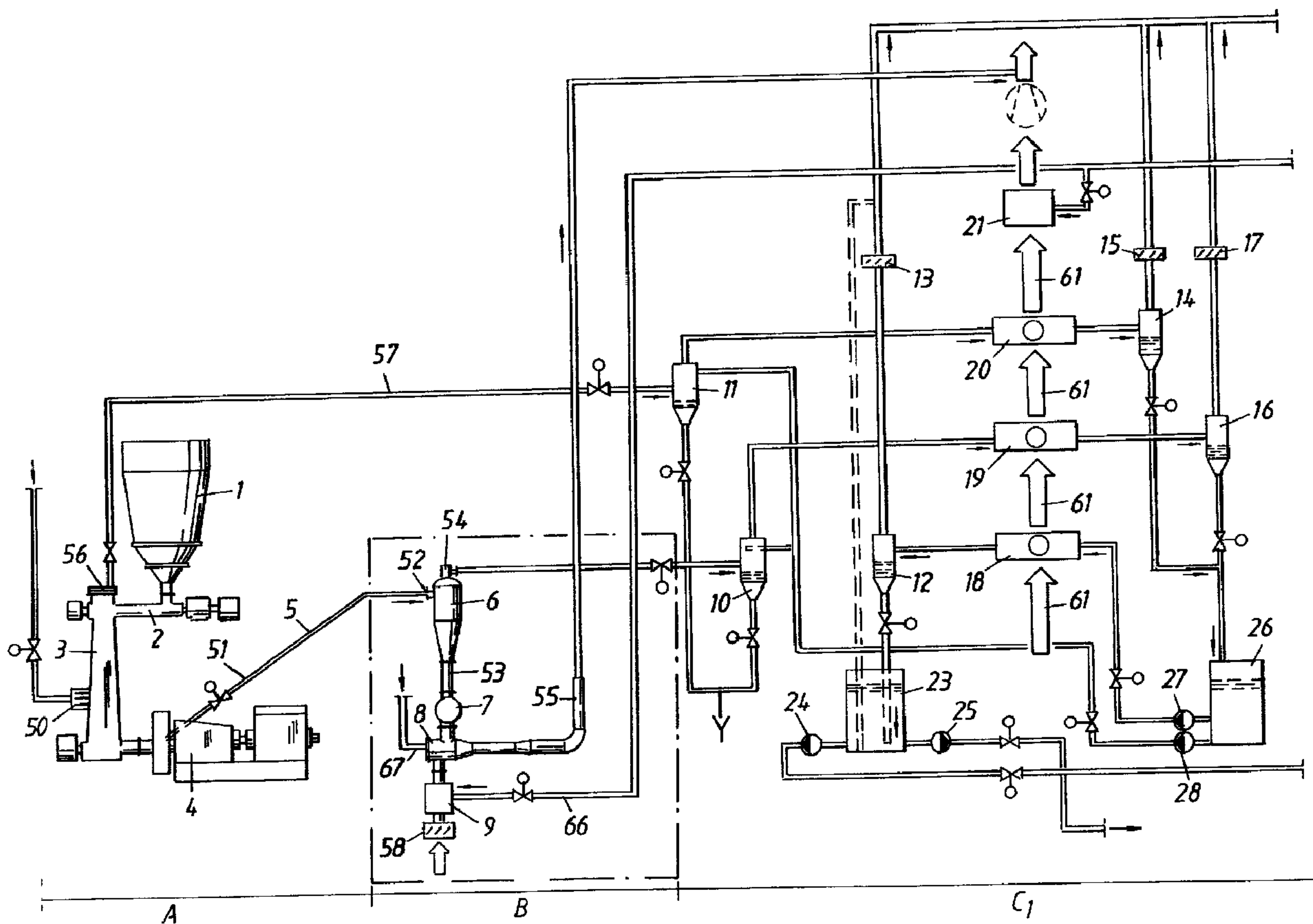




(86) Date de dépôt PCT/PCT Filing Date: 1998/08/10
 (87) Date publication PCT/PCT Publication Date: 1999/03/04
 (45) Date de délivrance/Issue Date: 2007/02/13
 (85) Entrée phase nationale/National Entry: 2000/02/15
 (86) N° demande PCT/PCT Application No.: SE 1998/001451
 (87) N° publication PCT/PCT Publication No.: 1999/010594
 (30) Priorités/Priorities: 1997/08/25 (SE9703062-1);
 1997/12/15 (SE9704674-2)

(51) Cl.Int./Int.Cl. *D21B 1/12* (2006.01)
 (72) Inventeurs/Inventors:
 SAFSTROM, CHRISTER, SE;
 SODERBERG, CARL-JOHAN, SE;
 LUNDGREN, GORAN, SE
 (73) Propriétaire/Owner:
 VALMET FIBERTECH AB, SE
 (74) Agent: FETHERSTONHAUGH & CO.

