exerts a pulping action on the intercepted paper material. The incidence, at different angles, of the two series of jets has a cutting effect on the paper material which thus undergoes a first substantial operation involving destruction of the fibrous structure.

[0034] The paper material and the water supplied by the nozzles of the two series 13, 15 are collected on the bottom 9A of the container 9 which is formed inclined downward from one end to the other of the container 9 in the direction of longitudinal extension thereof, i.e. parallel to the direction of alignment of the nozzles 13, 15 of the two series.

[0035] In the lowermost zone of the bottom 9A of the container 9, an intake duct 25 of a pump 27 is situated. The latter is a so-called chopper pump, i.e. a pump comprising means able to break up and fragment any solid particles which are suspended in the water flow sucked

in through the intake duct. Typically the chopper pump 27 is a pump of the centrifugal type. The refuse paper material which is sucked in by the pump 27 is thus further pulverized.

[0036] As shown in particular in the hydraulic flow diagram shown in Fig. 6, a delivery duct 29 which has a branched recirculation duct 29A extends from the chopper pump 27. The branched duct 29A emerges inside the container 9, at a greater height than the inlet mouth of the intake duct 25 and at the opposite end of the container 9. With this arrangement, a part of the delivery of the chopper pump 27 is recirculated directly into the container 9. The flow which is produced is oriented parallel to the longitudinal direction of the container 9 and therefore facilitates the outflow of the residual paper material along the bottom 9A of the container 9 which is in any case inclined downward from the outlet of the branched duct 29A toward the inlet mouth of the intake duct 25 of the pump 27. A valve 30 for regulating the recirculation flow is arranged on the branched duct 29A.

[0037] As can be seen from the diagram in Fig. 6, the main duct 29 extends as far as a second pump 31 which, by means of a delivery duct 33, conveys the flow of water and refuse paper material extracted from the container 9 toward a thickening station generically denoted by 35. Here the density of the mixture of water and cellulose fibers obtained from the destruction of the scrap or waste paper material is increased. The substantially purified water which is extracted from the thickening station 35 is discharged by means of a duct 37 into a tank 39 from where it is subsequently recycled. From this tank, water is for example removed (by means of a pump 40) in order to supply the nozzles of the series of nozzles 13, 15, as well as for other utilities, for example for the said thickening station 35, by means of a pump 42 and a duct 44. From an overflow 46 any excess water is discharged from the tank 39 and conveyed away for further purification.

[0038] The thickened mixture, i.e. with a richer solid content (having a solid content for example of about 4% by weight) is discharged from the thickening station 35 into a second tank 41 and from here recycled by means of conveying to the inflow chamber (not shown) which is supplied with the slurry for production of the web V.

[0039] The interior of the container 9 is kept under a vacuum by means of a suction duct 51, the inlet 51A of which is located below the inclined surface 23A, between the latter and the external wall of the container 9. Here a closed volume is defined by means of a further separating baffle 53 which has suction openings 55. Air is sucked from the container 9 toward the suction duct 51 through the openings 55. Any fibrous dusts and/or small droplets of atomized water are also entrained in the air flow.

[0040] The suction duct 51 leads into a separator 54, which in the example illustrated is shown as a cyclone separator. Here the liquid and/or solid particles suspended in the air flow are separated and recovered, while the air flow is discharged externally. 56 denotes the suction fan which draws the air through the duct 51.

[0041] It is understood that the drawing shows only one practical embodiment of the invention, the forms and arrangements of which may vary without thereby departing from the scope of the idea forming the basis of the invention. The presence of any reference numbers in the accompanying claims has solely the purpose of facilitating the reading thereof in the light of the above description and the accompanying drawings and does not limit in any way the scope of protection.

Claims

1. Pulper device for waste paper material, **characterized in that** it comprises:
   - a container (9) for collecting said waste, having an inlet opening (11) for said waste;
   - at least one pressurized water nozzle (13; 15) which produces a jet of water which intercepts the waste which falls into said container,
   - and a first pump (27) which removes the water and the waste from said container, **characterized in that** said first pump (27) is a chopper pump.

2. Device according to claim 1, **characterized in that** it comprises a first series (11) of pressurized water nozzles and a second series (13) of pressurized water nozzles, the jets produced by the nozzles of the first series and the nozzle jets produced by the second series having trajectories which intersect in a zone where said waste falls.

