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OPENING MECHANISM FOR DOOR CLOSER.

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Description

This invention relates to an opening mechanism for a door closer of the type comprising a housing which can be fixedly mounted on a wall and which via a rotatable shaft supports a pivot arm which is connectible to a door or the like and which, when the door is opened, bring about temporary tensioning or compression of a spring mechanism incorporated in said housing, for automatically returning the door to closed position after completion of the opening movement, said opening mechanism comprising a driver which is movable by means of an electric motor via a mechanical transmission back and forth between an inactive position or initial position and an active position and which, on the one hand, when the door is opened manually remains in its inactive position in which it leaves the pivot arm unaffected and, on the other hand, when the motor is energised causes the pivot arm to move for opening the door without the need of any manual actuation of the door.

Background of the invention

Conventional door closers are relatively inexpensive and adequately serve their purpose, i.e. after manual opening of the door bring about automatic closure thereof. Especially serviceable are such modern door closers which have a built-in accelerated closure effect, meaning that the door during its return movement towards closed position initially moves at a moderate speed ensuring a uniform closure process, and finally at a substantially increased speed with a substantially increased force for a short period of time so as to efficiently overcome the resistance produced by locking bolts, friction and such like, thus bringing about a distinct closure of the door at the final stage of the closure process.

For operating doors, use is also made of mechanical door openers, especially on public premises, business premises and the like. By means of these door openers, the door is not only closed but also opened, more specifically by means of some type of remote control system electrically activating a hydraulic assembly associated with the door. The remote control system generally consists of manually operable trigger means placed at a certain distance in front of the door or of photocells which automatically sense if a person is approaching the door and then open it. A common feature of prior art door openers however is that they involve very high manufacturing and installation costs. Another major drawback is that it is impossible after a power failure to manually open the door before a special switch has been manually switched from one state to another. If a panicky situation should arise on premises subjected to a power failure before the door opener has been switched, most unpleasant consequences may result.

Attempts have previously been made to supplement the simple and inexpensive door closer with a special opening mechanism which can be temporarily activated in order to bring about, if desired, mechanical opening of the door against the action of the door closer. Such an opening mechanism of the type stated by way of introduction is previously known from US-A-4,348,835. This known mechanism however suffers from several drawbacks. Thus, the mechanism according to US-A-4,348,835 uses a transmission in the form of two cooperating obliquely cut gears or angular gears, one of which is permanently non-rotatably connected to the shaft of the door closer which serves to rotate and tension a spring arrangement in the door closer when the door is opened, and which causes an arm to pivot, while the other angular gear is connected to a remote-controlled electric motor. In order that the second angular gear when in the normal state should be out of engagement with the door closer, it must be not only rotatable but also axially movable in a manner not described in more detail in the patent. This means that the known construction, if practicable at all, will become most expensive and complex. Moreover, the teeth of the two gears must, on each particular occasion of engagement, be held accurately fitting in with each other, for otherwise both an irritating noise and a delay of the correct engagement will result. Another drawback inherent in the known construction is that the opener operates at a constant speed during the entire opening process unless the motor is controlled in a special manner. It should also be noted that the construction according to US-A-4,348,835 requires a special device for holding the door open during the time required for allowing a person to pass through the door.

Summary of the invention

The present invention aims at overcoming the above-mentioned drawbacks of the opening mechanism known from US-A-4,348,835 by providing an inexpensive opening mechanism which is reliable and operates without affecting the function of the conventional door closer in respect of the above-mentioned accelerated closure effect. According to the present invention, this is achieved in that the driver is adapted to move rectilinearly between its end positions and, when operated, to act on an auxiliary arm rigidly connected to the rotatable shaft and extending at an angle to the rectilinear path of movement of the driver so as to be operated with a relatively large lever arm during the initial stage as well as the final stage of an opening operation, but with a shorter lever arm during an intermediate stage thereof.

Brief description of the accompanying drawings

In the drawings,

FIG 1 is a top plan view of a door closer and an opening mechanism according to the invention applied thereto,

Fig. 2 is a vertical front view of the opening mechanism, and

FIG.3 is a perspective view showing an opening mechanism applied to a door.

Detailed description of a preferred embodiment of the invention

In the drawings, 1 generally designates a door closer comprising in conventional manner a housing 2 which via a rotatable shaft 3 supports a pivot arm 4 in turn articulated to a link arm 5 having an attachment 6 which can be applied to the pivotal door or door leaf. The housing 2 can be applied to the wall surrounding the door or to the door frame, more specifically in the region immediately above the door. The rotatable shaft 3 may advantageously be a through shaft to permit mounting the pivot arm 4 on either of the sides of the housing to make it possible to apply the door closer to both right-hung and left-hung doors. When the door is manually opened, the arm 4 is swung clockwise in Fig. 1 so as to tension or compress, through the rotatable shaft 3, a spring mechanism (not shown) which is incorporated in the housing 1 and which, after completion of the opening movement, causes the door to automatically return to closed position.

