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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
9 July 2015 (09.07.2015)

WIPO | PCT

(10) International Publication Number
WO 2015/102502 A1

(51) International Patent Classification:
E06B 11/02 (2006.01) *E05F 15/673* (2015.01)

(21) International Application Number:
PCT/PL2014/000163

(22) International Filing Date:
30 December 2014 (30.12.2014)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
P.406783 3 January 2014 (03.01.2014) PL
P.410784 29 December 2014 (29.12.2014) PL

(72) Inventors; and
(71) Applicants : **KUHNL-KINEL, Jacek** [PL/PL]; ul.Jaworowska 2, PL-05-510 Konstancin-Jeziorna (PL). **WOJCIECHOWSKI, Piotr** [PL/PL]; ul.Rowickiego 1, PL-96-313 Budy-Grzybek (PL).

(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, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, 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, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, 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, 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))*

(54) Title: GATE WITH COUNTERWEIGHT AND LOWERING EXCHANGEABLE SPAN

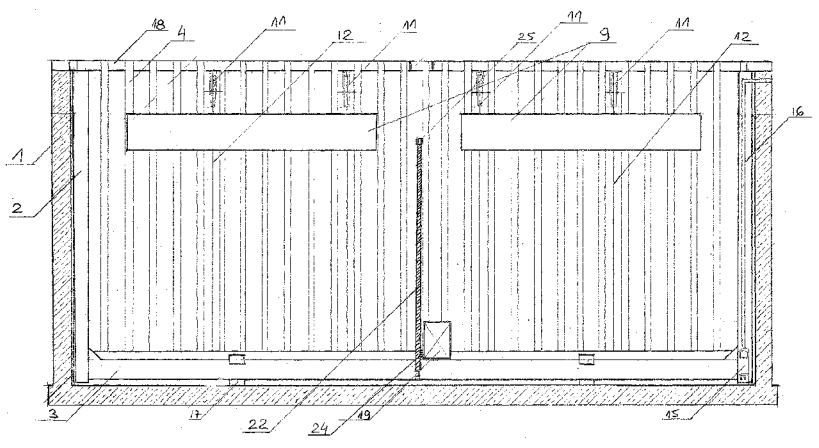


Fig. 1

(57) Abstract: The gate has an exchangeable span (4) that is fixed to the load bearing beam (3) and is connected with pulley bearings (11) and rope-slings (12) to the system of adjustable counterweights (9). The drive system is fitted with an electric drive (19) with a worm-wheel (24) mounted to the load bearing beam (3) that travels vertically along the worm (22). The beam, span and the drive travel on adjustable guiderails (2) inside a reinforced concrete pit (1) in the direction opposite to that of counterweights (9). The load bearing beam (3) is fitted with rollers (5) and retaining rollers mounted to the cover (18). Emergency (manual) operation of the gate is possible by turning a crank handle connected with the worm (22), having released the lock that prevents the worm from rotating on its axis.

WO 2015/102502 A1

Gate with counterweight and lowering exchangeable span

The subject of the invention is a gate with counterweight and lowering exchangeable span driven by a worm drive system, that as a whole make up a gate.

Gates are commonly found as either single or double swing or as sliding gates. Single or double swing gates have wings that rotate on hinges that are fixed to fence posts or other parts of fencing. Sliding gates slide along a track or are suspended along the length of the fence. Very rarely do you find gates that lower into a cavity. Such gates move vertically along guide posts that normally extend above ground level. All varieties of gates can be fitted with elements of automation that allow them to be remotely opened and closed. Some of the automation elements are an actuator that is a drive system for the gate and a remote control device that allows the actuators to be activated remotely. The automation elements are fitted with protection devices that safeguard people and property from being accidentally damaged by the operation of the gate drive system.

The inconvenience of swing and sliding gates is the necessity to have appropriately sufficient space in front of the gate or alongside the fence to open the gate, however gates that lower into a cavity do not require this space to operate.

Solutions that are known to technically allow span gates to lower into a cavity in the ground are used for gates that are quite low (up to 1.5m) and are also not very wide. These type of gates require guide posts that protrude above ground level to a height that is at least the same as the height of the span. Additionally, due to limitations in the space dedicated for the fitment of the

actuators that move the span, the actuators have a limited lifting force, and consequently it is not possible to lift spans that have a very large mass. It is not without significance that the majority of existing span gates which lower into a cavity in the ground require access shafts with a ladder to install and maintain the gates, making the emergency operation very difficult if not impossible without a heavy handling equipment. The solutions that have been used in the gates to date do not allow for the use of any type of span that is tailor made to the individual taste of the Customer, neither are they easy to be changed once installed. In the majority of cases, it becomes very complicated to change the existing type of gate (i.e. a swing or sliding gate) to a gate with a span that lowers into a cavity, when the same span is to be reused.

These inconveniences are not present in the invention "Gate with counterweight and lowering exchangeable span".

The unique solution is made up of: a reinforced concrete pit, where all of the mechanical elements of the gate are located, an exchangeable span, connected by a system of catches to a load bearing beam, a load bearing beam with mounting slots and catches to the exchangeable span, a set of silent self-adjusting rollers permanently connected to the load bearing beam, two separate guiderails, where sets of rollers connected to the load bearing beam move up, a counterweight with a infinitely adjustable weight, a safe worm drive system. All these elements make up the complete gate.

The reinforced concrete pit is a slot, where the span on the load bearing beam and the counterweights connected with the load bearing beam with a

system of rope-slings move in opposite directions in the guiderails on sets of rollers.

Pulley bearings that hold counterweights hanging off a steel cable are mounted on a crosspiece at the top part of the pit. These crosspieces also serve as the pit geometry stabilizer and as a support for the pit closing covers. The brackets which fix the guiderails in place are mounted in the bottom and the top section of the pit. The guiderails have three-way adjustment. The gate unit is stabilized in the closed position by a set of moving rollers that are below ground level at all times. Additional stabilization is ensured by the set of retaining rollers mounted under the gate cover and which "clasp" around the span.

The counterweight is made up of concrete or steel weights that travel up and down in the pit as one combined set. The total weight of the counterweight equals the total weight of the load bearing beam, the span and the electric drive with a worm-wheel. This weight may be adjusted by adding or removing weights adequately to mass of the span.

The electric drive with a worm-wheel is permanently fixed to the load bearing beam and moves together with it when the span is lifted / lowered.

Vertical movement of the drive and the span is possible as the worm-wheel turns on the locked worm that is not able to rotate on its axis when the system operates in automatic mode.

In emergency mode (e.g. when there is a power outage or when rollers are blocked) the worm should be unlocked to allow its rotation on its axis. In this mode the worm-wheel is locked and vertical movement of the drive with the span is possible by turning a manual crank handle mounted in the worm socket.

An advantage is that the gate is stabilized in the closed position by adequately selected set of counterweights, stabilising rollers and the drive firmly connected with the vertically mounted worm. All these allow for the total elimination of any guides that protrude above ground level.

An advantage is that the gate can be fitted with a span of any weight as it is possible to precisely adjust the weight of the counterweight.

An advantage is that the load bearing beam and the system of catches and locks provides full flexibility for span configurations, heights and widths.

An advantage is that lifting and lowering of the gate is executed through electric drive system with worm-wheel and vertically mounted worm that allows for manual lowering and lifting of the gate when a lock is released.

An advantage is that the load bearing beam with exchangeable span is counterbalanced by counterweights in such a way so that the gate is neutrally balanced in any position.

An advantage is that the drive system allows for fast lowering and lifting of the span at 17-20 metres per minute, which combined with the fact that the gate opening way is twice as short as for standard sliding gate systems results in the total time of gate opening/closing reduced by several times. This makes also possible to use the gate for pedestrian access onto a property.

An advantage is that all of the key drive and control systems are located in a safe and dry zone of the reinforced concrete pit that ensures easy access for maintenance.

An advantage is that a sump pump for dirty water fitted with an automatic start and stop switch pumps out water directly from the bottom of the pit, where it collects.

An advantage is that the system of adjusted counterweights makes the gate have a small inertia that allows for the gate mechanism to be stopped quickly in the event that any unwanted obstacle is detected, thus ensuring a high level of safety.

An advantage is that the use of a set of pulley bearings with a plastic shield on the rings ensures silent movement of the beam and span along the length of the pit.

An advantage is that at the bottom of the pit, a safety end stop made of metal and rubber is installed. Due to the precise selection of the lengths of the cables that connect the counterweight to the beam, the beam stops at the minimum distance from the rubber end when in the lowered position. On the other hand, in the lifted position, the counterweight is at the minimum distance from the rubber end that makes the system safe.

An advantage is that the drive system is fitted with an integrated optical detection system, precise limit switches, circuit-breakers, warning lights and sirens, and radio-wave control.