3. Device according to claim 2, **characterized in that** said nozzles have trajectories with different inclinations.

4. Device according to claim 2 or 3, **characterized in that** two inclined surfaces (21, 23) for guiding the jets produced by the nozzles are associated with said first series (11) and said second series (13) of nozzles.

5. Device according to claim 4, **characterized in that** said inclined surfaces are oriented approximately parallel to the trajectory of the jets produced by the respective nozzles.

6. Device according to claim 4 or 5, **characterized in that** each of said surfaces extends from the respective series of nozzles as far as a respective terminal edge (21A, 23A), the terminal edges of said two surfaces delimiting a passage for conveying the water and the waste paper material.

7. Device according to claim 4, 5 or 6, **characterized in that** said surfaces are flat.

8. Device according to one or more of the preceding claims, **characterized in that** said container has an elongated longitudinal extension, the inlet opening extending in the longitudinal direction of extension of said container.

9. Device according to one or more of claims 2 to 8, **characterized in that** said container has an elongated upper opening, parallel to which said first and said second series of nozzles extend.

10. Device according to one or more of the preceding claims, **characterized in that** it comprises a recirculation duct (29A) between said first pump (27) and the container (9), by means of which a part of the flow sucked in by said first pump is recirculated inside said container.

11. Device according to claim 10, **characterized in that** the outlet of said recirculation duct (29A) is situated in a position approximately opposite an intake opening (25) of said first pump.

12. Device according to at least claims 8 and 11, **characterized in that** the outlet of said recirculation duct (29A) and the intake opening of said first pump are arranged approximately at the ends of the elongated longitudinal extension of said container.

13. Device according to claim 11 or 12, **characterized in that** the bottom of said container is inclined downwardly and from the outlet of said recirculation duct toward the intake opening of said first pump.

14. Device according to one or more of the preceding claims, **characterized in that** said container is connected to a suction duct (51) which sucks air from inside said container (9).

15. Device according to at least claims 4 and 14, **characterized in that** said suction duct (51) has suction openings (55) arranged underneath at least one of said two inclined surfaces.

16. Device according to claim 14 or 15, **characterized in that** said suction duct is connected to a separator (53) for separating air from solid and/or liquid particles entrained in the air flow.

17. Device according to one or more of the preceding claims, **characterized in that** it comprises a thickening station (35) to which at least partly the mixture of water and waste paper material sucked by said first pump is conveyed and inside which the solid content of the mixture is increased, eliminating therefrom a part of the water content.

18. Device according to claim 17, **characterized in that** a second pump (31), which conveys the flow sucked by said first pump, less the recirculation flow, toward said thickening station (35), is arranged along the delivery duct of said first pump (27).

19. Device according to claim 17 or 18, **characterized in that** the mixture leaving said thickening station is conveyed to a container for subsequent conveying to a headbox associated with the paper production line and the water separated from said mixture is recycled.

20. Method for recovering and recycling waste paper material supplied from a paper production line, wherein said waste is subjected to a pulping action by means of one or more pressurized water jets so as to produce a mixture of water and waste paper material, which is recycled, **characterized in that** said waste is reduced to pulp by the action of said one or more pressurized water nozzles and by suction of a water flow containing said waste using a chopper pump.

21. Method according to claim 20, **characterized in that** said waste is passed between a first and a second series of pressurized water nozzles, the jets produced by said first and said second series of nozzles intersecting each other.

22. Method according to claim 20 or 21, **characterized in that** said waste is sucked into a container kept under a vacuum.

23. Method according to claim 22, **characterized in that** said container is kept under a vacuum by sucking air from inside it to underneath a surface guiding one or more jets of water produced by said pressurized water nozzles.

24. Method according to claim 23, **characterized in that** an air flow sucked from said container is generated, and water and any solid particles are separated from said flow, said water and said solid parts being recycled.

25. Method according to one or more of claims 20 to 24, **characterized in that** the solid-matter content of said mixture is increased by means of partial separation of the water contained therein and **in that** the mixture thus treated is introduced again into the paper production cycle and the separated water is recycled into the paper production plant.

Patentansprüche

1. Stofflösevorrichtung für Papierabfallmaterial, **dadurch gekennzeichnet, dass** sie umfasst:

   - einen Behälter (9) für das Sammeln des Abfalls, wobei der Behälter eine Eintrittsöffnung (11) für den Abfall aufweist,

   - mindestens eine unter Druck stehende Wasserdüse (13, 15), welche einen Wasserstrahl erzeugt, der den Abfall schneidet, der in den Behälter fällt,

   - und eine erste Pumpe (27), welche das Wasser und den Abfall aus dem Behälter entfernt,

   dadurch gekennzeichnet, dass die erste Pumpe (27) eine Zerhackerpumpe ist.

2. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** sie eine erste Reihe (13) von unter Druck stehenden Wasserdüsen und eine zweite Reihe (15) von unter Druck stehenden Wasserdüsen aufweist, wobei die von den Düsen der ersten Reihe erzeugten strahlen und die von der zweiten Reihe erzeugten Düsenstrahlen Bahnen aufweisen, welche sich in einem Bereich kreuzen, wo der Abfall herunter fällt.

3. Vorrichtung nach Anspruch 2, **dadurch gekennzeichnet, dass** die Düsen Bahnen mit unterschiedlichen Neigungen erzeugen.

4. Vorrichtung nach Anspruch 2 oder 3, **dadurch gekennzeichnet, dass** zu der ersten Reihe (13) und der zweiten Reihe (15) von Düsen zwei geneigte Flächen (21, 23) zur Führung der von den Düsen erzeugten Strahlen zugeordnet sind.

5. Vorrichtung nach Anspruch 4, **dadurch gekennzeichnet, dass** die geneigten Flächen annähernd parallel zur Bahn der von den jeweiligen Düsen erzeugten Strahlen ausgerichtet sind.

6. Vorrichtung nach Anspruch 4 oder 5, **dadurch gekennzeichnet, dass** jede der Flächen sich von der jeweiligen Reihe von Düsen bis zur zugehörigen Abschlusskante (21A, 23A) erstreckt, wobei die Abschlusskanten der zwei Flächen einen Durchgang für die Förderung des Wassers und des Papierabfallmaterials begrenzen.

7. Vorrichtung nach Anspruch 4, 5 oder 6, **dadurch gekennzeichnet, dass** die Flächen eben sind.

8. Vorrichtung nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Behälter eine verlängerte Längserstrekkung aufweist, wobei die Eintrittsöffnung sich in Längsrichtung der Erstreckung des Behälters erstreckt.

9. Vorrichtung nach einem oder mehreren der Ansprüche 2 bis 8, **dadurch gekennzeichnet, dass** der Behälter eine verlängerte obere Öffnung aufweist, wobei die erste und die zweite Reihe von Düsen sich parallel zu dieser erstrecken.

10. Vorrichtung nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie eine Rückführleitung (29A) zwischen der ersten Pumpe (27) und dem Behälter (9) aufweist, mittels derer ein Teil des von der ersten Pumpe angesaugten Stromes in den Behälter rückgeführt wird.

11. Vorrichtung nach Anspruch 10, **dadurch gekennzeichnet, dass** der Auslass der Rückführleitung (29A) sich an einer Stelle annähernd gegenüber einer Einlassöffnung (25) der ersten Pumpe befindet.

12. Vorrichtung nach mindestens den Ansprüchen 8 und 11, **dadurch gekennzeichnet, dass** der Auslass der Rückführleitung (29A) und die Einlassöffnung der ersten Pumpe annähernd an den Enden der verlängerten Längserstreckung des Behälters angeordnet sind.

13. Vorrichtung nach Anspruch 11 oder 12, **dadurch gekennzeichnet, dass** der Boden des Behälters nach unten und vom Auslass der Rückführleitung hin zur Einlassöffnung der ersten Pumpe geneigt ist.

14. Vorrichtung nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Behälter mit einer Saugleitung (51) verbunden ist, welche Luft aus dem Innern des Behälters (9) ansaugt.

15. Vorrichtung nach mindestens den Ansprüchen 4 und 14, **dadurch gekennzeichnet, dass** dass die Saugleitung (51) saugöffnungen (55) aufweist, die unterhalb von mindestens einer der zwei geneigten Flächen angeordnet sind.

16. Vorrichtung nach Anspruch 14 oder 15, **dadurch gekennzeichnet, dass** die Saugleitung mit einem Abscheider (53) zum Abscheiden von Luft von im Luftstrom mitgeführten festen und/oder flüssigen Teilchen verbunden ist.

17. Vorrichtung nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie eine Eindickstation (35) umfasst, zu wel-

cher wenigstens teilweise das von der ersten Pumpe-angesaugte Gemisch aus Wasser und Papierabfallmaterial gefördert wird und in deren Innern der Feststoffgehalt des Gemischs erhöht ist, indem daraus ein Teil des enthaltenen Wassers entfernt wird.