(54) Titre : USINE DE PRODUCTION ET DE TRAITEMENT DE FIBRES DE BOIS
 (54) Title: PLANT FOR PRODUCING AND TREATING WOOD FIBRES



(57) Abrégé/Abstract:

Plant for producing and treating wood fibres, comprising a fibre-producing part (A) equipped with a chip preheater (3) and a beater (4) used to free fibre from wood chips and at least one drier stage (C) used to dry the fibre. A steam separator part (B) is provided

(57) Abrégé(suite)/Abstract(continued):

between fibre-producing part (A) and drier stage (C) and includes a cyclone separator (6) whose inlet (52) is connected to blower line (5) used for fibre and steam obtained from beater (4). The bottom outlet (53) on cyclone separator (6) is connected via a sluice valve (7) to a conveyance/drying line (55) used for fibre. The top outlet (54) on cyclone separator (6) is connected to devices used to separate volatile organic substances and to recover heat from steam obtained from cyclone separator (6).

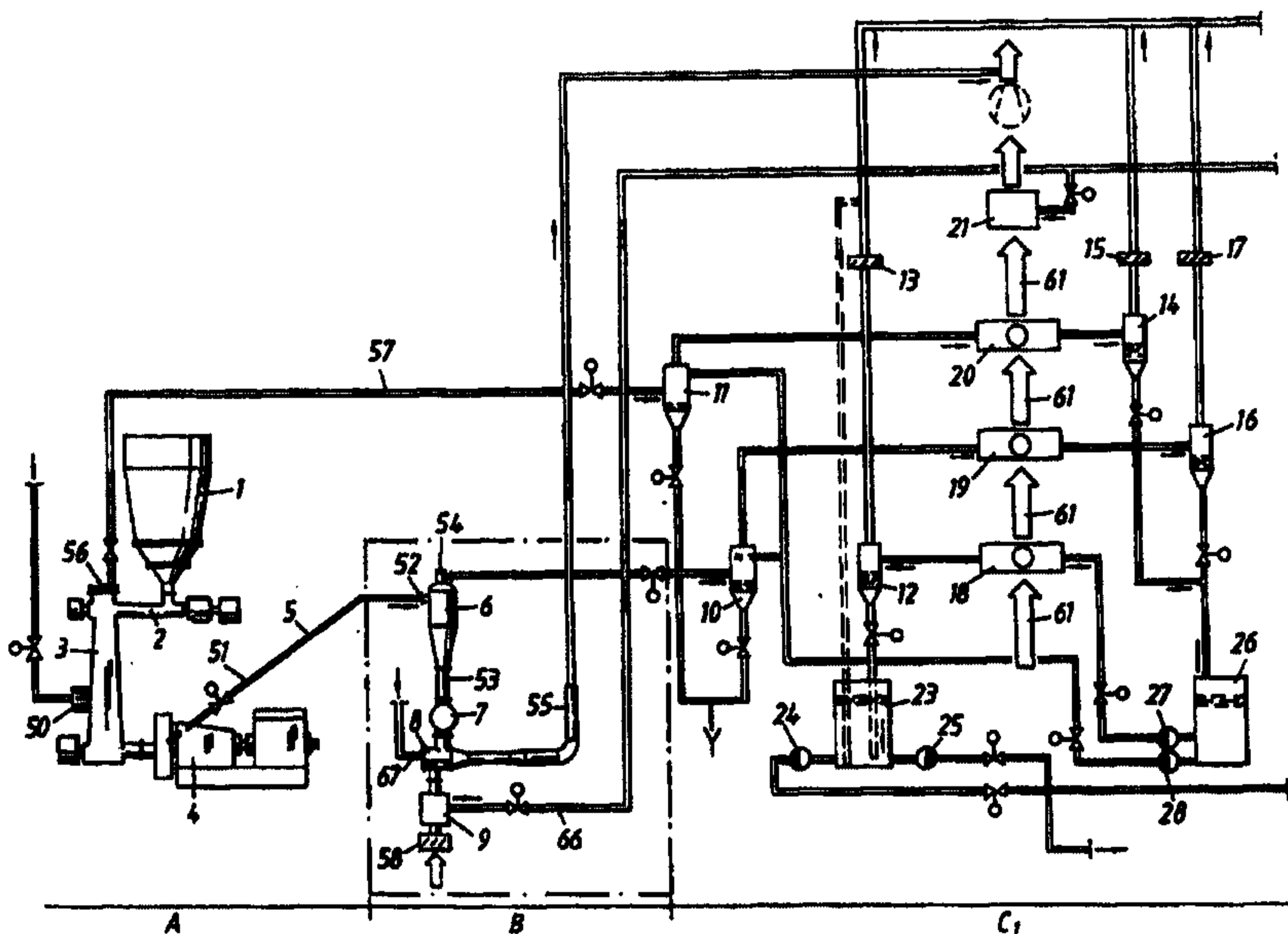
PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁶ : D21B 1/12</p>	<p>A1</p>	<p>(11) International Publication Number: WO 99/10594</p> <p>(43) International Publication Date: 4 March 1999 (04.03.99)</p>
<p>(21) International Application Number: PCT/SE98/01451</p> <p>(22) International Filing Date: 10 August 1998 (10.08.98)</p> <p>(30) Priority Data: 9703062-1 25 August 1997 (25.08.97) SE 9704674-2 15 December 1997 (15.12.97) SE</p> <p>(71) Applicant (for all designated States except US): SUNDS DEFI- BRATOR INDUSTRIES AB [SE/SE]; S-851 94 Sundsvall (SE).</p> <p>(72) Inventors; and (75) Inventors/Applicants (for US only): SÄFSTRÖM, Chris- ter [SE/SE]; Utkiksbacken 26, S-117 67 Stockholm (SE). SÖDERBERG, Carl-Johan [SE/SE]; Allégatan 11, S-856 41 Sundsvall (SE). LUNDGREN, Göran [SE/SE]; Metkroksvägen 2, S-865 91 Alnö (SE).</p> <p>(74) Agent: STOLT, Lars, C.; L.A. Groth & Co. KB, P.O. Box 6107, S-102 32 Stockholm (SE).</p>	<p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p>Published With international search report. With amended claims.</p>	

