

(12) STANDARD PATENT
(19) AUSTRALIAN PATENT OFFICE

(11) Application No. **AU 2006337463 B2**

(54) Title
Method and casting/rolling plant for the production of hot-rolled metallic strips, especially steel strips, having great surface quality

(51) International Patent Classification(s)
B21B 45/08 (2006.01) **B22D 11/12** (2006.01)
B22D 11/053 (2006.01)

(21) Application No: **2006337463** (22) Date of Filing: **2006.12.22**

(87) WIPO No: **WO07/087886**

(30) Priority Data

(31) Number	(32) Date	(33) Country
10 2006 004 688.9	2006.02.02	DE

(43) Publication Date: **2007.08.09**

(44) Accepted Journal Date: **2012.04.05**

(71) Applicant(s)
Hermetik Hydraulik AB;SMS Siemag Aktiengesellschaft

(72) Inventor(s)
Boecher, Tilmann;Bilgen, Christian;Gaydoul, Juergen;Hennig, Wolfgang

(74) Agent / Attorney
Griffith Hack, GPO Box 1285, Melbourne, VIC, 3001

(56) Related Art
US 5502881 A
WO 2000/010741A

(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
9. August 2007 (09.08.2007)

PCT

(10) Internationale Veröffentlichungsnummer
WO 2007/087886 A1

(51) Internationale Patentklassifikation:

B21B 45/08 (2006.01) **B22D 11/12** (2006.01)
B22D 11/053 (2006.01)

(21) Internationales Aktenzeichen: PCT/EP2006/012459

(22) Internationales Anmeldedatum:
22. Dezember 2006 (22.12.2006)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
10 2006 004 688.9 2. Februar 2006 (02.02.2006) DE

(71) Anmelder (für alle Bestimmungsstaaten mit Ausnahme von US): **SMS DEMAG AG** [DE/DE]; Eduard-Schloemann-Str. 4, 40237 Düsseldorf (DE). **HERMETIK HYDRAULIK AB** [SE/SE]; Lansenvägen 3, S-187 62 Täby (SE).

(72) Erfinder; und

(75) Erfinder/Anmelder (nur für US): **BILGEN, Christian** [DE/DE]; Becherstrasse 16, 40476 Düsseldorf (DE). **BÖCHER, Tilmann** [DE/DE]; Eduard-Schloemann-Strasse 66, 40237 Düsseldorf (DE). **HENNING, Wolfgang** [DE/DE]; Schelmrather Strasse 49, 41469 Neuss (DE). **GAYDOUL, Jürgen** [DE/SE]; Langenwägen 3, S-183 65 Täby (SE).

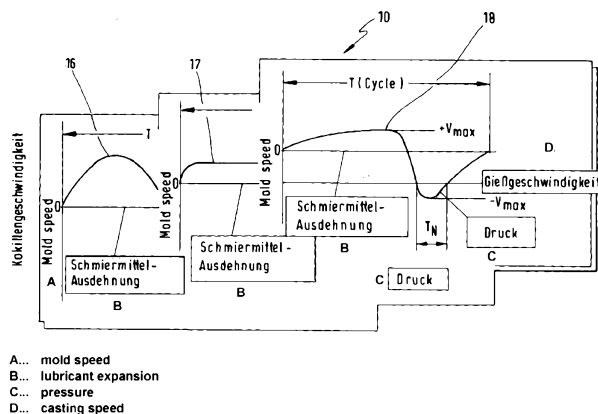
(74) Anwalt: **KLÜPPEL, Walter**; Hemmerich & Kollegen, Hammerstrasse 2, 57072 Siegen (DE).