18. Vorrichtung nach Anspruch 17, **dadurch gekennzeichnet, dass** eine zweite Pumpe (31), welche den von der ersten Pumpe angesaugten Strom abzüglich des Rückführstroms zu der Eindickstation (35) fördert, in der Förderleitung der ersten Pumpe (27) angeordnet ist.

19. Vorrichtung nach Anspruch 17 oder 18, **dadurch gekennzeichnet, dass** das Gemisch, welches die Eindickstation verlässt, zu einem Behälter für die nachfolgende Förderung zu einem Stoffeinlauf, der mit der Papierfertigungslinie verbunden ist, gefördert wird und das aus dem Gemisch abgetrennte Wasser wieder verwendet wird.

20. Verfahren zur Rückgewinnung und Wiederverwendung von Papierabfallmaterial, welches von einer Papierfertigungslinie zugeführt wird, wobei der Abfall einer Aufschlusswirkung mittels einem oder mehreren unter Druck stehenden Wasserstrahlen unterzogen wird, so dass ein Gemisch aus Wasser und Papierabfallmaterial erzeugt wird, welches wieder verwendet wird, **dadurch gekennzeichnet, dass** der Abfall zu Papiermasse zerkleinert wird durch die Wirkung der einen oder mehreren unter Druck stehenden Wasserdüsen und durch Ansaugen eines Wasserstroms, welcher den Abfall enthält, unter Verwendung einer Zerhackerpumpe.

21. Verfahren nach Anspruch 20, **dadurch gekennzeichnet, dass** der Abfall zwischen einer ersten und einer zweiten Reihe unter Druck stehender Wasserdüsen durchgeleitet wird, wobei die von der ersten und der zweiten Reihe von Düsen erzeugten Strahlen einander kreuzen.

22. Verfahren nach Anspruch 20 oder 21, **dadurch gekennzeichnet, dass** der Abfall in einen unter Vakuum gehaltenen Behälter gesaugt wird.

23. verfahren nach Anspruch 22, **dadurch gekennzeichnet, dass** der Behälter unter Vakuum gehalten wird, indem Luft aus seinem Innern unterhalb einer Fläche abgesaugt wird, welche einen oder mehrere der von den unter Druck stehenden Wasserdüsen erzeugten Wasserstrahlen leitet.

24. Verfahren nach Anspruch 23, **dadurch gekennzeichnet, dass** ein aus dem Behälter abgesaugter Luftstrom erzeugt wird und dass Wasser und jegliche Feststoffteilchen aus dem Strom abgeschieden werden, wobei das Wasser und die Feststoffteile wieder verwendet werden.

25. Verfahren nach einem oder mehreren der Ansprüche 20 bis 24, **dadurch gekennzeichnet, dass** der Feststoffgehalt des Gemischs durch teilweises Abscheiden des darin enthaltenen Wassers erhöht wird, und dadurch, dass das so behandelte Gemisch wieder in den Papierfertigungskreislauf eingebracht wird und das abgeschiedene Wasser in die Papierfertigungsanlage rückgeführt wird.

Revendications

1. Dispositif défibreur pour vieux papiers, **caractérisé en ce qu'**il comprend :

un conteneur (9) pour collecter lesdits déchets, ayant une ouverture d'entrée (11) pour lesdits déchets ;
au moins une buse (13 ; 15) d'eau sous pression qui produit un jet d'eau qui intercepte les déchets qui tombent dans ledit conteneur,
et une première pompe (27) qui retire l'eau et les déchets dudit conteneur,

caractérisé en ce que ladite première pompe (27) est une pompe broyeuse.

2. Dispositif selon la revendication 1, **caractérisé en ce qu'**il comprend une première série (11) de buses d'eau sous pression et une seconde série (13) de buses d'eau sous pression, les jets produits par les buses de la première série et les jets de buse produits par la seconde série ayant des trajectoires qui se coupent dans une zone dans laquelle lesdits déchets tombent.

3. Dispositif selon la revendication 2, **caractérisé en ce que** lesdites buses ont des trajectoires avec différentes inclinaisons.

4. Dispositif selon la revendication 2 ou 3, **caractérisé en ce que** deux surfaces inclinées (21, 23) pour guider les jets produits par les buses, sont associées à ladite première série (11) et à ladite seconde série (13) de buses.