To the conventional door closer 1 is added, as special accessory equipment, an opening mechanism according to the invention. This opening mechanism comprises an electric motor 8 mounted on a frame 7, a transmission generally designated 9 and, in this case, two drivers 10, 10'. The drivers 10, 10' advantageously are in the form of wheels or rollers provided with bearings and mounted on a shaft 11 supported by a slide member 12 movable back and forth. More particularly, the slide member 12 is rectilinearly movable back and forth along a guide 13 fixedly mounted on the frame 7. The wheels 10, 10' serving as drivers are adapted to cooperate with a pair of auxiliary arms 14, 14' which are rigidly or non-rotatably connected to one and the same through shaft 3 to which the pivot arm 4 is also rigidly connected. The auxiliary arms 14, 14' extend at an acute angle to the pivot arm 4 and also at an acute angle to the rectilinear path of movement defined by the wheels 10, 10' when the slide member 12 moves along the guide 13.

The electric motor 8, which in practice may be a conventional windscreen-wiper motor, has an output drive shaft 15 provided with a gear rim 16 non-rotatably connected to the shaft. In the illustrated embodiment, the transmission 9 consists of a chain which is passed around the gear rim 16 and one end of which is fixedly connected to the slide member 12 by means of an attachment 17, while the other end of the chain

is fixed to a relatively weak tension spring 18 whose end remote from the chain is fixed to the frame 7 at a point designated 19. To the attachment or member 17 is further fixed one end of a second tension spring 20 whose opposite end is fixed to the frame 7 at a point 21. The second tension spring 20 is advantageously more powerful than the first spring 18. In practice, the motor 8 is suitably controlled by an electronic circuit with a built-in time relay or the like by means of which the drive shaft 15 can be caused first to rotate counterclockwise in Fig. 2, and then remain stationary in a given position for a predetermined period of time and finally caused to rotate in the opposite direction of rotation.

As appears from Fig. 2, the slide member 12 may be guided in a manner known per se along the guide 13 by means of a plurality of balls 22 arranged in an endless configuration.

The opening mechanism now described operates in the following way. If it is desirable to open a door mechanically by means of the inventive opening mechanism, the motor 8 is energised in a suitable manner, for instance by operating a trigger mechanism or the like. The shaft 15 is then caused to rotate counterclockwise in Fig. 2, the portion of the chain 9 extending between the gear rim 16 and the point of attachment 17 imparting to the slide member 12 a rectilinear movement to the left in Fig. 2. The wheels 10, 10' serving as drivers will then entrain the auxiliary arms 14 and cause them to pivot, thereby rotating the shaft 3, such that the pivot arm 4, together with the associated link arm 5 is also caused to pivot for opening the door. The movements of the slide member and the drivers 10, 10' between the two opposite end positions may in practice be determined by two limit switches 23, 24, the distance therebetween being selectable so that the mechanism opens the door e.g. to a position at 90° to the closed position. When the door has been opened, e.g. through 90°, the motor 8 is stopped and is allowed to remain stationary for a suitable period of time, for instance 5-30 seconds, whereupon it is reversed so that the drive shaft is rotated clockwise in Fig. 2. The tension spring 20 acting as return spring will then return the slide member 12 to the initial position shown in Fig. 2. During both the forward movement and the return movement of the slide member, the spring 18 ensures that the chain passing around the gear rim 16 is held properly stretched. Advantageously, the speed of rotation of the drive shaft 15 of the motor is so selected that the driver wheels 10, 10' move faster than the auxiliary arms 14, such that the driver wheels leave their engagement with the auxiliary arms as soon as the return movement of the slide member is started. In this manner, the ordinary closure characteristics of the door closer 1 remain unaffected by the driver wheels, whereby the accelerated closure effect integrated in the door closer is automatically provided at the end of the door closing

process without any interference from the driver wheels. Another advantage of the opening mechanism now described is that the opening movement becomes relatively smooth in both the initial stage and the final stage, but faster during the intermediate stage, since the driver wheels 10, 10' during their rectilinear movement act on the auxiliary arms 14, 14' with a relatively large lever arm during the initial stage and the final stage, whereas with a shorter lever arm during the intermediate stage when the auxiliary arms in fact extend at nearly 90° to the rectilinear path of movement of the driver wheels.

