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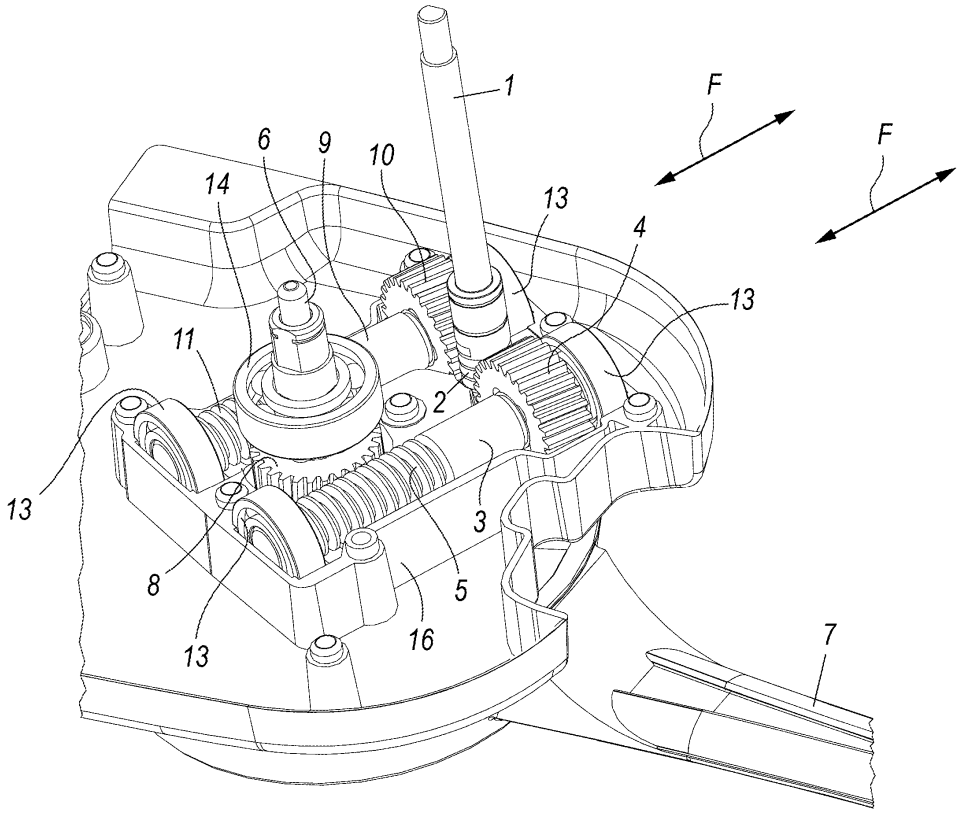
(71) Applicant: **Cavalieri Ducati, Lorenzo**
20061 Carugate (MI) (IT)

(72) Inventor: **Cavalieri Ducati, Lorenzo**
20061 Carugate (MI) (IT)

(74) Representative: **Ripamonti, Enrico**
Giambrocono & C. S.p.A.,
Via Rosolino Pilo, 19/B
20129 Milano (IT)

(54) Door opening or gate opening device with simplified mechanical transmission

(57) A door opening or gate opening device comprising a first drive shaft (1) adapted to be connected to a motor, a first worm (2) fitted to said first drive shaft (1), a second drive shaft (3) adapted to receive motion from said first drive shaft (1), a first toothed wheel (4) fitted to said second drive shaft (3) and meshed with the first worm (2) to receive motion therefrom, a second worm (5) located on the second drive shaft (3), a third drive shaft (6) connected to a gate opening arm (7), a second toothed wheel (8) fitted to said third drive shaft (6) and meshed with the second worm (5) to receive motion therefrom, said device comprising a fourth drive shaft (9), adapted to receive motion from the first drive shaft (1) and to transmit it to the third drive shaft (6).



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Description

[0001] The present invention relates to a door opening or gate opening device according to the preamble of the main claim.

At the current state of the art, doors or gates with automatic opening use a reduction gear which transmits the motion of an electric motor to a gate-opening arm. The transmission ratio is relatively high, as the fast movement of the motor must be translated into a relatively slow movement of the gate-opening arm. The dimension of the teeth and the diameter of the gear wheels used in the reduction gear is relatively high to allow transmission of the force necessary to open and close a gate which may also be heavy.

[0002] A problem of current door opening or gate opening devices is that this reduction gear is somewhat cumbersome and heavy. Moreover, in current devices a relatively powerful, and therefore costly, motor is necessary.

An object of the present invention is therefore to produce a device that allows the aforesaid drawbacks to be overcome, a particular object is to produce a door opening or gate opening device of small dimensions.

Another object of the present invention is to produce a door opening or gate opening device which allows the use of a less powerful motor.