5. Dispositif selon la revendication 4, **caractérisé en ce que** lesdites surfaces inclinées sont orientées à peu près parallèlement à la trajectoire des jets produits par les buses respectives.

6. Dispositif selon la revendication 4 ou 5, **caractérisé en ce que** chacune desdites surfaces s'étend à partir de la série respective de buses jusqu'à un bord terminal (21A, 23A) respectif, les bords terminaux desdites deux surfaces délimitant un passage pour

transporter l'eau et les vieux papiers.

7. Dispositif selon la revendication 4, 5 ou 6, **caractérisé en ce que** lesdites surfaces sont plates.

8. Dispositif selon une ou plusieurs des revendications précédentes, **caractérisé en ce que** ledit conteneur a une extension longitudinale allongée, l'ouverture d'entrée s'étendant dans la direction longitudinale de l'extension dudit conteneur.

9. Dispositif selon une ou plusieurs des revendications 2 à 8, **caractérisé en ce que** ledit conteneur à une ouverture supérieure allongée, parallèle à laquelle lesdites première et seconde séries de buses s'étendent.

10. Dispositif selon une ou plusieurs des revendications précédentes, **caractérisé en ce qu'**il comprend un conduit de recyclage (29A) entre ladite première pompe (27) et le conteneur (9), au moyen duquel une partie de l'écoulement aspiré par ladite première pompe est recyclée à l'intérieur dudit conteneur.

11. Dispositif selon la revendication 10, **caractérisé en ce que** la sortie dudit conduit de recyclage (29A) est située dans une position approximativement opposée à une ouverture d'entrée (25) de ladite première pompe.

12. Dispositif selon au moins les revendications 8 et 11, **caractérisé en ce que** la sortie dudit conduit de recyclage (29A) et l'ouverture d'entrée de ladite première pompe sont agencées approximativement aux extrémités de l'extension longitudinale allongée dudit conteneur.

13. Dispositif selon la revendication 11 ou 12, **caractérisé en ce que** le fond dudit conteneur est incliné vers le bas et à partir de la sortie. dudit conduit de recyclage vers l'ouverture d'entrée de ladite première pompe.

14. Dispositif selon une on plusieurs des revendications précédentes, **caractérisé en ce que** ledit contenèur est raccordé à un conduit d'aspiration (51) qui aspire l'air provenant de l'intérieur dudit conteneur (9).

15. Dispositif selon au moins les revendications 4 et 14, **caractérisé en ce que** ledit conduit d'aspiration (51) possède des ouvertures d'aspiration (55) agencées au dessous d'au moins l'une desdites deux surfaces inclinées.

16. Dispositif selon la revendication 14 ou 15, **caractérisé en ce que** ledit conduit d'aspiration est raccordé à un séparateur (53) pour séparer l'air des solides et/ou particules liquides entraînées dans l'écoulement d'air.

17. Dispositif selon l'une ou plusieurs des revendications précédentes,

caractérisé en ce qu'il comprend une station d'épaississement (35) dans laquelle au moins en partie le mélange d'eau et de vieux papiers aspiré par ladite première pompe est transporté et, à l'intérieur de laquelle la teneur en solide du mélange est augmentée, éliminant de celle-ci une partie de la teneur en eau.

18. Dispositif selon la revendication 17, **caractérisé en ce qu'**une seconde pompe (31), qui transporte l'écoulement aspiré par ladite première pompe, moins l'écoulement de recyclage, vers ladite station d'épaississement (35), est agencée le long du conduit de distribution de ladite première pompe (27).

19. Dispositif selon la revendication 17 ou 18, **caractérisé en ce que** le mélange quittant ladite station d'épaississement est transporté vers un conteneur pour le transport ultérieur vers une caisse d'anivée associée à la chaîne de production de papier et l'eau séparée dudit mélange est recyclée.

20. Procédé pour récupérer et recycler des vieux papiers alimentés à partir d'une chaîne de production de papier, dans lequel lesdits déchets sont soumis à une action de défibrage au moyen d'un ou de plusieurs jets d'eau sous pression afin de produire un mélange d'eau et de vieux papiers, qui est recyclé, **caractérisé en ce que** lesdits déchets sont réduits en pâte à papier par l'action desdites une ou plusieurs buses d'eau sous pression, et par l'aspiration d'un écoulement d'eau contenant lesdits déchets en utilisant une pompe broyeuse.

