

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
15 May 2025 (15.05.2025)



(10) International Publication Number
WO 2025/098756 A1

(51) International Patent Classification:

F04D 15/00 (2006.01) *F24F 11/85* (2018.01)
F24D 19/10 (2006.01) *F04D 13/12* (2006.01)

(21) International Application Number:

PCT/EP2024/079699

(22) International Filing Date:

21 October 2024 (21.10.2024)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

PA202370566 09 November 2023 (09.11.2023) DK

(71) Applicant: **GRUNDFOS HOLDING A/S** [DK/DK]; Poul Due Jensens Vej 7-11, 8850 Bjerringbro (DK).

(72) Inventors: **NICOLAISEN, Mogens Groth**; Poul Due Jensens Vej 7-11, 8850 Bjerringbro (DK). **OVERGAARD,**

Anders; Poul Due Jensens Vej 7-11, 8850 Bjerringbro (DK). **KALLESØE, Carsten Skovmose**; Poul Due Jensens Vej 7-11, 8850 Bjerringbro (DK).

(74) Agent: **PATENTANWÄLTE HEMMER LINDFELD FRESE PARTNERSCHAFT MBB**; Wallstraße 33a, 23560 Lübeck (DE).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH,

(54) Title: A CONTROL SYSTEM FOR DISTRIBUTED PUMPING IN A THERMAL ENERGY DISTRIBUTION SYSTEM

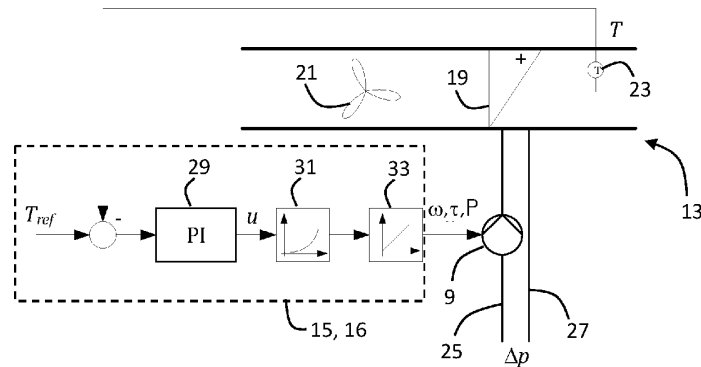


Fig. 3a

(57) **Abstract:** The present disclosure is directed to a control system (15) for distributed pumping in a thermal energy distribution system (1), wherein the thermal energy distribution system (1) comprises at least two system branches (7) being arranged in parallel to each other, wherein - a pump assembly is installed in one of the system branches (7) comprising a thermal energy transfer element (13) and at least one temperature sensor (23) for providing a measured temperature value (T) that is affected by an output power (Φ) of the thermal energy transfer element (13), and the pump assembly is configured to control and provide a fluid flow (q) through said system branch (7), wherein the output power (Φ) of the thermal energy transfer element (13) scales non-linearly with the fluid flow (q) through said system branch, characterised in that the control system (15) is configured to provide a pump actuation signal (ω , τ , P) for operating the pump assembly in a closed-loop control with the measured temperature (T) as a feedback signal to control the fluid flow (q) through said system branch (7), wherein the control system (15) is further configured to apply a non-linear correction function in the closed-loop control such that the output power (Φ) of the thermal energy transfer element (13) scales linearly with the pump actuation signal (ω , τ , P).

[Continued on next page]

TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS,
ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

- *with international search report (Art. 21(3))*
- *in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE*