Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2651029 A1 2007/11/08

(21) 2 651 029

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(86) Date de dépôt PCT/PCT Filing Date: 2007/04/24
(87) Date publication PCT/PCT Publication Date: 2007/11/08
(85) Entrée phase nationale/National Entry: 2008/11/03
(86) N° demande PCT/PCT Application No.: EP 2007/003582
(87) N° publication PCT/PCT Publication No.: 2007/124892
(30) Priorité/Priority: 2006/05/03 (DE10 2006 020 441.7)

(51) Cl.Int./Int.Cl. *E02F 9/22* (2006.01), *F04B 49/00* (2006.01), *F04B 49/06* (2006.01)

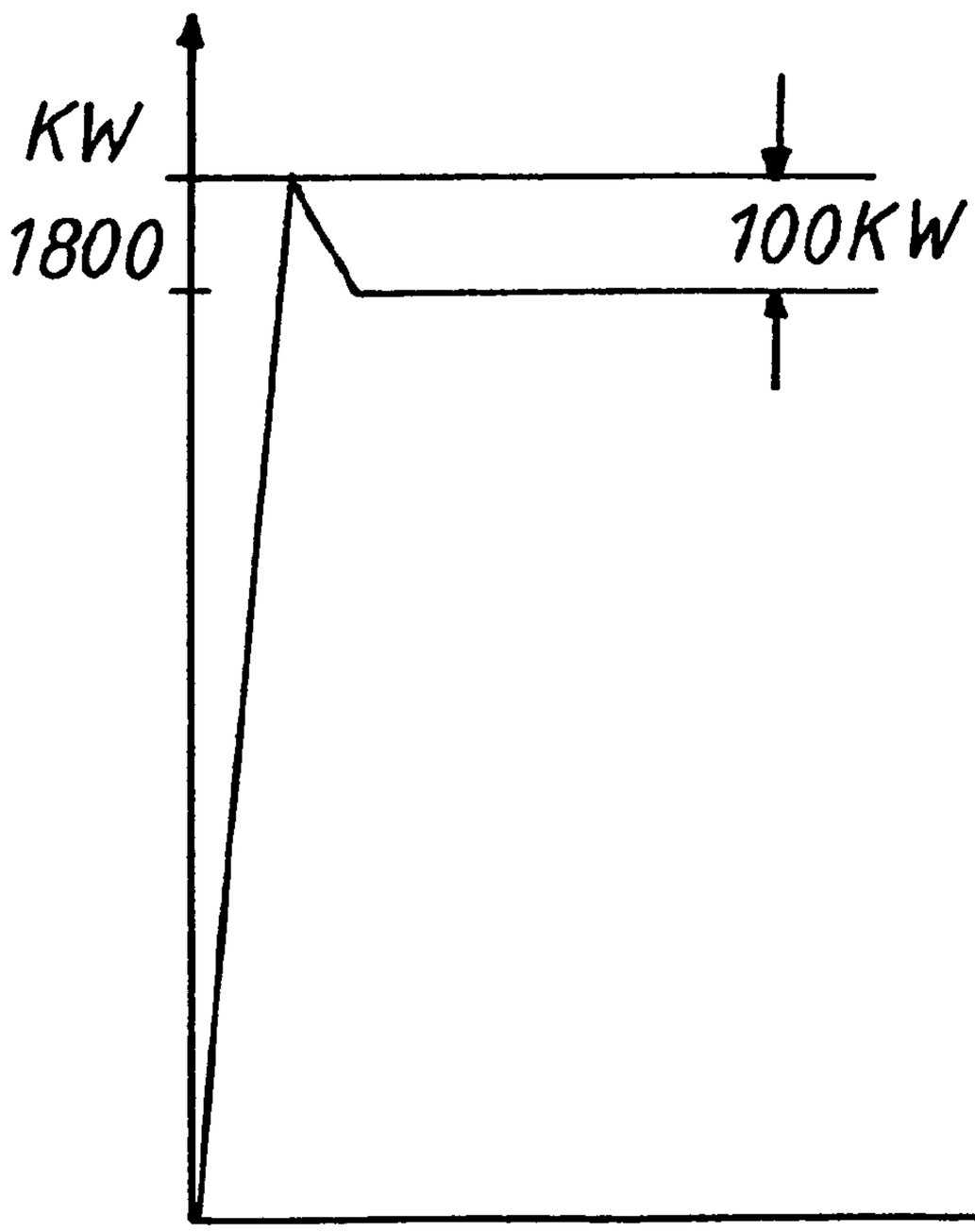
(71) Demandeur/Applicant:
TEREX GMBH, DE

(72) Inventeurs/Inventors:
BUSSE, WILFRIED, DE;
EMMINGER, REINHARD, DE

(74) Agent: MACRAE & CO.