The invention will now be described solely by way of example and with reference to the accompanying drawings in which:

fig. 1 is a longitudinal elevation of the gate,

fig. 2 is a plan view of the gate,

fig. 3 is a side elevation of the gate, the load bearing beam in lifted position, typical span and the drive system shown,

fig. 4 is a part of the plan view of the gate, worm lock and crank handle socket shown,

fig. 5 is a part of the elevation of the gate span crosspiece, pulley bearing and counterweight,

fig. 6 is a part of the side elevation of the pit; the worm with lock and emergency mode operation socket, as well as retaining rollers shown.

The main assembly of the gate is a reinforced concrete pit 1. In the pit 1, the guiderail system 2 is mounted for the load bearing beam 3 with the span 4 to move along this. A span of any design is mounted and fixed mechanically or by welding to the universal load bearing beam 3. Soft and silent operation is ensured by the use of rollers 5 and retaining rollers 21.

Due to the use of a set of counterweights 9 with a weight that is adjustable by the addition or removal of weights, any span 4 and load bearing beam 3 may be stabilized in a neutrally balanced position. As a result it is possible to manually operate the system in any position of the gate.

The operation cycle of the gate is executed with the use of an electric drive 19 with a worm-wheel 24 that is mounted to the load bearing beam 3 with screws and connected to the worm 22. Rotation of the worm on its vertical axis is disabled with the lock 26. A manual mode is activated by placing a crank handle in the worm socket 25 and release of the lock 26 on the worm 22. This enables the worm to rotate on its vertical axis. The span may be lifted or lowered by turning a crank handle in the proper direction.

In order to reactivate the automatic mode, the worm must be locked and crank handle removed from the worm socket.

The set of counterweights 9 is fixed to the bottom of the load bearing beam with catches 10, rope-slings 12 and pulley bearings 11. Additionally, in the

pit 1 a sump pump 15 is installed with a control system and pipework 16 to drain the water from the pit 1. At the bottom of the pit 1 a safety end stops 17 made of metal and rubber are installed to protect the load bearing beam 3 and the counterweight 9 in the case of uncontrolled drop. A system of covers 18 supported on crosspieces 23 ensures the safety of operation in the area where the pit 1 and the span 4 meet. These covers have holes that match the type of span that is used.

The drive system is fitted with a system of electrical connections that are not shown in the figures (to make them easier to read), audible signals and warning lights, and a control system with radio signal receivers and an optical detection system.

The described invention has a wide range of uses as a vehicle entrance/exit gate onto/from a property where due to space constraints or for more aesthetic reasons, the use of a traditional single swing, double swing or sliding gate is not recommended. Another place where the described gate can be installed is any industrial, military, healthcare establishment or ambulance depot whatsoever, where the nature of operations requires the minimum opening/closing time of the gate in either automatic or emergency mode. Fast and easy mode change from automatic to emergency mode, and vice versa, is not negligible here as this allows for manual operation of the gate from either side of it by physically weaker persons. This unique feature of the invention, namely the very short time required to fully open and close the gate, also allows for it to be used as a remotely controlled pedestrian access gate. Also relatively easy exchange of the span is not negligible here as this gate is useful for all types of

fences exposed to frequent damage, or where the look and arrangement changes periodically (e.g. at themed exhibitions, fencing for fairs). As design of the spans may be chosen freely it provides a lot of room to manoeuvre for designers of modern, innovative, pioneering facilities. The above described invention will make it possible for them to further enhance their designs by the incorporation of, for example, "invisible" glass gates.

Claims

1. A gate with counterweight and lowering exchangeable span equipped with two vertical guiderails permanently connected with a reinforced concrete pit, load bearing beam with rollers, drive system, counterweight system, control system, characterised in that inside the reinforced pit (1) there is a span (4) that is embedded on the load bearing beam (3), equipped with sets of rollers (5) that is unweighted by counterweights (9).
2. The gate according to claim 1 characterized in that it has an electric drive (19) mounted with screws to the load bearing beam (3) with a worm-wheel (24) and a worm (22) that is located inside of the reinforced concrete pit (1).
3. The gate according to claim 1 characterized in that the worm (22) is mounted vertically under the system of covers (18), and is locked with the lock (26) in automatic mode.
4. The gate according to claim 1 characterized in that the worm (22) is fitted with a socket (25) for a crank handle.
5. The gate according to claim 1 characterized in that it is fitted with a set of crosspieces (23) with pulley bearings (11) attached, and where rope-slings (12) that connect the system of counterweights (9) with the load bearing beam (3) as fastened with catches (10) run through such pulley bearings.
6. The gate according to claim 1 characterized in that the load bearing beam (3) has mounting slots for grub screws that fix the span (4) to it.
7. The gate according to claim 1 characterized in that the sump pump (15) is located in the slot at the bottom of the reinforced concrete pit (1).