(54) Title: PLANT FOR PRODUCING AND TREATING WOOD FIBRES



(57) Abstract

Plant for producing and treating wood fibres, comprising a fibre-producing part (A) equipped with a chip preheater (3) and a beater (4) used to free fibre from wood chips and at least one drier stage (C) used to dry the fibre. A steam separator part (B) is provided between fibre-producing part (A) and drier stage (C) and includes a cyclone separator (6) whose inlet (52) is connected to blower line (5) used for fibre and steam obtained from beater (4). The bottom outlet (53) on cyclone separator (6) is connected via a sluice valve (7) to a conveyance/drying line (55) used for fibre. The top outlet (54) on cyclone separator (6) is connected to devices used to separate volatile organic substances and to recover heat from steam obtained from cyclone separator (6).

21209-433

PLANT FOR PRODUCING AND TREATING WOOD FIBRES

The present invention relates to a plant of the type set forth herein designed/constructed to produce and treat wood fibres as well as a method for the treatment of
5 wood chips.

One problem encountered in connection with such plants is the emission to the surrounding atmosphere of volatile, organic substances, i.e. Volatile Organic Compounds (VOC), and formaldehyde from the raw wood and from
10 the size used in the process. One purpose of the present invention is to solve this problem. Another purpose is to recover thermal energy in these processes. These purposes are achieved by imparting to a plant designed/constructed in accordance with the invention the characteristics set forth
15 in the claims.

In accordance with an aspect of the present invention, there is provided a method for the treatment of wood chips comprising preheating said wood chips in a preheater in the presence of steam thereby producing
20 preheated wood chips and volatile organic substances from said wood chips, mechanically processing said preheated wood chips in a beater whereby wood fibers are released from said wood chips and said steam and said volatile organic substances are contained therein, feeding size to said wood
25 fibers, separating said wood fibers from said steam and said volatile organic substances in a cyclone including an inlet, an upper outlet and a lower outlet, transporting said wood fibers, said steam, said size, and said volatile organic substances from said beater to said inlet of said cyclone
30 through a blower line, carrying said wood fibers from said

21209-433

lower outlet of said cyclone through a drying conduit,
controlling said removal of said wood fibers from said
cyclone through a sluice valve associated with said lower
outlet of said cyclone, and processing said steam and said
5 volatile organic substances from said upper outlet of said
cyclone, whereby said volatile organic substances separated
in said cyclone are separated, and heat associated with said
steam separated in said cyclone is recovered.

The invention will now be described in greater
10 detail with reference to the attached drawings on which:

Figs. 1a and 1b show schematically the process
performed in a plant designed/constructed in accordance with
the invention.