(54) Titre : PROCEDE POUR REDUIRE LA CHARGE D'UN OU DE PLUSIEURS MOTEURS DANS UNE EXCAVATRICE HYDRAULIQUE DE GRAND VOLUME

(54) Title: METHOD OF REDUCING THE LOAD OF ONE OR MORE ENGINES IN A LARGE HYDRAULIC EXCAVATOR



(57) Abrégé/Abstract:
Method of reducing the load of at least one engine, in particular an internal combustion engine, arranged in a large hydraulic excavator by at least one hydraulic secondary consumer, in particular a feed pump, in an overload speed situation of the respective engine, being reduced in its delivery quantity until the respective engine is returned again to its operational speed range.

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
8. November 2007 (08.11.2007)

PCT

(10) Internationale Veröffentlichungsnummer
WO 2007/124892 A3

(51) Internationale Patentklassifikation:
E02F 9/22 (2006.01) *F04B 49/06* (2006.01)
F04B 49/00 (2006.01)

(21) Internationales Aktenzeichen: PCT/EP2007/003582

(22) Internationales Anmeldedatum:
24. April 2007 (24.04.2007)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
10 2006 020 441.7 3. Mai 2006 (03.05.2006) DE

(71) Anmelder *(für alle Bestimmungsstaaten mit Ausnahme von US)*: **TEREX GMBH** [DE/DE]; Karl-Funke-Strasse 36, 44149 Dortmund (DE).

(72) Erfinder; und

(75) Erfinder/Anmelder *(nur für US)*: **BUSSE, Wilfried** [DE/DE]; Hunscheidtstrasse 117, 44789 Bochum (DE). **EMMINGER, Reinhard** [DE/DE]; Gerhard-Haupt-mann-Ring 8a, 59379 Selm (DE).

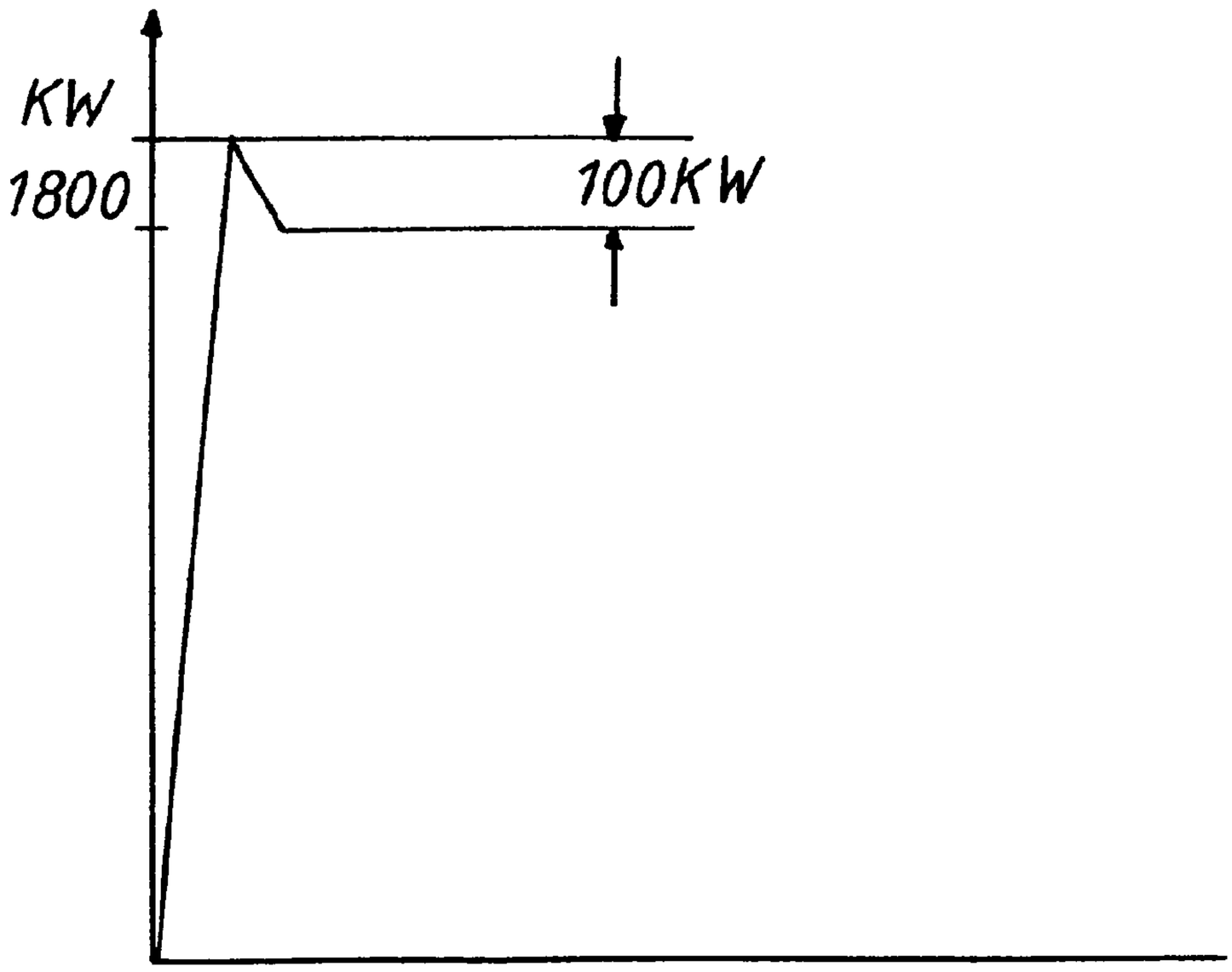
(81) Bestimmungsstaaten *(soweit nicht anders angegeben, für jede verfügbare nationale Schutzrechtsart)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Bestimmungsstaaten *(soweit nicht anders angegeben, für jede verfügbare regionale Schutzrechtsart)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG,