[0003] Said objects are achieved by a door opening or gate opening device whose novel features are set forth in the appended claims.

The invention will be better understood from the following detailed description, provided purely by way of non-limiting example, of an embodiment illustrated in the sole figure, which shows a perspective view of the door opening or gate opening device.

[0004] To avoid repetition, hereafter the device according to the invention will be referred to as gate opening device, although it is evident that it can also be used for opening doors and gates with one or two wings or the like.

In gate opening devices currently available on the market, the gate opening arm performs a rotation of 90°, to take the gate from a closed position to an open position or vice versa. It is normally connected to a vertical shaft, fitted to which is a toothed wheel, which receives motion from an electric motor through a mechanical reduction device. Therefore, this toothed wheel only operates along a 90° arc and is thus under-used. The present invention achieves the desired results by splitting the transmission and transmitting the force to two opposed points of this toothed wheel. This allows the use of a smaller toothed wheel and a reduction in the overall dimensions of the gate opening device.

[0005] With reference to the embodiment shown in the figure, it can be seen that this gate opening device comprises a first drive shaft 1 adapted to be connected to a motor (not represented for simplicity), a first worm 2 fitted to -or however coaxially mounted on- said first drive shaft 1, a second drive shaft 3 adapted to receive motion from said first drive shaft 1, a first toothed wheel 4 fitted to -or however coaxially mounted on- said second drive shaft 3 and meshed with the first worm 2 to receive motion therefrom, a second worm 5 located on the second drive shaft 3, a third drive shaft 6 connected to a gate opening arm 7, a second toothed wheel 8 fitted to -or however coaxially mounted on- said third drive shaft 6 and meshed with the second worm 5 to receive motion therefrom. The second drive shaft 3 is side by side with a fourth drive shaft 9, adapted to receive motion from the first drive shaft 1 and to transmit it to the third drive shaft 6. Preferably but not necessarily the rotation axes of the two shafts 3, 9 are substantially parallel one with another.

[0006] A third toothed wheel 10 is fitted to -or however coaxially mounted on- said fourth drive shaft 9 and meshed with the first worm 2 to receive motion therefrom, while a third worm 11 is located on said fourth drive shaft 9 and meshed with said second toothed wheel 8 to transmit motion thereto. Preferably but not necessarily the rotation axes of the worms 5, 11 are substantially parallel one with another. The bearings 13 allow a rotating coupling of the second and to the fourth drive shaft 3 and 9. The bearing 14 allows rotating coupling of the third drive shaft 6 located normally to the previous shafts. A box 16 (the top half is not represented in the figure to show the device according to the invention contained therein) houses the gate opening device. The box 16 is made of two metal blocks in which the appropriate housings of the various components of the gate opening device have been produced.

[0007] In order to simplify the costruction, the second and the fourth drive shaft 3 and 9 are preferably identical, as preferably are the first and the third toothed wheel 4 and 10 and the second and third worm 5 and 11. More generally, the transmission ratio between the first worm 2 and the first toothed wheel 4 is preferably equal to the transmission ratio between the first worm 2 and the fourth toothed wheel 10 and, still preferably, the transmission ratio between the second worm 5 and the second toothed wheel 8 is equal to the transmission ratio between the third worm 11 and the second toothed wheel 8. To reduce noise and improve efficiency, the teeth of the first and of the third toothed wheel meshed on the first worm 2 are inclined. The transmission ratio between the first worm 2 and said first and third toothed wheels 4 and 10 is 27: 1. The transmission ratio between said second and third worms 5 and 11 and said second toothed wheel 8 is 27: 1. The overall transmission ratio is 729:1.

[0008] Advantageously the second 3 and fourth drive shaft 9 are mounted on the bearings 13 so as to be able to slide axially back and forth (arrows F) as much as to adapt itself to the manufacture inaccuracies of the first 4 and/or the second 9 and/or the third toothed wheel 10 and/or the first 2 and/or the second 5 and/or the third worm 11, allowing the second 3 and fourth drive shaft 9 to remain simultaneously meshed with the second toothed wheel 8 during operation. Approximately the second 3 and fourth drive shaft 9 can slide axially by at least

one fourth of the pitch of the second toothed wheel 8, and more preferably they can slide by at least half pitch. However preferably the axial sliding of the second 3 and fourth drive shaft 9 is equal to or smaller than the pitch of the second toothed wheel 8. The above mentioned axial slidings allow the various gears of the door- or gate opening device be manufactured with no need of unduly strict tolerances, and hence with reasonably limited manufacturing costs. However the axial sliding of of the two shafts 3, 9 can be limited by suitable mechanical stops, and the two shafts 3, 9 do not need to be axially preloaded by springs or other elastic components.