Fig. 2 shows a part of the plant shown in Fig. 1a
15 drawn to a larger scale, but an alternative embodiment is
presented here.

Fig. 3 shows the same part as that shown in
Fig. 2, but yet another alternative embodiment is shown
here.

20 Fig. 4 shows schematically the process in an
alternative embodiment of a plant designed/constructed in
accordance with the invention.

The plant shown in Figs. 1a and 1b comprises a
number of parts: a fibre-production part A, a steam
25 separator part B, two fibre drying stages C1, C2 and an
energy subplant D. The plant will be described with regard
to its design/construction while simultaneously explaining
its operation in order to avoid needless repetition.

21209-433

In fibre-production part A, the wood chips are preheated in an alkalinizing bin 1 using, if so desired, steam at atmospheric pressure. From bin 1, the chips are fed by plug-type screw conveyor 2 which compresses and dewateres them as they are conveyed to chip preheater 3. Chip preheater 3 heats the chips with heat obtained from condensing steam that is supplied through steam inlet 50 located in the lower part of the preheater, the pressure, temperature and time having been preset and adapted to the raw wood chips. Preheater 3 has a top outlet 56 where released organic emissions are degassed from the wood along with air during heating, thereby improving heat transfer between the steam and chips. The greater part of the emissions, i.e. volatile organic substances (VOC and formaldehyde), is released in the preheater and separated with high concentration in the top of the preheater and conveyed together with steam and air via line 57 to scrubber 11 where solid particles are separated along with certain condensable organic substances and volatile waste gases and where heat is recovered from the steam. Since the steam

WO 99/10594

PCT/SE98/01451

is supplied through inlet 50 at a low level the chips, which enter from the top of the preheater, can be washed in counterflowing steam during condensation.

The electrical energy that is added to free fibre from the chips in beater 4 is converted, for the most part, to steam in connection with the mechanical processing of the preheated chips to produce free fibres or fibre bundles. During processing, a certain amount of organic emissions are released from the wood, and they are conveyed forward in blower line 5 in the gaseous state together with the steam. In blower line 5 the fibres, fibre bundles and steam are conveyed at high speed to inlet 52 on cyclone separator 6. If size is to be used, it is added in blower line 5 at 51 thereby sizing the fibre. Emissions of volatile, organic substances are also released from the size and together with the fibre and the steam, they are conveyed to cyclone separator 6 for separation from the fibre. Bottom outlet 53 on cyclone separator 6 is connected, via sluice valve 7, to conveyance line 55 in which the fibre is sent to a fibre drier. However, drying of the fibre can also take place in line 55 due to the fact that the transport medium is drying air (see especially Figs 2 and 4). Consequently, line 55 will hereinafter be called conveyance/drying line 55. Upper connection 54 on the cyclone separator is connected to scrubber 10 that separates the fibres and organic substances from the steam obtained from the cyclone separator.

Cyclone separator 6 can be included in several alternative basic embodiments. In alternative embodiment 1, which is shown in Fig. 1a, steam ejector 8 is connected downstream from sluice valve 7. Steam ejector 8, which is supplied with steam at 67, handles further conveyance of the fibre together with preheated drying air and flue gases that are sucked from mixing chamber 9. This mixing chamber 9 receives flue gases via line 66, which runs from energy subplant D in the plant and also receives drying air via valve 58. In this alternative embodiment, the fibre is already being dried while it is being conveyed to drier stage C₁.

In alternative embodiment 2, which is shown in Fig. 2, conveyance/drying line 55 is connected directly to sluice valve 7 wherewith hot air is supplied directly to the drier line at 59. In alternative embodiment 3, which is shown in Fig. 3, the fibre is transported to the drier stage by means of compressor 31 which is supplied with conveyance air at 60 and feeds injector 32.

In drier stage C₁, the drying air is heated as indicated by arrows 61 in air/hot-water coil 18 and in air/steam coils 19, 20 and also in mixing chamber 21 used for flue gas obtained from energy subplant D. The suspension of steam, air and volatile organic substances (VOC and formaldehyde) that arrives at scrubber 11 from preheater 3 is washed free of solid particles in scrubber 11 using condensate pumped from condensate tank 26 by means of pump 28. Parts of released emissions from the wood are condensed and leave scrubber 11 together with the scrubber water. Steam leaving scrubber 11 is used during condensation to heat the drying air in air/steam coil 20. Condensate from coil 20 leaves separator 14 where volatile organic emissions

WO 99/10594

PCT/SE98/01451

proceed via regulator valve 15, suction fan 22 (Fig. 1b) and duct 30 to incinerator 62 in energy subplant D.