[Fortsetzung auf der nächsten Seite]

(54) **Title:** METHOD OF REDUCING THE LOAD OF ONE OR MORE ENGINES IN A LARGE HYDRAULIC EXCAVATOR

(54) **Bezeichnung:** VERFAHREN ZUR LASTMINDERUNG EINES ODER MEHRERER MOTORE IN EINEM GROSS-HYDRAULIKBAGGER



(57) **Abstract:** Method of reducing the load of at least one engine, in particular an internal combustion engine, arranged in a large hydraulic excavator by at least one hydraulic secondary consumer, in particular a feed pump, in an overload speed situation of the respective engine, being reduced in its delivery quantity until the respective engine is returned again to its operational speed range.

[Fortsetzung auf der nächsten Seite]

WO 2007/124892 A3

WO 2007/124892 A3

ZM, ZW), eurasisches (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), europäisches (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Veröffentlicht:

— *mit internationalem Recherchenbericht*

— *vor Ablauf der für Änderungen der Ansprüche geltenden Frist; Veröffentlichung wird wiederholt, falls Änderungen eintreffen*

(88) Veröffentlichungsdatum des internationalen Recherchenberichts: 20. März 2008

(57) Zusammenfassung: Verfahren zur Lastminderung mindestens eines in einem Groß-Hydraulikbagger angeordneten Motors, insbesondere eines Verbrennungsmotors, indem in einer drehzahlmäßigen Überlastsituation des jeweiligen Motors mindestens ein hydraulischer Nebenverbraucher, insbesondere eine Arbeitspumpe, in seiner Fördermenge soweit abgesenkt wird, bis der jeweilige Motor wieder in seinen betriebsgemäßen Drehzahlbereich zurückgeführt ist.

METHOD OF REDUCING THE LOAD OF ONE OR MORE ENGINES IN A LARGE HYDRAULIC EXCAVATOR

[001] The invention relates to a method of reducing the load of at least one engine, in particular in an internal combustion engine, arranged in a large hydraulic excavator.

[002] The document DE 699 20 452 T2 describes a mobile working machine with hydraulic circuit, wherein the hydraulic circuit comprises one of the cylinders arranged in a hoisting device, which is suitable for handling a variable load. Furthermore provided is a storage battery for the recovery or feedback of the decreasing load energy.

[003] Among other things, the overload of a drive motor is indicated by a drop in the speed. If this speed drop is not counter-acted by reducing the load, the speed of the drive motor continues to drop until the motor stops.