(81) Bestimmungsstaaten (soweit nicht anders angegeben, für jede verfügbare nationale Schutzrechtsart): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, 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, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY,

[Fortsetzung auf der nächsten Seite]

(54) Title: METHOD AND CASTING/ROLLING PLANT FOR THE PRODUCTION OF HOT-ROLLED METALLIC STRIPS, ESPECIALLY STEEL STRIPS, HAVING GREAT SURFACE QUALITY

(54) Bezeichnung: VERFAHREN UND GIESS-WALZ-ANLAGE ZUM HERSTELLEN VON WARMGEWALZTEM METALL-BAND, INSBESONDERE STAHLWERKSTOFFBAND, MIT HOHER OBERFLÄCHENGÜTE



(57) Abstract: Disclosed are a method and a casting/rolling plant for producing hot-rolled metallic, particularly steel, strips (7) having great surface quality from slabs or flat thin bars (2, 2a) that are cast in a continuous casting process, descaling being performed based on a rotary descaling process. In order to take into account parameters which are not considered in prior art in addition to rotary descaling, the hydraulically oscillated permanent mold (9) travels along several different oscillation curves (16, 17, 18) while the oscillation marks are deep-cleaned by adjusting the oscillation pattern that is determined to be optimal for each casting material.

(57) Zusammenfassung: Ein Verfahren und eine Gieß-Walz-Anlage zum Herstellen von warmgewalztem Metall-, insbesondere Stahlwerkstoff-Band (7) mit hoher Oberflächengüte aus im Stranggießverfahren gegossenen Brammen- oder flachen Dünnssträngen (2, 2a) werden zum Entzundern auf der Grundlage der Rotorentzunderung

[Fortsetzung auf der nächsten Seite]

WO 2007/087886 A1



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.

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).

(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, 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,

Veröffentlicht:

— mit internationalem Recherchenbericht

Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

betrieben. Um neben der Anwendung des rotierenden Entzündens bisher nicht berücksichtigte Parameter des Stranggießens mit ein zu beziehen, wird die hydraulisch oszillierte Stranggießkokille (9) in mehreren unterschiedlichen Oszillationskurven (16, 17, 18) gefahren und die tiefe Reinigung der Oszillationsmarken wird durch Einstellen des als optimal für jeden Gießwerkstoff ermittelten Oszillationsverlaufs durchgeführt.

TRANSLATION (HM-849PCT-original):

WO 2007/087,886 A1

PCT/EP2006/012,459

METHOD AND CASTING/ROLLING PLANT FOR THE PRODUCTION
OF HOT-ROLLED METALLIC STRIPS, ESPECIALLY STEEL
STRIPS HAVING GREAT SURFACE QUALITY

The invention concerns a method and a casting and rolling plant for producing hot-rolled metal strip, especially steel strip, of high surface quality from continuously cast slabs or thin slabs, which is subjected to a surface descaling, heated to rolling temperature, and finish rolled to thin strip gauges in a multiple-stand hot-strip rolling train, where the cast strand, after emerging from a strand guide, before entering a soaking furnace and/or after emerging from a soaking furnace and entering the hot-strip rolling train, is sprayed on one or both of its surfaces by several rotating nozzles, from which pressurized liquid is recurrently sprayed onto the same places on the surface with high impact pressure to remove scale and/or casting flux and to deep-clean the oscillation marks.

A similar method is known from DE 43 28 303 C2. However, that method does not start from a continuously cast slab or thin slab cross section, and the rotary descaling is applied essentially to rolling stock and thus does not take into consideration the special production method of continuous

casting. In addition, the depth of removal is not sufficient for taking care of not only invisible scale but also all production-related oscillation marks.

Furthermore, the very large amount of water that is used
5 causes undesirably strong cooling of the rolling stock.

EP 0 586 823 B1 discloses a descaling device for casting and rolling trains. In this device, a rotary arm with a nozzle is used, and retaining, protective, and recovery plates for the removed scale and the large amount
10 of spray water are proposed.

EP 0 625 383 B1 describes a first descaling device, which can consist of a descaling sprayer of a conventional design, and a second descaling device with rotating nozzles.

15 EP 0 611 610 B1 describes rotary descaling with low water consumption, which is intended to produce a smaller temperature drop of the rolling stock.

In an embodiment, there is provided a method for producing hot-rolled metal strip, especially steel strip,
20 of high surface quality from continuously cast slabs or thin slabs which is subjected to a descaling of the strand surface, heated to rolling temperature, and finish rolled to thin strip gauges in a multiple-stand hot-strip rolling train, where the cast strand, after emerging from a strand
25 guide, before entering a soaking furnace and/or after

emerging from a soaking furnace and entering the hot-strip rolling train, is sprayed on one or both of its surfaces by several rotating nozzles, from which pressurized liquid is recurrently sprayed onto the same places on the surface
5 with high impact pressure to remove scale and/or casting flux and to deep-clean oscillation marks, wherein a hydraulically oscillated continuous casting mold is moved in several different oscillation curves and where the deep cleaning of the oscillation marks is carried out by
10 setting an oscillation pattern that is determined to be optimal for each casting material.

In another embodiment, the hydraulically oscillated continuous casting mold is moved in

several different oscillation curves and that the deep cleaning of the oscillation marks is carried out by setting the oscillation pattern that is determined to be optimal for each casting material. The advantages are that, besides the actual descaling, the oscillation marks can now be largely cleaned, which is conducive to final rolling to ultrathin final rolling thicknesses of less than or equal to 1.2 mm. This means that, for example, for these dimensions, finish rolling in the austenite range of crystalline structure is possible.

In a modification of the invention, it is proposed that much less pressurized liquid be admitted into the rotating nozzles as pressure medium than has previously been used in so-called descaling sprayers, with parameters of the casting or rolling process that are otherwise the same. This makes it possible to use less pressure medium, e.g., water, while achieving the same or better descaling results.

In accordance with other features of the invention, the temperature losses of the cast strand are kept low by admission of pressure medium to the rotating nozzles under automatic control according to the temperature level of the cast strand or strand of rolling stock. This reduces the temperature losses of the slabs and thin slabs, which results

in significantly better conditions for the hot rolling of the ultrathin final rolling thicknesses and in energy savings.

The associated casting and rolling plant, especially a compact casting and rolling plant (CSP), which consists of a continuous casting installation for liquid metals, especially liquid steel, whose continuous casting mold is connected with a hydraulic oscillation drive, which is followed in the direction of strand withdrawal by at least a strand guide, a soaking furnace, possibly a furnace transverse conveyor, a multiple-stand hot-strip finishing train, and a coiler, is further developed in such a way that a device with rotating nozzles is arranged between the strand guide and the soaking furnace or between a straightening driver and a shear and/or between the soaking furnace and the hot-strip finishing train and that a pressure medium is recurrently sprayed from these nozzles onto the same places on the surface with high impact pressure. This makes it possible to produce the effects of the process that were described earlier.

As is well known in other connections, several nozzles for pressure medium are installed on a rotor. However, it is also advantageous to provide nozzles of this type for media other than water at standard temperature.

In another embodiment, several rotors with nozzles for

pressure medium mounted on the periphery of the rotor are arranged in a row transverse to the direction of travel of the cast strand or strand of rolling stock. This makes it possible to replace some or all of the previously used spray bars of the descaling sprayer.

Finally, the invention provides for the use of the rotary descaling device in a hot-strip rolling train with seven or more finish rolling stands before entry into the first finish rolling stand.

Specific embodiments of the features of the invention are illustrated in the drawings and explained in greater detail below.

-- Figure 1 shows a compact casting and rolling plant in a perspective side view.

-- Figure 2 shows a continuous casting mold, which has a hydraulic oscillation drive and is housed in a compact protective housing.

-- Figure 3 shows several diagrams of different oscillatory movements of the continuous casting mold.

-- Figure 4 shows an individual rotor with nozzles arranged on the periphery of the rotor.

A casting and rolling plant 1 (Figure 1), which is especially a CSP plant (compact steel plant), consists of a

continuous casting installation 2, in which liquid metal, especially liquid steel, is cast by means of a continuous casting mold 9. The continuous casting mold 9 is provided with a hydraulically oscillating drive 9a (Figure 2). The continuous casting mold 9 is followed in the direction of strand withdrawal 11 by a strand guide 3, a soaking furnace 4, optionally a furnace transverse conveyor 5, a multiple-stand hot-strip finishing train 6, and a coiler 8 for coiling the strip 7.