Steam obtained from cyclone separator 6 that contains organic emissions released in connection with fibre production and sizing is washed free of solid particles in scrubber 10 using condensate from condensate tank 26. Parts of the aforesaid emissions are condensed and leave scrubber 10 together with the scrubber water. The washed steam from scrubber 10 is sent to heating coil 19 where it is used to heat drying air 61. In heating coil 19 the steam is condensed, and the condensate is sent to separator 16 from which volatile non-condensable emissions are sent to incinerator 62 for incineration via regulator valve 17, suction fan 22 and duct 30.

The condensate in condensate tank 26 is transported by pump 27 to heat the drying air in heating coil 18. The condensate leaves coil 18 at a temperature of about 40°C via separator 12 where the remaining emissions of volatile organic gases are sent to incinerator 62 via valve 13, suction fan 22 and duct 30.

Condensate from separator 12 is sent to tank 23, which contains a decanter insert.

Condensate consisting of emission remnants (terpenes) released from the wood substance is decanted and transported by pump 24 and pipe 29 to incinerator 22 where it is used to moisten solid fuel 63 and grindings 64 which are also sent here.

The level in condensate tank 23 is regulated by means of pump 25. Water that proceeds via pump 25 is a) used if so desired to heat drying air, as indicated by arrows 65, in drier stage C₂ via heating coil 40, or b) used in the rest of the process wherever needed, or c) sent out directly for purification. Drying air 61 and drying air 65 in drier stages C₁ and C₂ are heated to the final temperature together, if so desired, with flue gas from the energy subplant via mixing chambers 21 and 41 or using some other heating medium.

Fig. 4 shows an alternative embodiment of the plant, which is somewhat simplified relative to the previously described alternative embodiments. Here, fibre-production part A is the same as in the embodiments previously described. In steam separator part B, on the other hand, the emissions released in preheater 3 are sent together with steam and air via line 70 to heat exchanger 73 and condensate tank 76 in order to separate condensable organic substances and volatile waste gases and recover heat from the steam. Bottom outlet 53 on cyclone separator 6 is connected, via sluice valve 7, to injector 32 which is located in conveyance/drying line 55 that runs to the first drier stage C₁. Upper connection 54 on cyclone separator 6 is also connected to heat exchanger 73 in order to heat the drying air.

In drier stage C₁, the drying air is heated, as indicated by arrows 87, in the following: a) heat exchanger 75, b) mixing chamber 74 together with mixed-in drying air leaving cyclone separator 83 in drier stage C₂, c) heat exchanger 73 together with steam from cyclone separator 6 and preheater 3 and d) mixing chamber 72 using the necessary supplementary drying energy

WO 99/10594

PCT/SE98/01451

introduced at 85. In drier stage C₂ the drying air is heated in heat exchanger 78 and also via heating coil 84 using, alternatively, a heating medium supplied at 86.

5 An alternative to the aforesaid drying air heating arrangement can be provided by eliminating mixing chamber 74 where mixed-in drying air from drier stage C₂ is used. Another alternative can be provided by eliminating heat exchangers 75 and 78 which are intended for cooling condensate sent from condensate tank 76 to condensate tank 79 and replacing them with some other form of cooling.

10 The suspension of steam, air and volatile organic substances (VOC and formaldehyde) which arrives at heat exchanger 73 from preheater 3 and cyclone separator 6 is condensed and sent out as condensate to tank 76 where volatile organic emulsions in the gaseous state are sent to the energy subplant for incineration via 93. Parts of the emulsions mentioned above are condensed and transported together with the condensate by pump 77 to heat exchanger 75 used for drier stage C₁ and also to heat exchanger 78 used for drier stage C₂, and they transfer parts of their heat content to the drying air. Transport to cyclone separator 83 is provided by fan 82.

15 Condensate from heat exchanger 78 is sent at a temperature of about 40°C to condensate tank 79 from which remaining emulsions of volatile organic gases are sent via 93 to the energy subplant for incineration. The level in condensate tank 79 is regulated by means of pump 80. If so desired, water from pump 80 is used, via 89, in the rest of the process wherever needed or is sent out directly for purification.