21. Procédé selon la revendication 20, **caractérisé en ce que** lesdits déchets passent entre une première et une seconde séries de buses d'eau sous pression, les jets produits par ladite première et ladite seconde séries de buses se croisant les uns par rapport aux autres.

22. Procédé selon la revendication 20 ou 21, **caractérisé en ce que** lesdits déchets sont aspirés dans un conteneur maintenu sous vide.

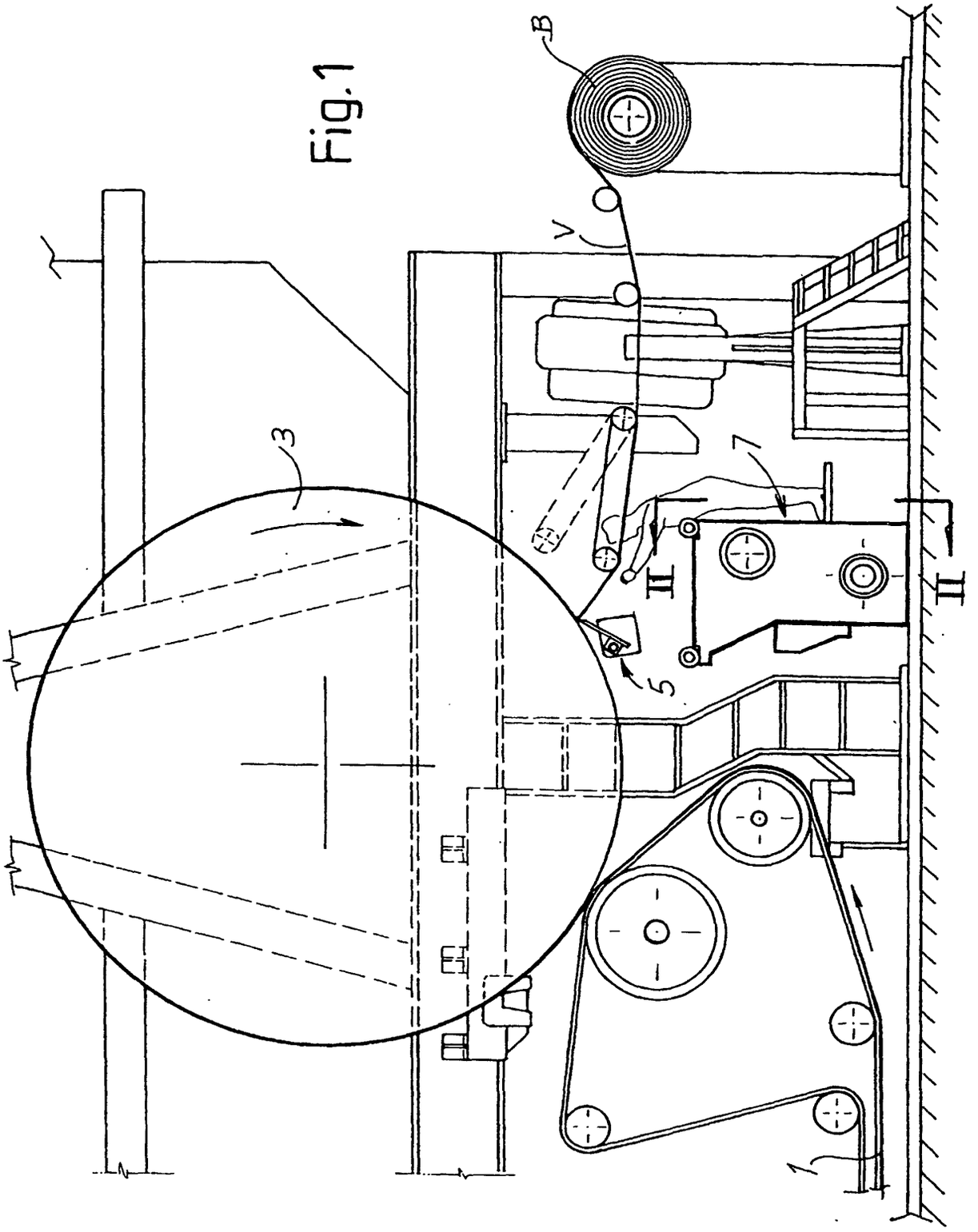
23. Procédé selon la revendication 22, **caractérisé en ce que** ledit conteneur est maintenu sous vide en aspirant l'air depuis son intérieur jusqu'au dessous d'une surface guidant un ou plusieurs jets d'eau produits par lesdites buses d'eau sous pression.