A device 14 with rotating nozzles 15 (Figure 4) is arranged between the strand guide 3 and the soaking furnace 4 or between a straightening driver 12 and a shear 13 and/or between the soaking furnace 4 and the hot-strip finishing train 6, and a pressure medium, usually a liquid, e.g., water, is recurrently sprayed from these nozzles onto the same places on the surface with high impact pressure.

According to Figure 3, the hydraulically oscillating continuous casting mold 9 is moved in several different oscillation curves 16, 17, 18, so that a different oscillation pattern 16a, 17a, 18a is obtained for each selected casting material. The oscillation curves 16, 17, 18 can be obtained by different magnitudes of mold oscillation, different casting speeds, different advancing mold speeds during the downward

stroke (so-called negative strip), different curve forms (e.g., sinusoidal oscillations), and the like. Much less pressurized liquid can be admitted into the rotating nozzles 15 as pressure medium than has previously been
5 used in so-called descaling sprayers under conditions that are otherwise identical, i.e., the opposing processes are based on the same parameters. At the same time, the temperature losses of the cast strand 2b are kept as low as possible by admission of pressure medium to the
10 rotating nozzles 15 under automatic control according to the desired temperature level of the cast strand or strand of rolling stock 2b.

Several nozzles 15 for the pressure medium are combined on a rotor 20 (Figure 4), and several rotors 20
15 have nozzles 15 for pressure medium mounted on the periphery 20a of the rotor 20 and are arranged in a row of nozzles 21 transverse to the direction of travel of the cast strand or strand of rolling stock. Advantages also result from several such rows of nozzles 21, where smaller
20 nozzle jets can be used than in the case of only a single row of nozzles 21.

The rotary descaling can be used on a hot-strip rolling train 6 with seven or more finish rolling stands 6a before the entry of the rolling stock into the first
25 finish rolling stand 6a.

It is to be understood that, if any prior art publication is referred to herein, such reference does not constitute an admission that the publication forms a part of the common general knowledge in the art, in Australia
30 or any other country.

List of Reference Numbers

- 1 CSP plant (compact steel plant)
- 2 slab profile
- 2a thin slab profile
- 2b cast strand
- 2c strand surface
- 3 strand guide
- 4 soaking furnace
- 5 furnace transverse conveyor
- 6 hot-strip rolling train
- 6a finish rolling stand
- 7 strip of steel
- 8 coiler
- 9 hydraulically oscillated continuous casting mold
- 9a oscillation drive
- 10 oscillation curve
- 11 direction of strand withdrawal
- 12 straightening driver
- 13 shear
- 14 device with rotating nozzles
- 15 rotating nozzle
- 16 oscillation curve

- 16a pattern of the oscillation curve
- 17 oscillation curve
- 17a pattern of the oscillation curve
- 18 oscillation curve
- 18a pattern of the oscillation curve
- 19 pressurized liquid
- 20 rotor
- 20a rotor periphery
- 21 row of rotors

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method for producing hot-rolled metal strip, especially steel strip, of high surface quality from
5 continuously cast slabs or thin slabs which is subjected to a descaling of the strand surface, heated to rolling temperature, and finish rolled to thin strip gauges in a multiple-stand hot-strip rolling train, where the cast strand , after emerging from a strand guide, before
10 entering a soaking furnace and/or after emerging from a soaking furnace and entering the hot-strip rolling train, is sprayed on one or both of its surfaces by several rotating nozzles, from which pressurized liquid is recurrently sprayed onto the same places on the surface
15 with high impact pressure to remove scale and/or casting flux and to deep-clean oscillation marks, wherein a hydraulically oscillated continuous casting mold is moved in several different oscillation curves and where the deep cleaning of the oscillation marks is carried out by
20 setting an oscillation pattern that is determined to be optimal for each casting material.

2. A method in accordance with Claim 1, wherein much less pressurized liquid is admitted into the rotating nozzles as pressure medium than has previously been used
25 in so-called descaling sprayers, with parameters of the

casting or rolling process that are otherwise the same.