21209-433

CLAIMS:

1. A method for the treatment of wood chips comprising preheating said wood chips in a preheater in the presence of steam thereby producing preheated wood chips and
5 volatile organic substances from said wood chips, mechanically processing said preheated wood chips in a beater whereby wood fibers are released from said wood chips and said steam and said volatile organic substances are contained therein, feeding size to said wood fibers,
10 separating said wood fibers from said steam and said volatile organic substances in a cyclone including an inlet, an upper outlet and a lower outlet, transporting said wood fibers, said steam, said size, and said volatile organic substances from said beater to said inlet of said cyclone
15 through a blower line, carrying said wood fibers from said lower outlet of said cyclone through a drying conduit, controlling said removal of said wood fibers from said cyclone through a sluice valve associated with said lower outlet of said cyclone, and processing said steam and said
20 volatile organic substances from said upper outlet of said cyclone, whereby said volatile organic substances separated in said cyclone are separated, and heat associated with said steam separated in said cyclone is recovered.

2. The method of claim 1 including separating said
25 volatile organic substances from said steam separated in said cyclone by means of a scrubber, and recovering heat from said steam separated in said scrubber.

3. The method of claim 2 including transporting said wood fibers in said drying conduit through a steam ejector
30 associated with said lower outlet of said cyclone, and

21209-433

mixing flue gas and drying air and supplying said mixture of flue gas and drying air to said steam ejector.

4. A method of claim 2 including supplying compressed air to an injector associated with said lower outlet of said
5 cyclone for transporting said wood fiber, said steam and said volatile organic substances in said drying conduit.

5. The method of claim 2 including supplying steam to a lower portion of said preheater, whereby said steam countercurrently contacts said wood chips entering a wood
10 chip entrance in said preheater, and said volatile organic substances and steam can exit from an outlet from said preheater, and separating said volatile organic substances from said steam in a scrubber connected to said outlet from said preheater, and recovering additional heat from said
15 steam.

6. The method of claim 2 including separating said volatile organic substances in a gaseous state for incineration from said upper outlet from said cyclone and recovering heat from said steam.

FETHERSTONHAUGH & CO.

OTTAWA, CANADA

PATENT AGENTS

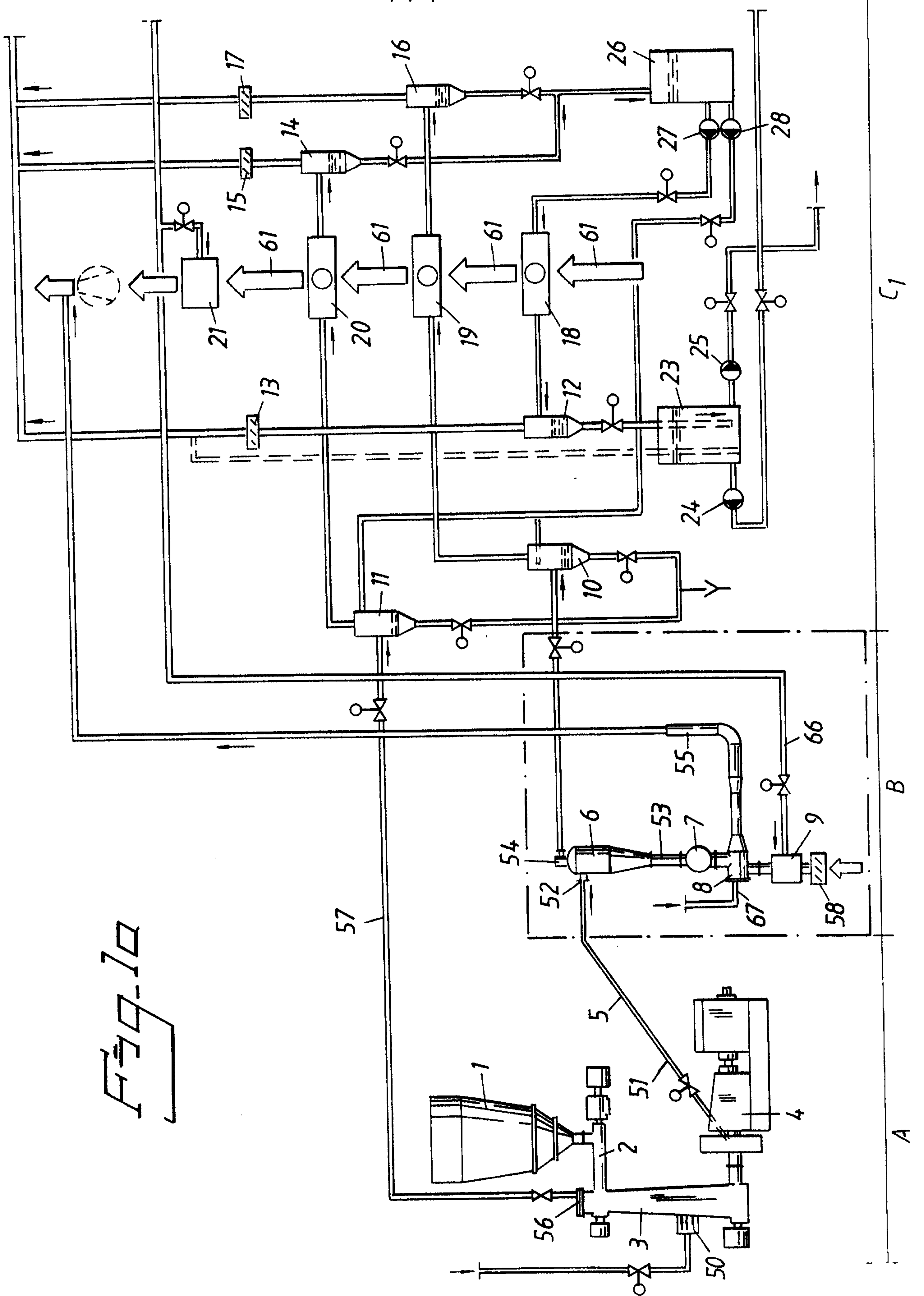


Fig. 10