[0009] The toothed wheels are made of sintered material and have a pitch circle diameter of 33.75 mm, while the drive shafts are made of C40 steel. The second and the third worm 5, 11 are produced on the second and fourth drive shaft 3, 9, and mesh at diametrically opposed points of the second toothed wheel 8. The first worm 2 is fitted to -or however coaxially mounted with- the first drive shaft 1.

[0010] As it is known, worms allow motion to be transmitted in one direction, but not in the opposite direction. The motor can therefore move the gate, but pressure on the gate cannot move the motor and the device according to the invention.

In the opening or closing movement of the gate opening arms integral with a wing of the gate, the toothed wheel 8 uses two 90° sectors of a circle.

[0011] During operation, the device according to the invention receives motion from an electric motor that rotates the first drive shaft 1, on which the first worm 2 is located. The motion is transmitted to the first and to the third toothed wheel 4 and 10 with a transmission ratio of 27:1. Said toothed wheels rotate the respective drive shafts 3 and 9 with the respective worms 5 and 11, which transmit motion to second toothed wheel 8 which, fitted to the third drive shaft 6, moves the gate opening arm 7.

[0012] Due to the fact that the line of force transmission is split between the second and fourth drive shaft, the toothed wheels can have lower diameters and modules and the gate opening device can be more compact.

This also allows the use of motors with lower power with respect to those currently used.

Claims

1. A door opening or gate opening device comprising a first drive shaft (1) adapted to be connected to a motor, a first worm (2) driven by said first drive shaft (1), a second drive shaft (3) adapted to receive motion from said first drive shaft (1), a first toothed wheel (4) integral with or fixed to said second drive shaft (3) and meshed with the first worm (2) to receive motion therefrom, a second worm (5) located on the second drive shaft (3), a third drive shaft (6) connected to a gate opening arm (7), a second toothed wheel (8) integral with or fixed to said third drive shaft (6) and meshed with the second worm (5) to receive motion therefrom, **characterized by** comprising a fourth drive shaft (9), adapted to receive motion from the first drive shaft (1) and to transmit it to the third drive shaft (6).

2. The door opening or gate opening device according to claim 1, **characterized in that** it comprises a third toothed wheel (10) integral with or fixed to said fourth drive shaft (9) and meshed with the first worm (2) to receive motion therefrom.

3. The door opening or gate opening device according to claim 1, **characterized in that** it comprises a third worm (11) located on said fourth drive shaft (9) and meshed with said second toothed wheel (8) to transmit motion thereto.

4. The door opening or gate opening device according to claim 2, **characterized in that** said third toothed wheel (10) is substantially identical to said first toothed wheel (4).

5. The door opening or gate opening device according to claim 3, **characterized in that** said third worm (11) is substantially identical to said second worm (5).

6. The door opening or gate opening device according to claim 4, **characterized in that** said first toothed wheel (4) and said third toothed wheel (10) have inclined teeth.

7. The door opening or gate opening device according to claim 4, **characterized in that** the transmission ratio between the first worm (2) and said first and third toothed wheels (4, 10) is 27:1.

8. The door opening or gate opening device according to claim 5, **characterized in that** the transmission ratio between said second and third worms (5, 11) and said second toothed wheel (8) is 27:1.

9. The door opening or gate opening device according to claim 1, **characterized in that** said second (3) and fourth drive shaft (9) are rotatably mounted so as to be able to slide axially adapting themselves to the manufacture inaccuracies of the first (4) and/or second (8) and/or third worm (11), allowing the second (3) and fourth drive shaft (9) to remain simultaneously meshed with the second toothed wheel (8) during operation.