3. A method in accordance with Claim 1 or Claim 2,
wherein the temperature losses of the cast strand are kept
low by admission of pressure medium to the rotating
5 nozzles under automatic control according to the
temperature level of the cast strand or strand of rolling
stock.

4. A casting and rolling plant, especially a compact
casting and rolling plant (CSP), which consists of a
10 continuous casting installation for liquid metals,
especially liquid steel, whose continuous casting mold is
connected with a hydraulic oscillation drive, which is
followed in the direction of strand withdrawal by at least
a strand guide, a soaking furnace, possibly a furnace
15 transverse conveyor, a multiple-stand hot-strip finishing
train, and a coiler, and a device with rotating nozzles is
arranged between the strand guide and the soaking furnace
or between a straightening driver and a shear and/or
between the soaking furnace and the hot-strip finishing
20 train and that a pressure medium is recurrently sprayed
from these nozzles onto the same places on the surface
with high impact pressure, wherein a hydraulically
oscillated continuous casting mold moves in several
different oscillation curves, where the oscillation curves
25 are defined by different magnitudes of mold oscillation,

different casting speeds, different advancing mold speeds during the downward stroke, and different curve forms, and where the deep cleaning of the oscillation marks by the rotating nozzles is carried out by setting a oscillation
5 pattern determined for each casting material.

5. A casting and rolling plant in accordance with Claim 4, wherein several nozzles for pressure medium are installed on a rotor.

6. A casting and rolling plant in accordance with
10 Claim 4 or Claim 5, wherein several rotors with nozzles for pressure medium mounted on the periphery of the rotor are arranged in a row transverse to the direction of travel of the cast strand or strand of rolling stock.

7. A casting and rolling plant in accordance with
15 any of Claims 4 to 6, characterized by the use of the rotary descaling device in a hot-strip rolling train with seven or more finish rolling stands before entry into the first finish rolling stand.

8. A method for producing hot-rolled metal strip
20 substantially as herein described with reference to the accompanying figures.

Figure 3.

KEY:

Kokillengeschwindigkeit = mold speed

Schmiermittelausdehnung = lubricant expansion

Gießgeschwindigkeit = casting speed

Druck = pressure

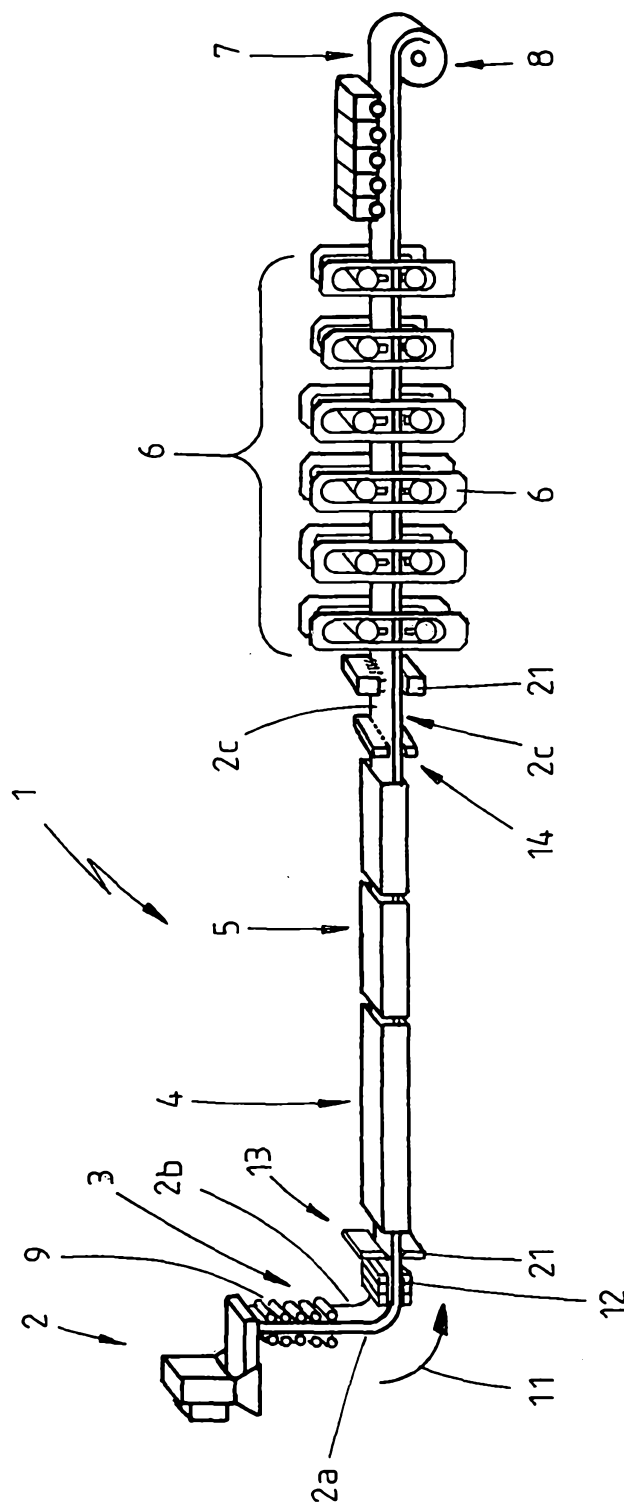


FIG. 1

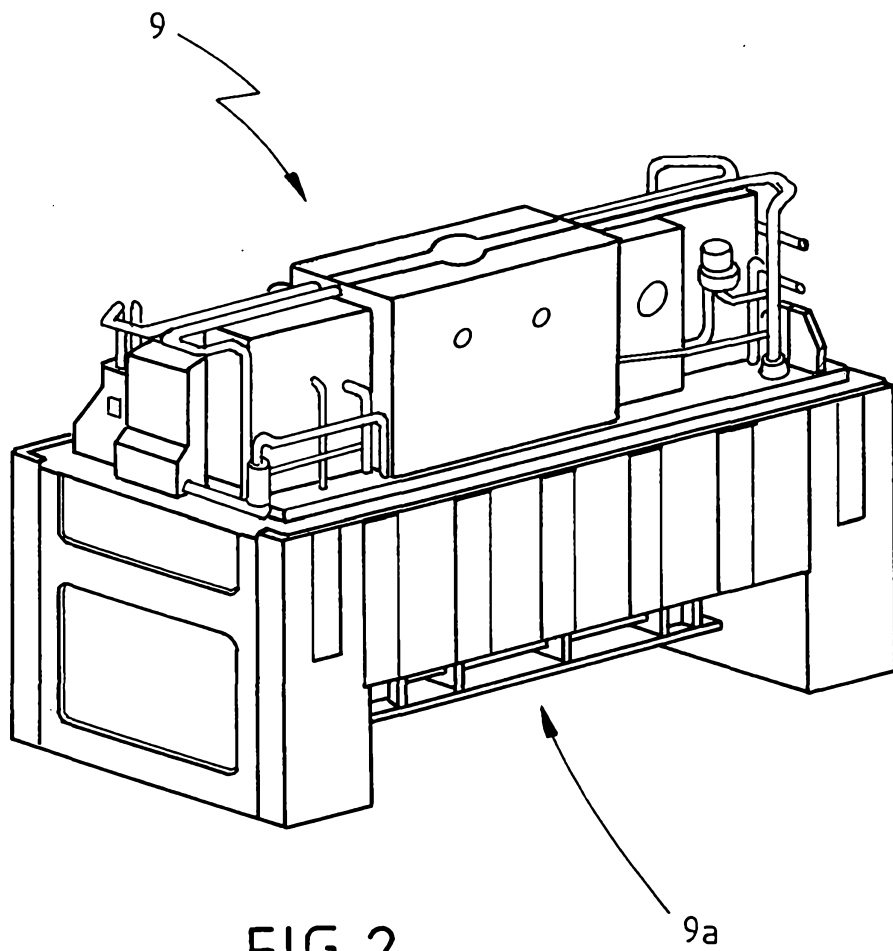


FIG. 3

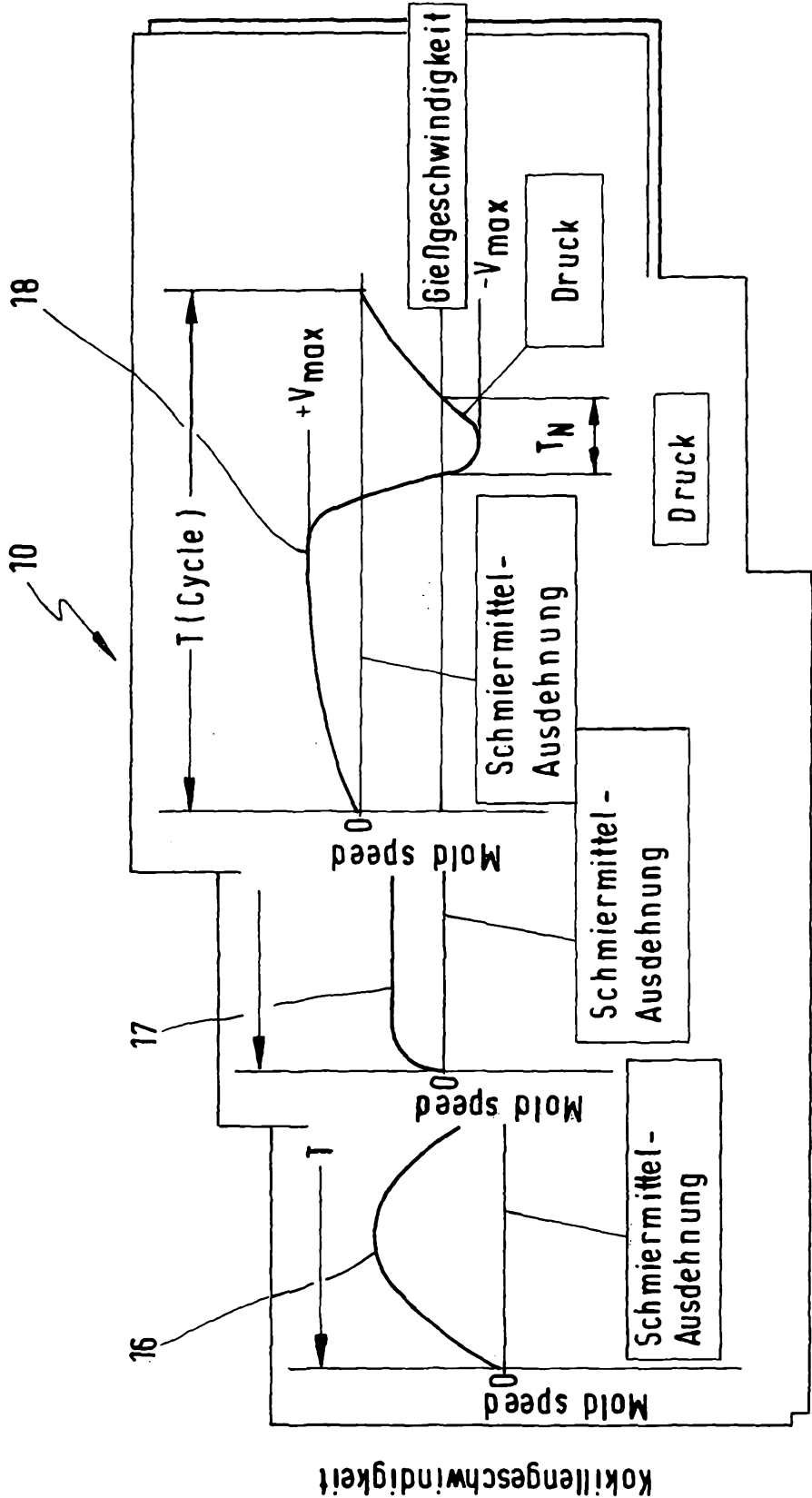


FIG. 4