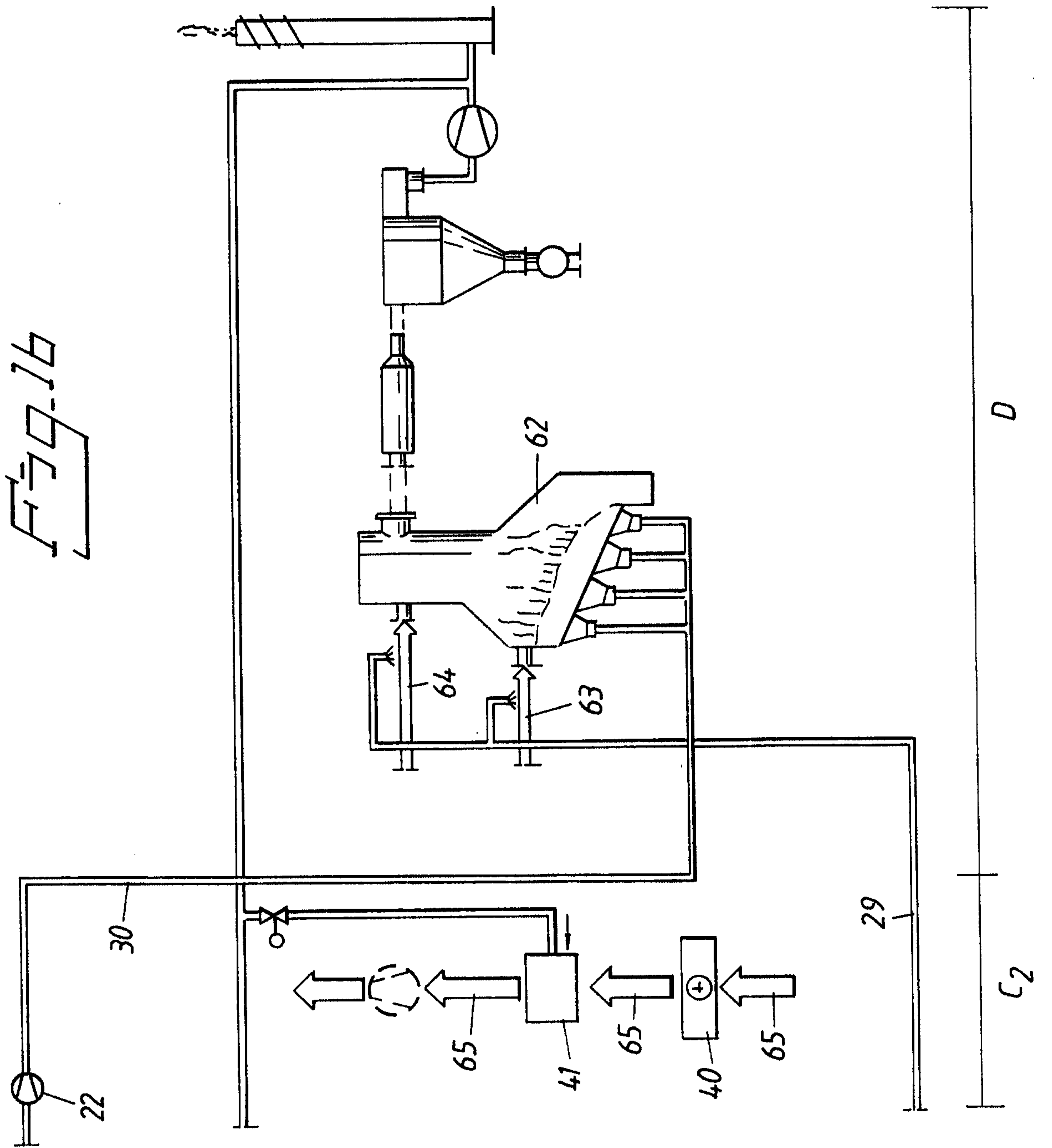


Fig. 2

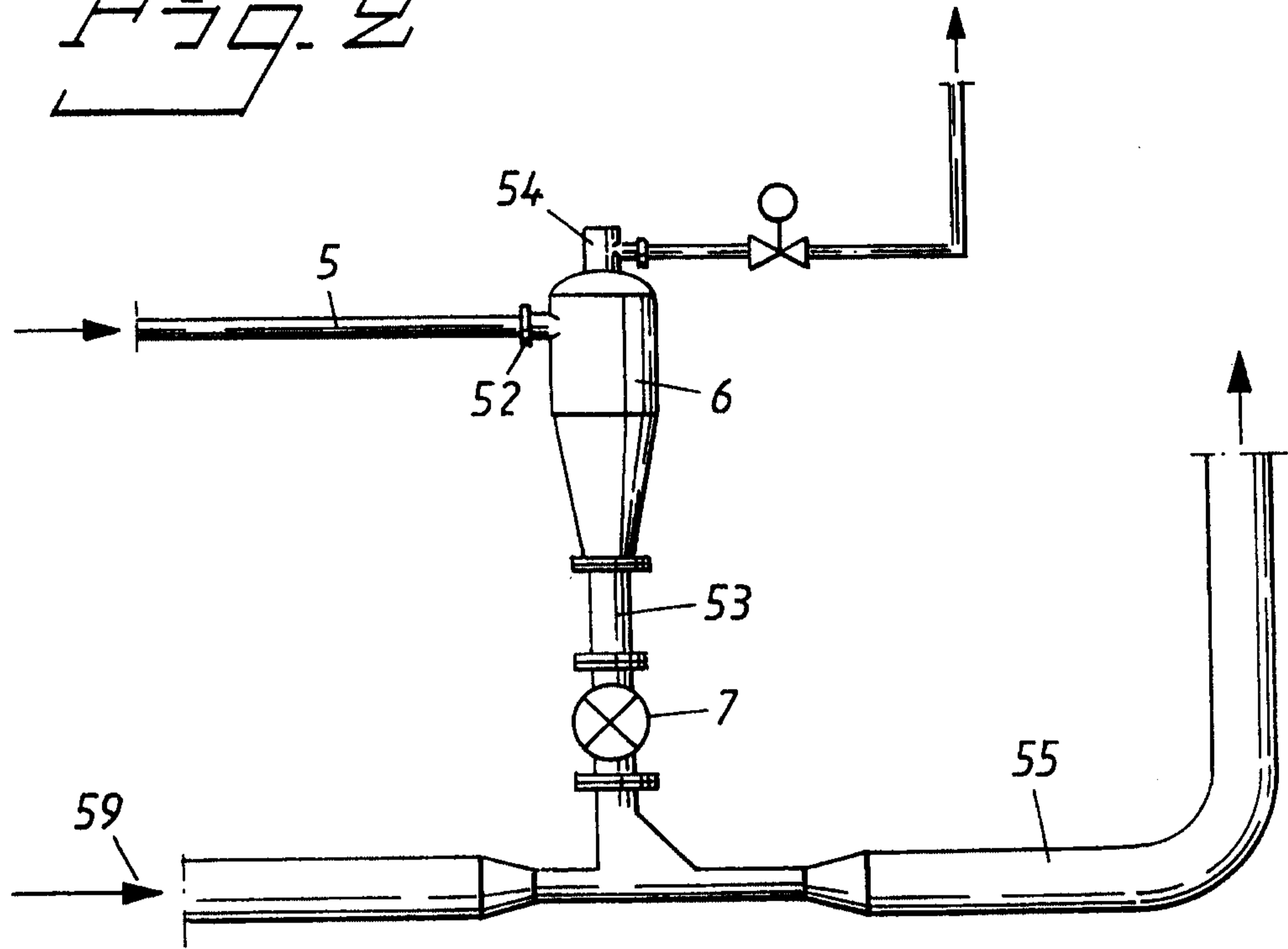


Fig. 3