[004] Large hydraulic excavators with an operational weight > 100 tons are normally provided with installed engine capacities on the order of magnitude of 500 to 3,000 kW. The cylinder volume for these engines as a rule is in the range of 15 to 60 liters, wherein the different cylinder volumes in this case correspond to their consumable output.

[005] Providing engines with even larger dimensions, which could compensate for any type of overload, is tied to such high costs that these engines become uneconomical.

As a result of the aforementioned reasons, engines are used that enter the overload

range during certain operating conditions and, as explained in the above, react with drastic speed drops.

[006] It is the goal of the present invention to provide a method which in certain overload situations permits the reduction of the load of at least one engine, in particular an internal combustion engine arranged in a large hydraulic excavator and, for the most part, makes it possible to compensate for the aforementioned negative effects.

[007] This goal is achieved for a speed overload situation with a method of reducing the load of at least one engine, in particular an internal combustion engine, arranged in a large hydraulic excavator by lowering the delivery quantity of at least one secondary hydraulic consumer, in particular a pump, far enough so that the respective engine is again returned to its operational speed range.

[008] Advantageous modifications of the subject matter of the invention follow from the dependent claims.

[009] If the desired reduction in the delivery quantity of the secondary consumer(s) is not sufficient to return the respective engine to its operational speed range, it is additionally proposed that once the desired reduction in the delivery quantity of the secondary consumer has been achieved, the delivery quantity of at least one hydraulic main consumer, e.g. a main operating pump, is also reduced by a predetermined amount of the delivery quantity, wherein the reduction in the delivery quantity continues until the respective engine has again been returned to its normal speed range for the operation.

[0010] Large hydraulic excavators with an operational weight of > 100 tons are equipped with a plurality of hydraulic consumers (main consumers and secondary consumers), which frequently are embodied as axial piston pumps with adjustable pumping capacity. The power consumption of these pumps is added up, thus resulting in the total load for the engine or engines.

[0011] To be able to use the smallest economically viable cylinder volume with respect to the engine and, as previously explained, reduce the drive motor speed at a relatively low overload already, e.g. when a bucket enters the material, the delivery quantity of at least one hydraulic secondary consumer (additional consumer) is initially reduced.

[0012] According to a different idea behind the invention, when using axial piston pumps, these pumps are adjusted using pressure-proportional valves or servo valves.

[0013] Controllable axial piston pumps are addressed herein, among other things, such as the ones used for ventilator drives in oil cooling and water cooling systems to which fixed displacement pumps are frequently assigned.

[0014] It is furthermore advantageous if the main operating pumps are controllable high-pressure axial piston pumps, for which the delivery quantity is controlled with the aid of pressure-proportional valves or servo valves, in the same way as for the secondary consumers. The delivery quantity of these pumps is reduced only following the completion of the fine control via the initially occurring reduction in the delivery quantity of the secondary consumer.

[0015]

[0016] The subject matter of the present invention is described in the following and is illustrated in the drawing, which shows in:

[0017] Figures 1 and 2 A graphic representation of different load spectrums of an engine installed in a large hydraulic excavator.

[0018] Two examples are presented in the following:

[0019] Example 1:

Engine capacity: 2 x 900 kW

Delivery quantity for installed operating pumps: 4 x 920 l/min, corresponding to 3,680 l/min.

Operating pressure: 280 bar

[0020] The associated diagram shows that with a given engine capacity (1,800 kW) and a given operating pressure for the pumps (280 bar), the operating load that adjusts at the pumps will be 1,900 kW, which exceeds the capacity of the installed engine (1,800 kW).

[0021] The engine can be returned to its capacity range at the time of installation by reducing, for example, the delivery quantity of at least one secondary hydraulic consumer that is not listed in further detail herein (e.g. a pump) by 100 kW.

[0022] Example 2:

Engine capacity: 2 x 900 kW

Delivery quantity of installed operating pumps: 4 x 920 l/min, corresponding to 3,680 l/min

Operating pressure: 320 bar

[0023] With a predetermined capacity for the installed engine (1,800 kW) in connection with the also predetermined operating pressure (320 bar), a necessary load of 2,200 kW would adjust for the operating pumps.

[0024] In a first phase, the delivery quantity of the secondary consumers is reduced by 500 l/min. The diagram shows that only a reduction to 1,900 kW is possible in this case, which still exceeds the installed engine capacity of 1,800 kW.