8. The gate according to claim 1 characterized in that the vertical guiderails (2) are fixed to the reinforced concrete pit (1) with steel angle brackets adjustable in three dimensions.

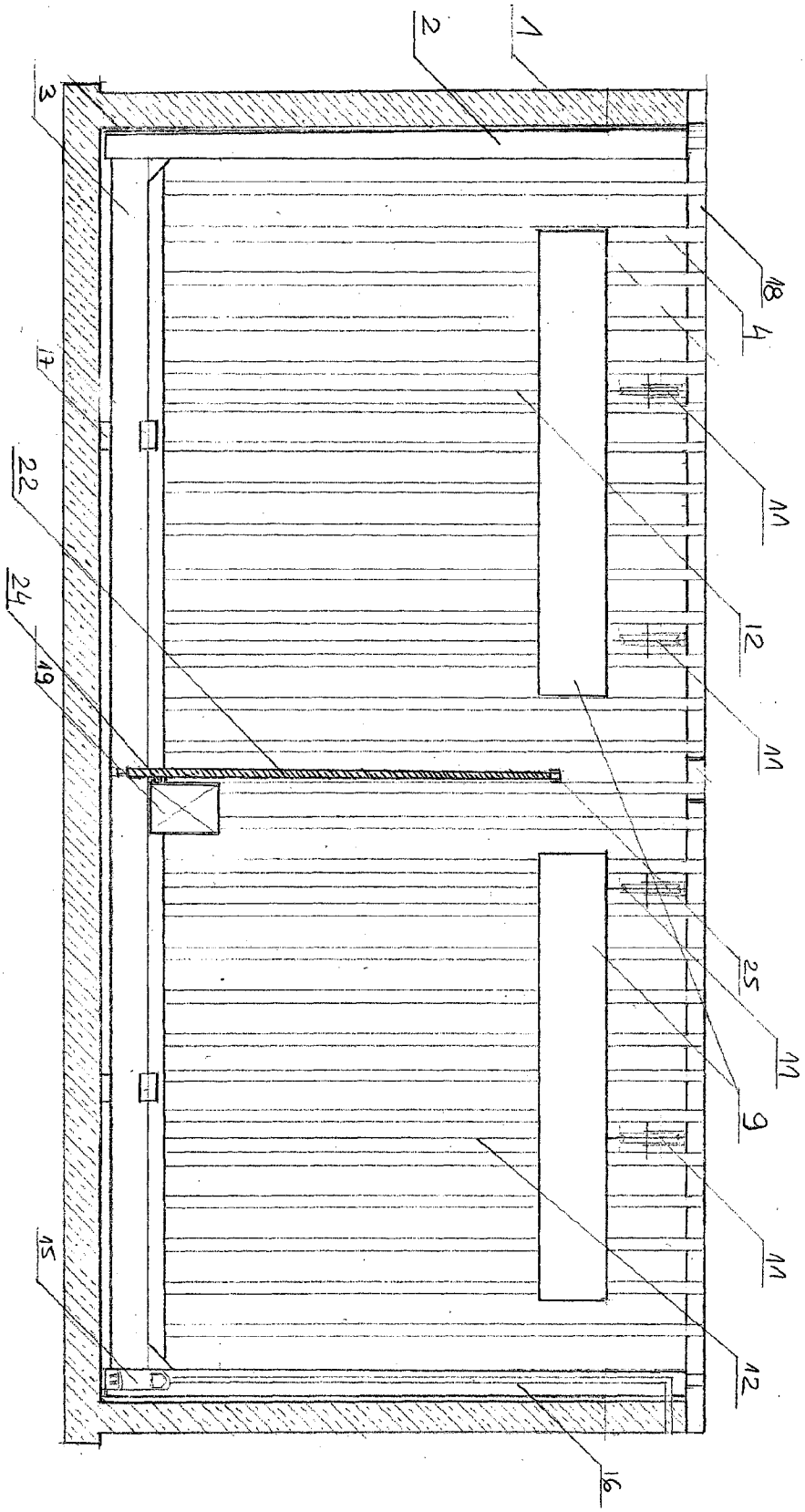


Fig. 1

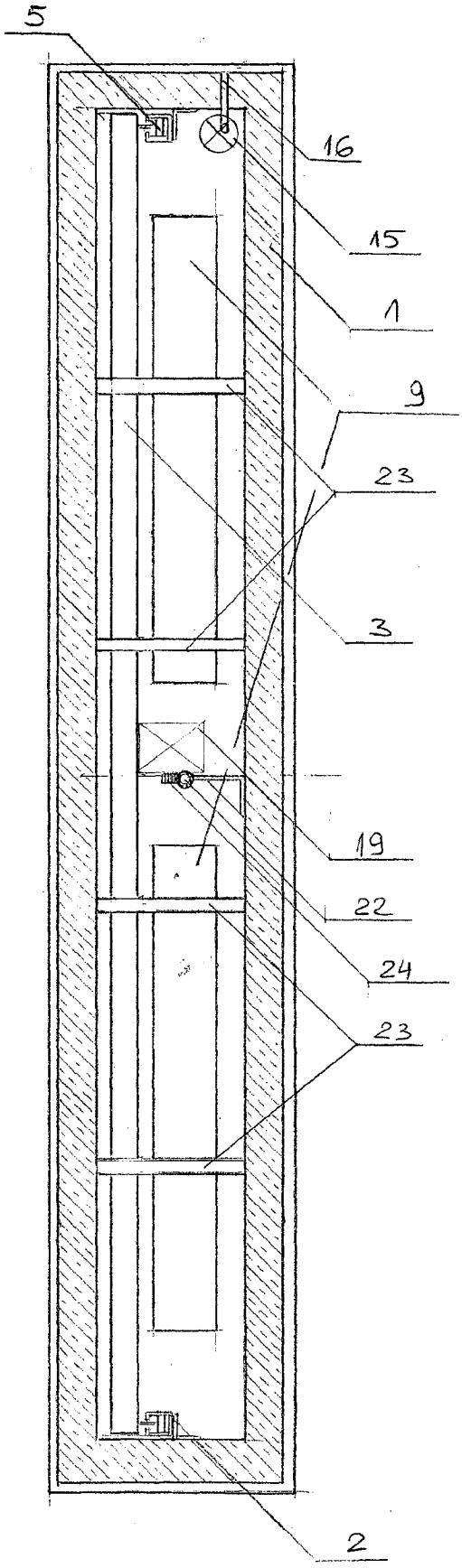


Fig. 2.