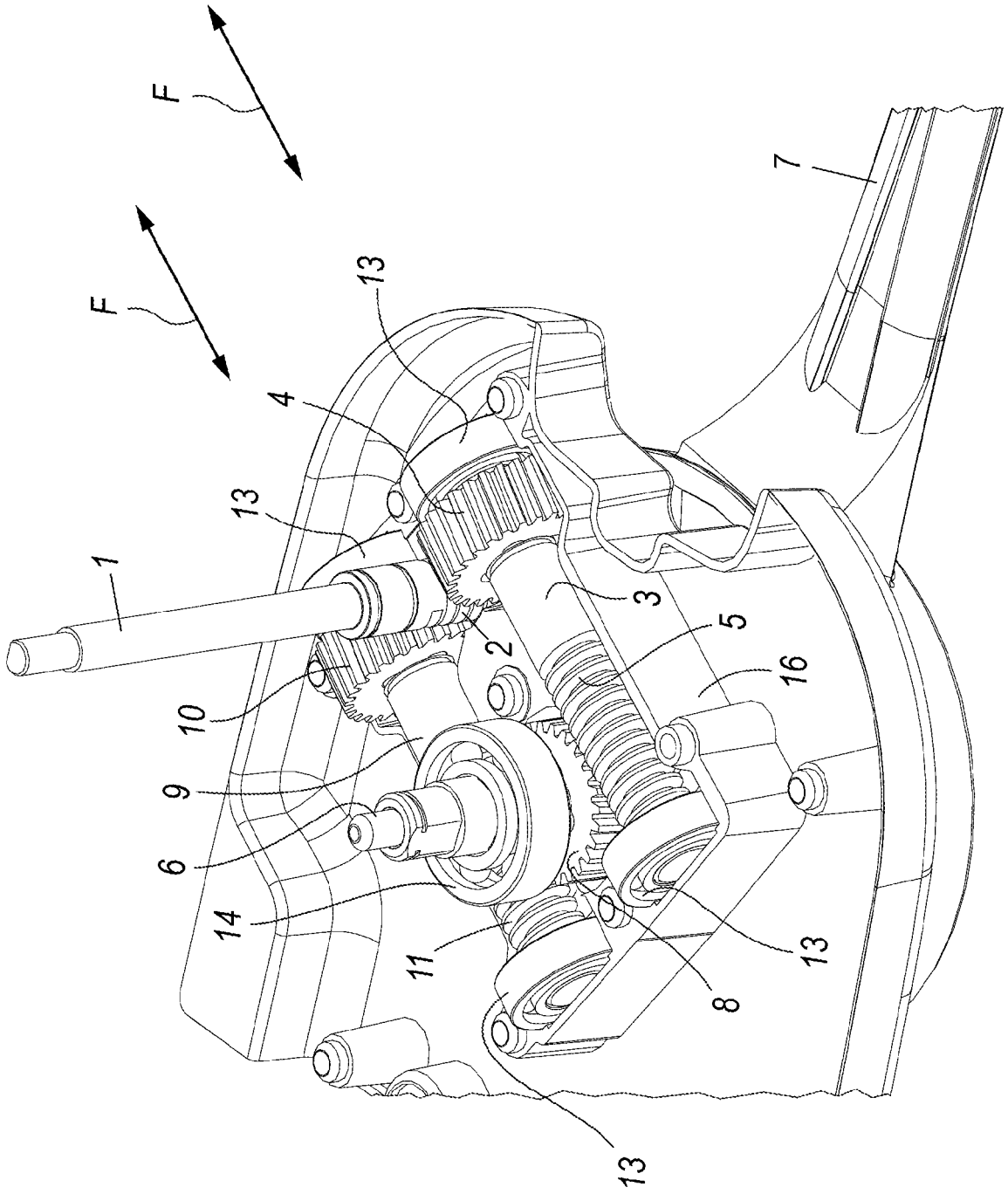
10. The door opening or gate opening device according to claim 9, **characterized in that** the second (3) and fourth drive shaft (9) can slide axially by a maximum travel equal to or greater than one fourth of the pitch of the second toothed wheel (8), optionally equal to

or greater than half of such pitch.

11. The door opening or gate opening device according to claim 10, **characterized in that** the second (3) and fourth drive shaft (9) can slide axially by a maximum travel equal to or smaller than the pitch of the second toothed wheel (8).

12. The door opening or gate opening device according to claim 2, **characterized in that** the transmission ratio between the first worm (2) and the first toothed gear (4) is equal to the transmission ratio between the first worm (2) and the fourth toothed gear (10).

13. The door opening or gate opening device according to claim 1, **characterized in that** the transmission ratio between the second worm (5) and the second toothed gear (8) is equal to the transmission ratio between the third worm (11) and the second toothed gear (8).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EUROPEAN SEARCH REPORT

Application Number
EP 09 17 6590

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 1 235 330 A (CIT ALCATEL [FR]) 28 August 2002 (2002-08-28) * paragraph [0004] - paragraph [0009] * * paragraph [0013] - paragraph [0014]; claims 1-4; figures 1,2 * -----	1-8	INV. E05F15/12
A	US 4 403 449 A (RICHMOND MOSCOW K [US]) 13 September 1983 (1983-09-13) * column 5, line 4 - column 7, line 54; claim 1; figures 1-5 * -----	1-8	
A	DE 10 2005 051722 A1 (ELKA TORANTRIEBE GMBH & CO BET [DE]) 10 May 2007 (2007-05-10) * the whole document * -----	1-8	
			TECHNICAL FIELDS SEARCHED (IPC) E05F H02K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	22 February 2010	Balice, Marco

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 09 17 6590

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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22-02-2010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1235330 A	28-08-2002	DE 10109278 A1	05-09-2002
		US 2002117917 A1	29-08-2002
US 4403449 A	13-09-1983	NONE	
DE 102005051722 A1	10-05-2007	NONE	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82