24. Procédé selon la revendication 23, **caractérisé en**

ce qu'un écoulement d'air aspiré dudit conteneur est généré, et l'eau et les particules solides sont séparées dudit écoulement, ladite eau et lesdites particules solides étant recyclées.

25. Procédé selon une ou plusieurs revendications 20 à 24, **caractérisé en ce que** la teneur en matière solide dudit mélange est augmentée au moyen de la séparation partielle de l'eau contenue à l'intérieur et **en ce que** le mélange ainsi traité est introduit à nouveau dans le cycle de production de papier et l'eau séparée est recyclée dans l'usine de production de papier.

Fig.1



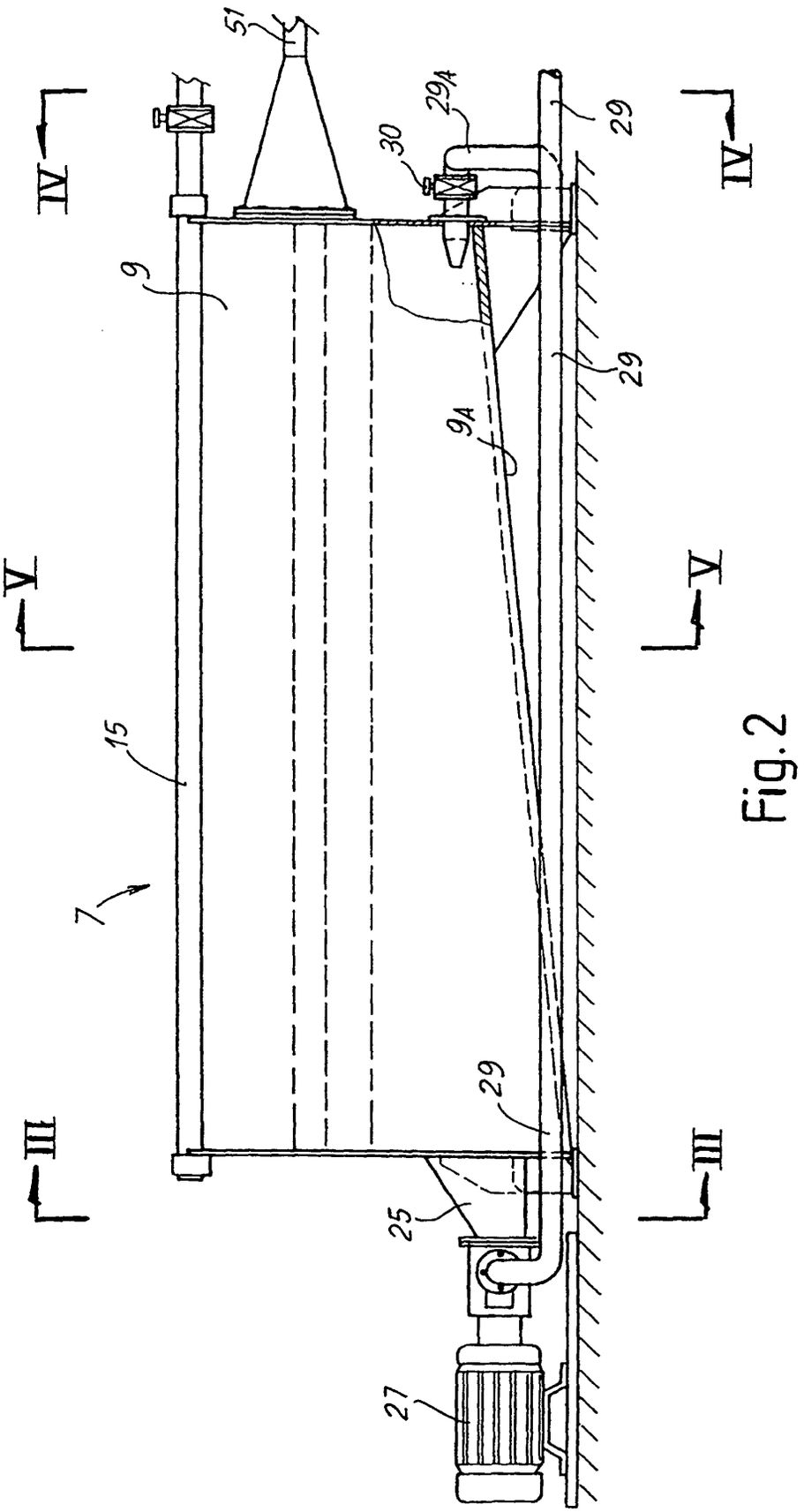


Fig.2

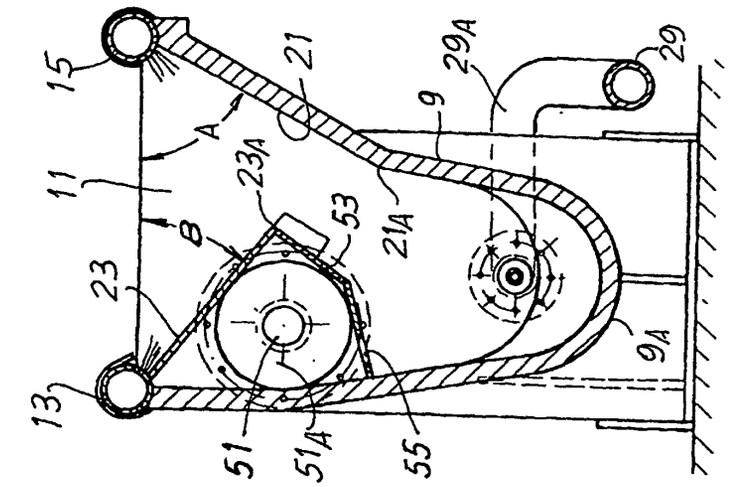


Fig. 5

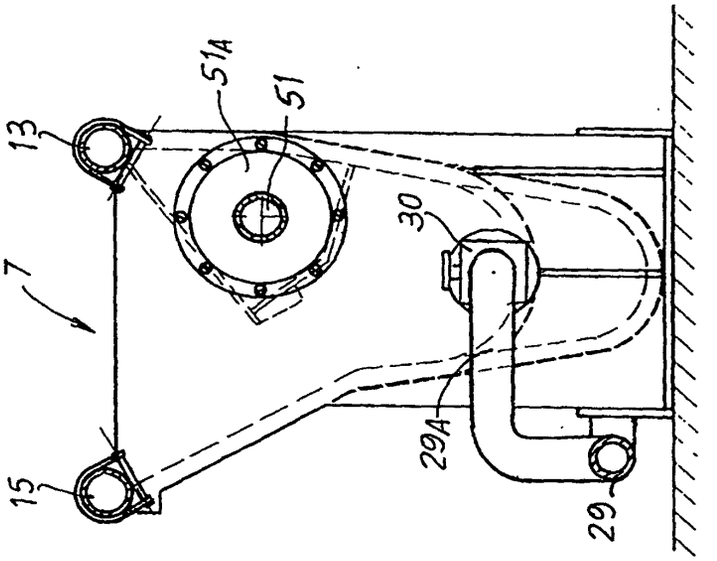


Fig. 4

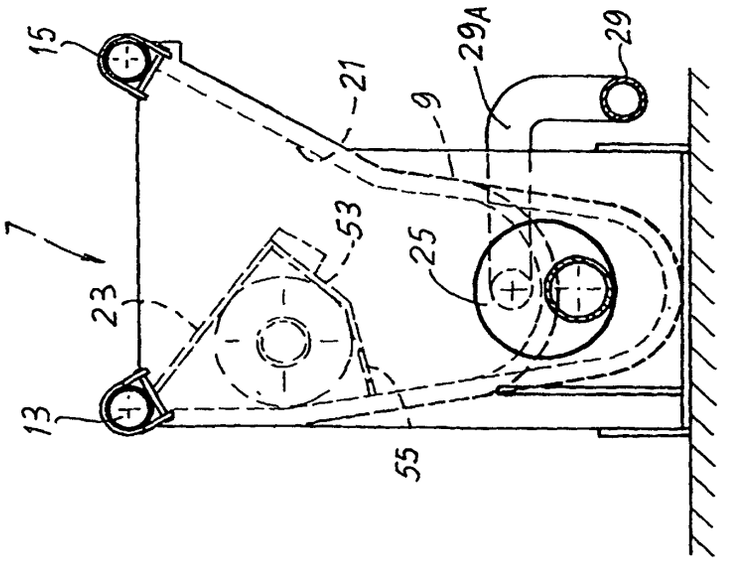


Fig. 3

Fig.6