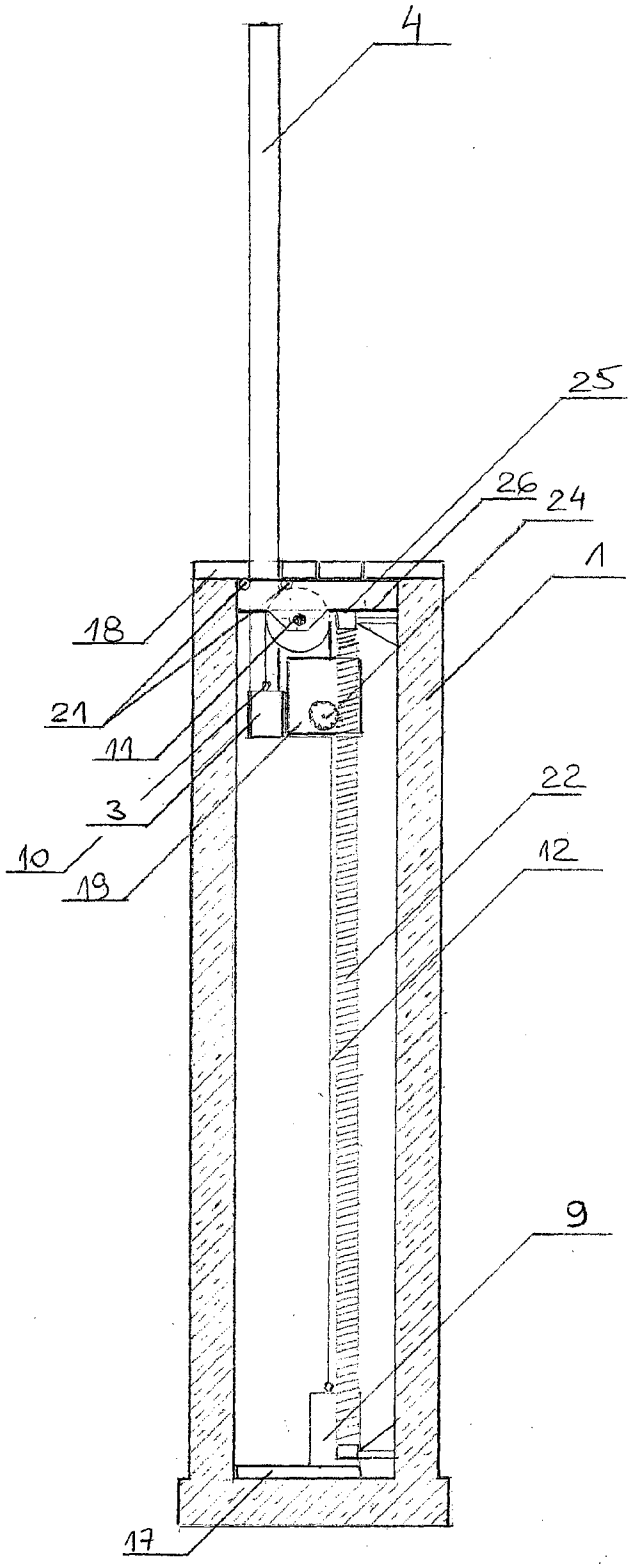


Fig. 3

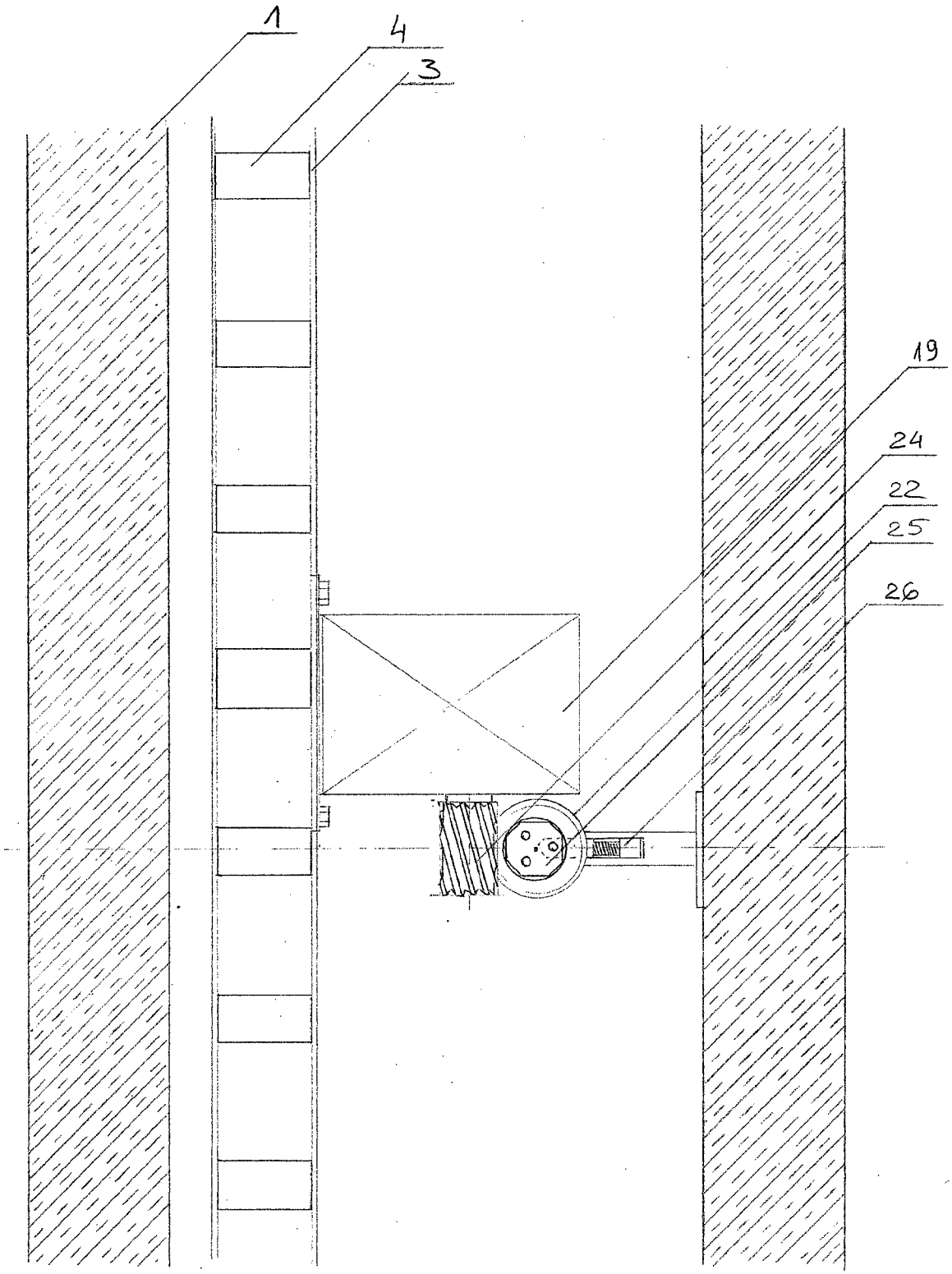


Fig. 4

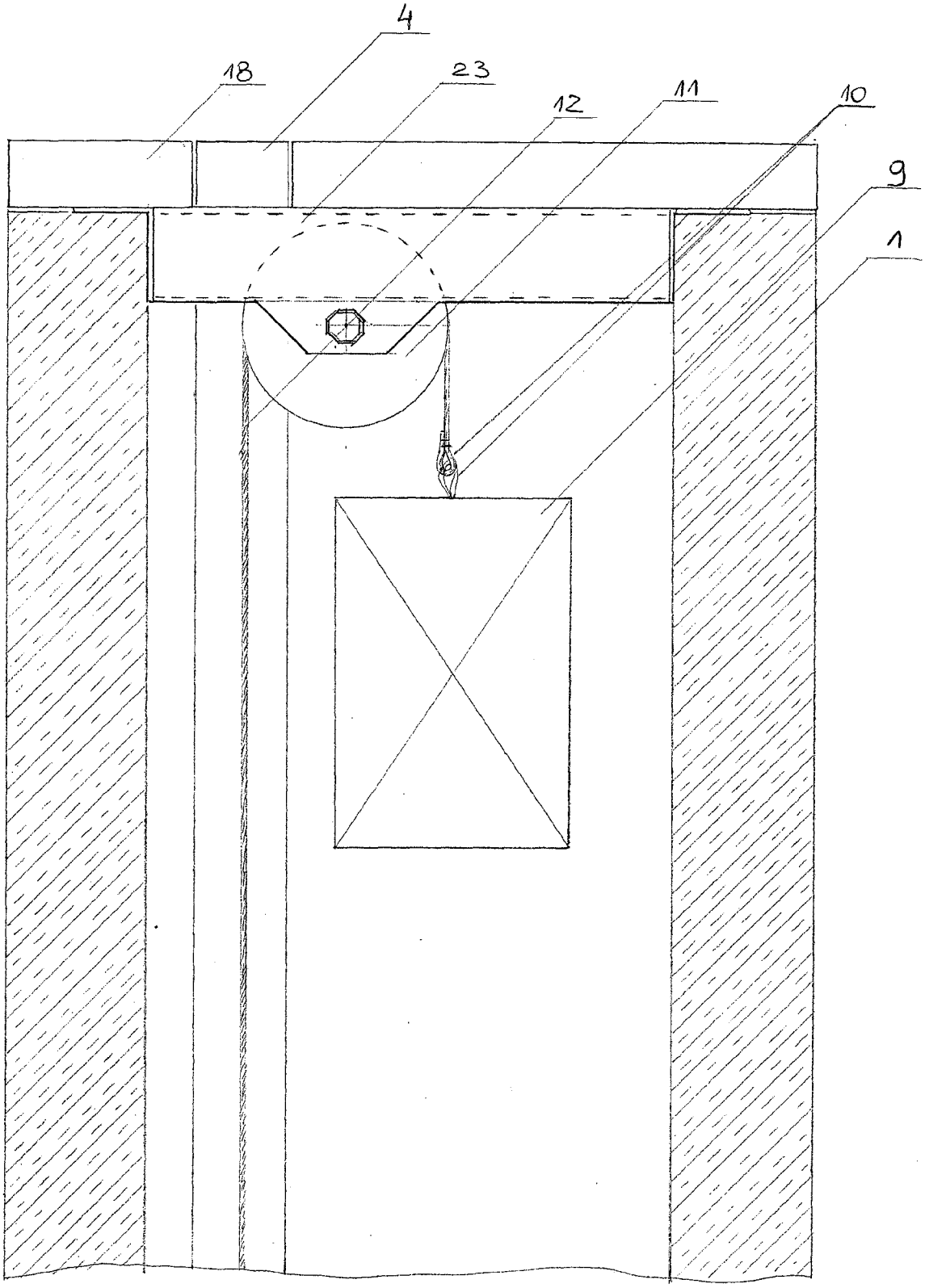


Fig. 5

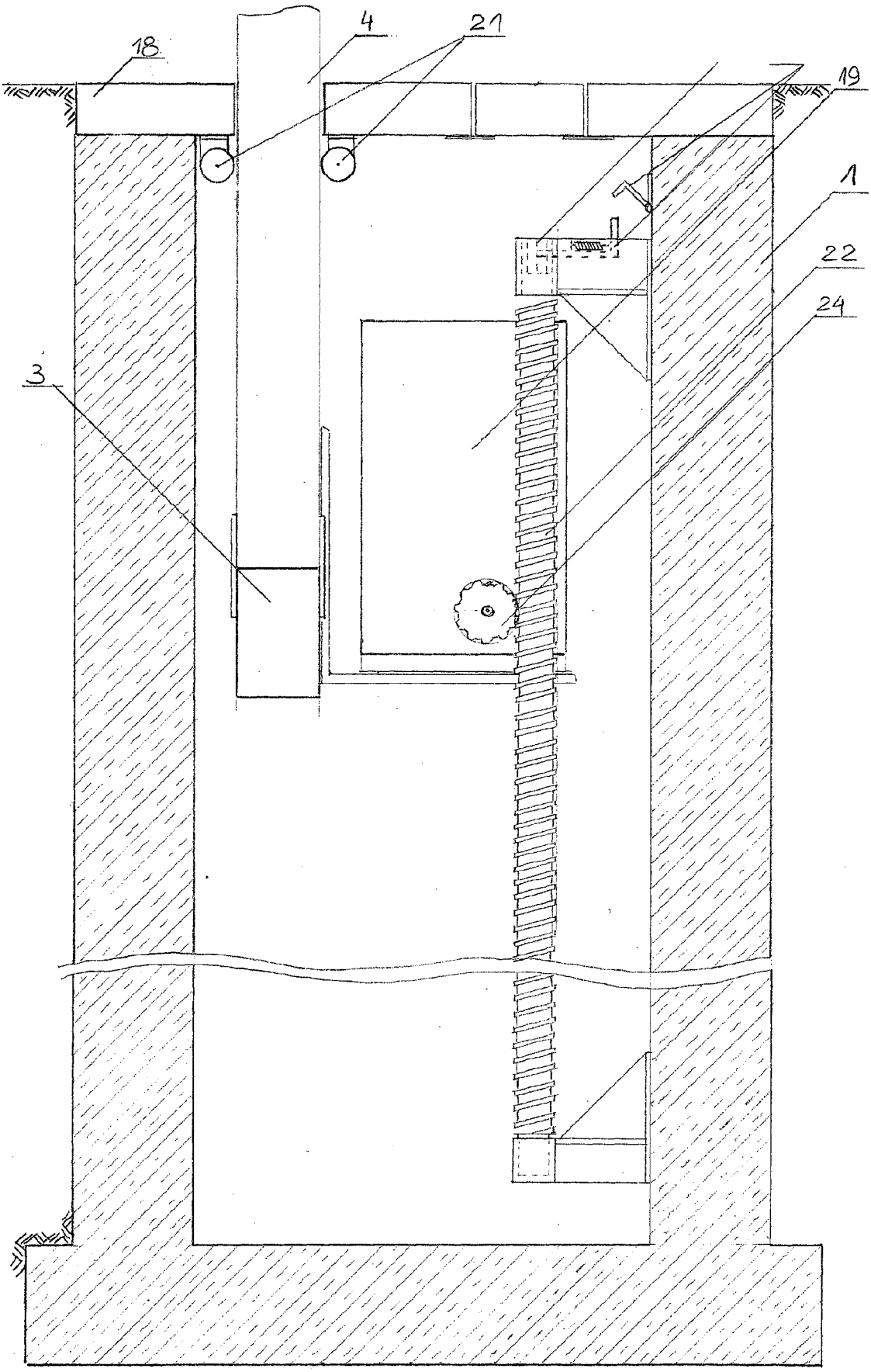


Fig. 6.

INTERNATIONAL SEARCH REPORT

International application No
PCT/PL2014/000163

A. CLASSIFICATION OF SUBJECT MATTER
INV. E06B11/02 E05F15/673
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E06B B61L E01F E05F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	AT 8 630 U1 (NEUBACHER HERBERT [AT]) 15 October 2006 (2006-10-15)	1,3-8
Y	figure 1	2

Y	DE 10 2008 042979 A1 (BOSCH GMBH ROBERT [DE]) 3 September 2009 (2009-09-03) figure 3	2

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 March 2015	09/04/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Cobusneanu, D

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/PL2014/000163

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
AT 8630 U1	15-10-2006	NONE	
DE 102008042979 A1	03-09-2009	NONE	