[0025] The engine can then be returned to the installation capacity of 1,800 kW by additionally reducing the delivery quantity of a main consumer by 100 kW and no further speed reductions will occur.

Patent Claims

1. A method of reducing the load of at least one engine, in particular an internal combustion engine, arranged in a large hydraulic excavator during a speed overload situation of the respective engine by reducing the delivery quantity of at least one hydraulic secondary consumer, in particular an operating pump, until the respective engine has been returned to the normal range for its operating speed.

2. The method according to claim 1, characterized in that the delivery quantity of the respective secondary consumer is lowered by a predetermined amount, relative to its total pumping capacity, and that once the delivery quantity of the secondary consumer has been lowered by this amount, the delivery quantity of at least one hydraulic main consumer, especially a main operating pump, is reduced by a predetermined share of its delivery quantity.

3. The method according to claim 1 or 2, characterized in that the respective secondary consumer is embodied as an axial piston pump with adjustable delivery quantity, for which the delivery quantity is lowered by a predetermined amount.

4. The method according to one of the claims 1 to 3, characterized in that the respective main consumer is a high-pressure axial piston pump, for which the delivery quantity is reduced.

5. The method according to one of the claims 1 to 4, characterized in that the respective consumer is activated with pressure-proportional valves or servo valves.

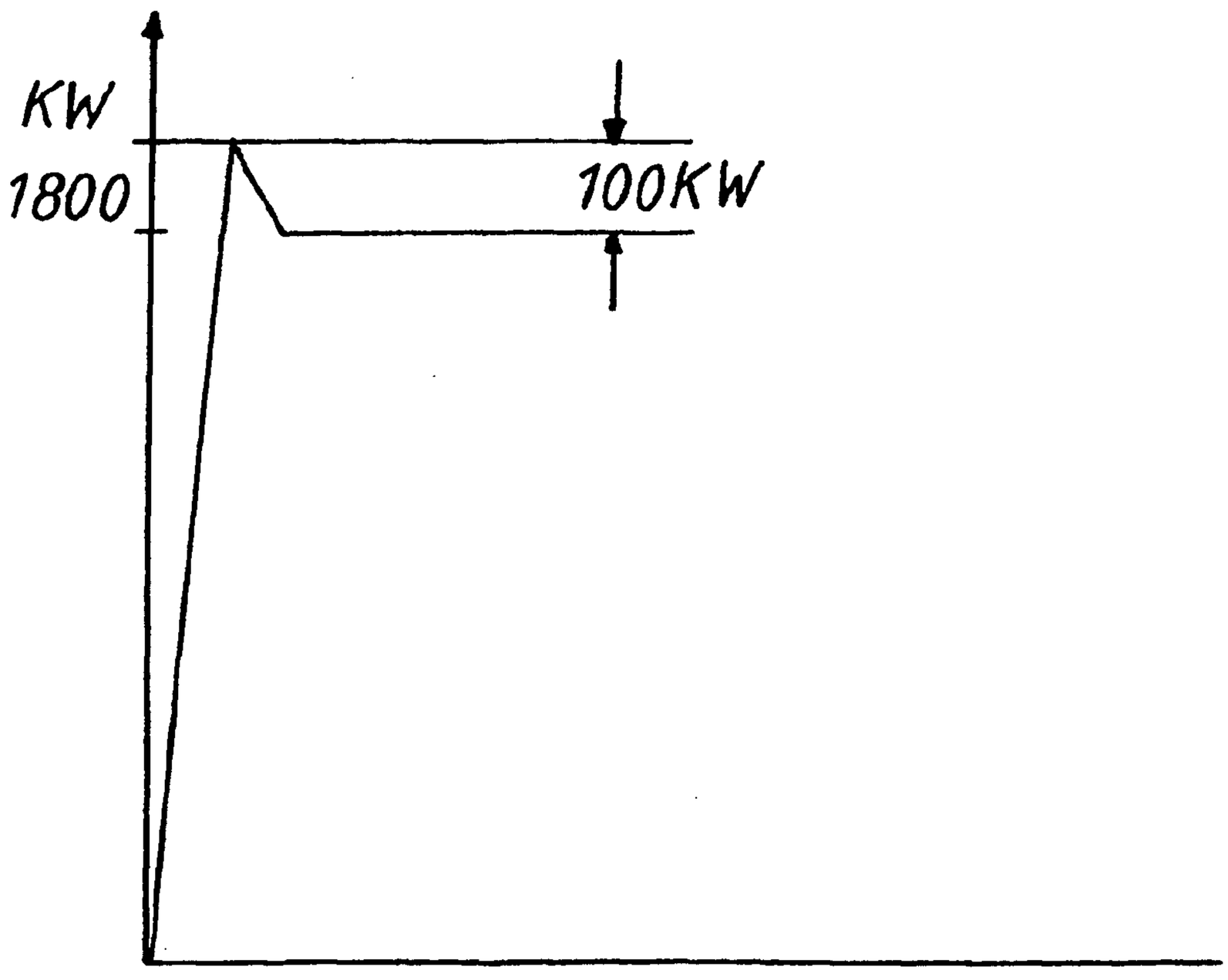


Fig.1

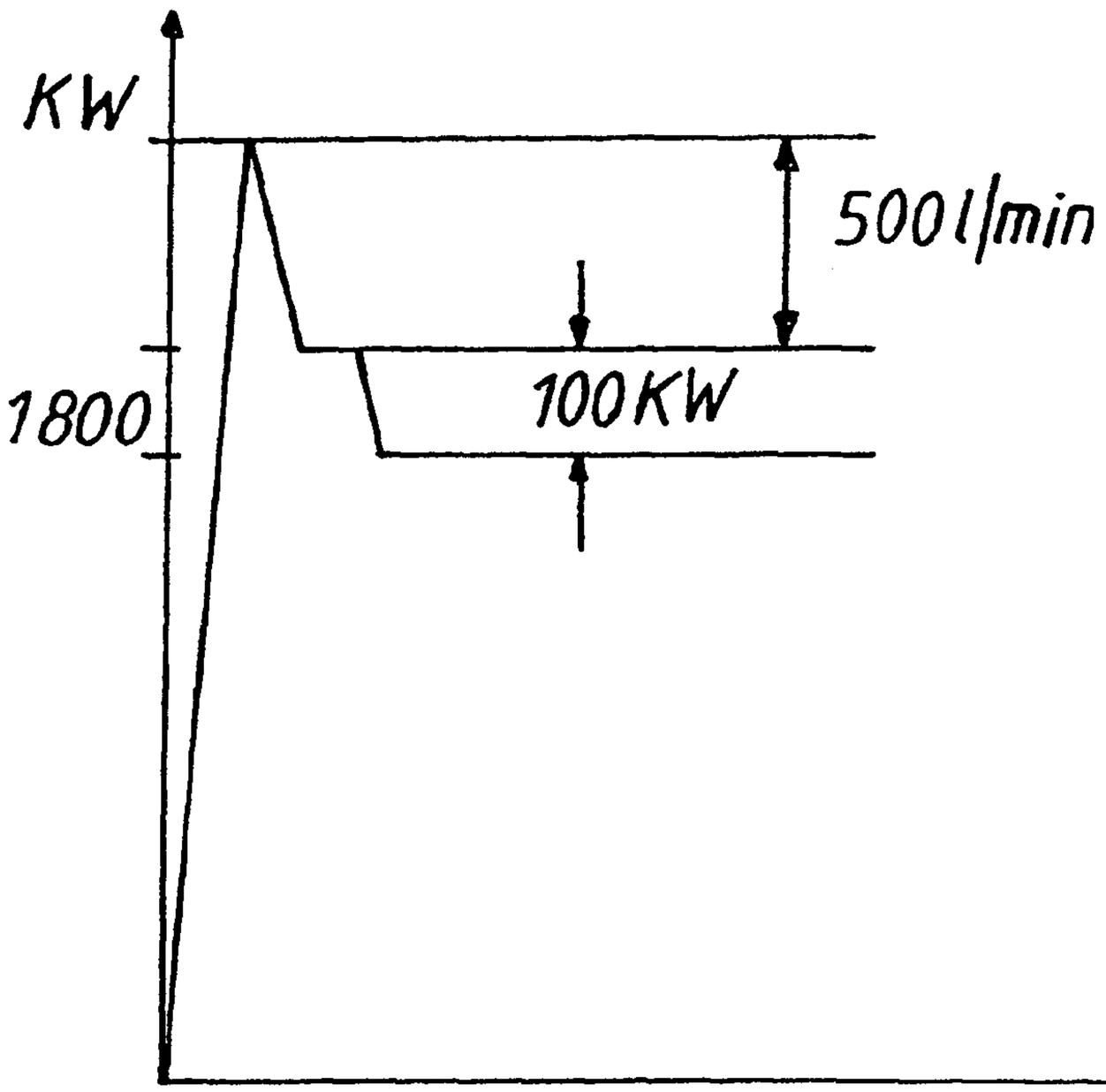
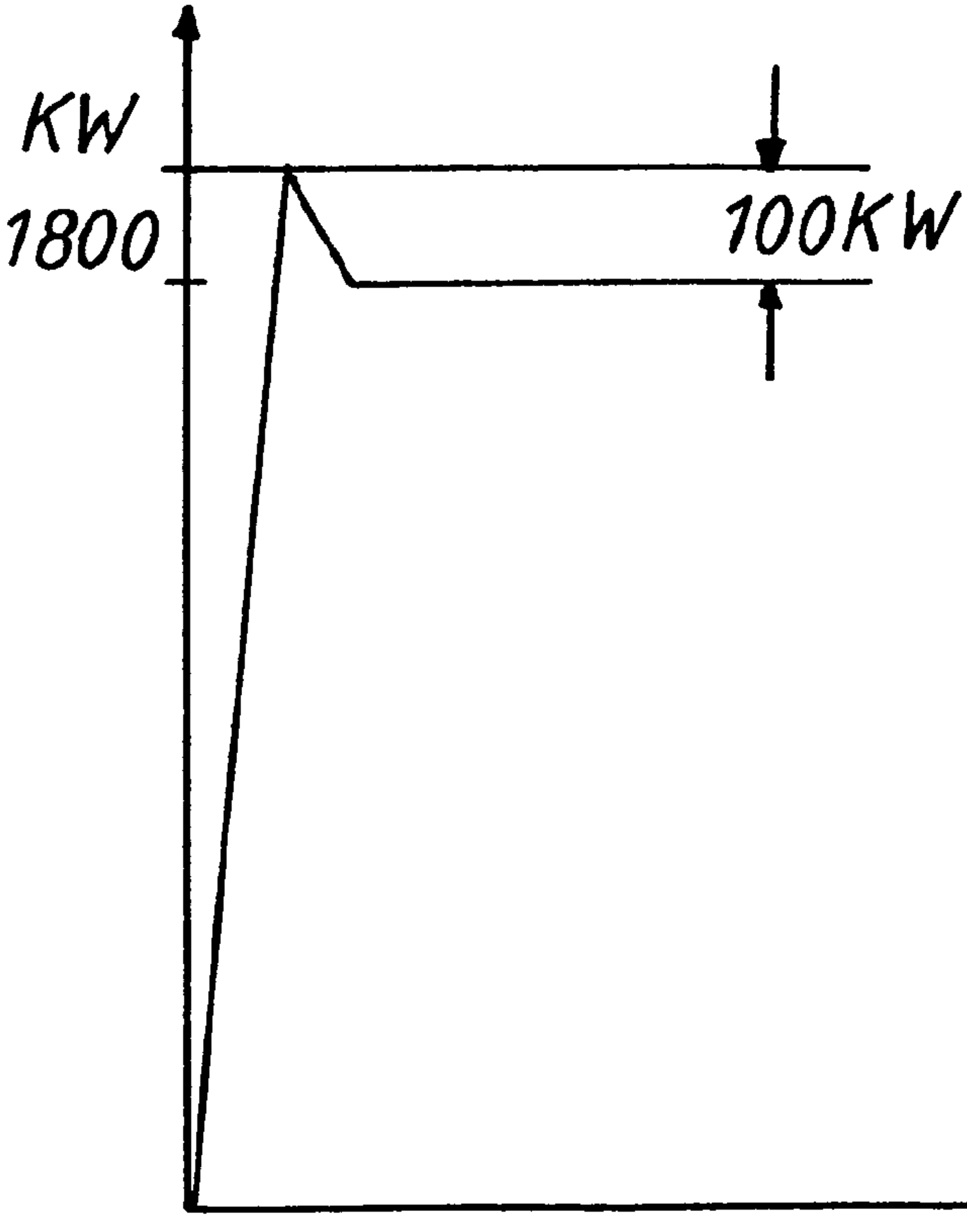


Fig. 2


KW
1800
100KW