If a person who is to pass through the door does not wish to use the opening mechanism, the two driver wheels 10, 10' remain in their inactive positions or initial positions according to Figs. 1 and 2, and manual opening of the door in entirely conventional manner entails that the spring mechanism in the housing 1 is compressed for subsequent automatic closure of the door. This can be achieved since the auxiliary arms 14, 14', in connection with manual opening of the door, simply leave their engagement with the driver wheels 10, 10' and passively accompany the shaft 3 during the rotary movement thereof.

As compared to the opening mechanism known from US-A-4,348,835, the inventive opening mechanism is most inexpensive and, in combination with the also inexpensive door closer, offers an economically very competitive alternative to the conventional door opener. It may be pointed out that the inventive opening mechanism not only can be designed as a separate accessory unit which can be mounted on an existing door closer, but also can be designed as an integrated part of the door closer.

It goes without saying that the mechanism can be modified in many different ways. Although it is preferred to provide it with two driver means and two auxiliary arms (producing a distributed action of force on the opposite sides of the slide member), it is conceivable to provide the mechanism with one such means only. Further, it may consist of a projection other than a wheel.

Claims

1. Opening mechanism for a door closer of the type comprising a housing (2) which can be fixedly mounted on a wall and which via a rotatable shaft (3) supports a pivot arm (4) which is connectible to a door or the like and which, when the door is opened, brings about temporary tensioning or compression of a spring mechanism incorporated in said housing, for automatically returning the door to closed position after completion of the opening movement, said opening mechanism comprising a driver (10, 10') which is movable by means of an electric motor (8) via a mechanical transmission (9) back and forth between an inactive position or initial position and an active position and which, on the one hand, when the door is opened manually remains in its inactive position in which it leaves the pivot arm (4) unaffected and, on the other hand, when the motor (8) is energised causes the pivot arm to move for opening the door without the need of any manual actuation of the door, **characterised** in that the driver (10, 10') is adapted to move rectilinearly between its end positions and, when operated, to act on an auxiliary arm (14, 14') rigidly connected to said rotatable shaft (3) and extending at an angle to the rectilinear path of movement of the driver so as to be operated with a relatively large lever arm during the initial stage as well as the final stage of an opening operation, but with a shorter lever arm during an intermediate stage thereof.
2. Opening mechanism as claimed in claim 1, **characterised** in that the driver is in the form of a wheel (10) adapted to roll along the auxiliary arm (14) executing a pivotal movement.
3. Opening mechanism as claimed in claim 1 or 2, **characterised** in that the driver or driver wheel (10) is provided on a slide member (12) movable back and forth along a guide (13) fixedly connected to the housing (2).
4. Opening mechanism as claimed in claim 3, **characterised** in that the slide member (12) comprises two driver wheels (10, 10') adapted to operate a pair of auxiliary arms (14, 14') provided at opposite ends of a rotatable shaft (3) known per se, which extends through the housing (2).
5. Opening mechanism as claimed in any one of the preceding claims, **characterised** in that the driver (10) is adapted during its return movement from the active end position back to the initial position to move faster than the auxiliary arm (14) of the door closer, whereby the ordinary closing characteristics of the door closer remain unaffected by the driver.
6. Opening mechanism as claimed in any one of claims 3-5, **characterised** in that the transmission comprises a chain (9) passed around a gear rim (16) on the output drive shaft (15) of the motor (8) and having opposite ends, one of which is connected to the slide member (12) and the other to a first tension spring (18), a second tension spring (20) serving as return spring for returning the slide member (12) to the initial position.
7. Opening mechanism as claimed in any one of the preceding claims, **characterised** in that it is in the

form of accessory equipment which can be mounted on an existing door closer of a type known per se or of any optional type.

Patentansprüche

1. Öffnungsmechanismus für einen Türschliesser mit einem Gehäuse (2), das fest an einer Wand montiert werden kann und das über eine drehbare Achse (3) einen Schwenkarm (4) trägt, der mit einer Tür o.dgl. verbindbar ist und beim Öffnen der Tür dazu dient, einen im Gehäuse eingebauten Federmechanismus zeitweilig zu spannen oder zusammenzudrücken, damit die Tür nach vollendeter Öffnungsbewegung automatisch in die geschlossene Position zurückgeführt wird, wobei der Öffnungsmechanismus einen Mitnehmer (10, 10') umfasst, der mittels eines Elektromotors (8) über eine mechanische Transmission (9) hin und zurück zwischen einer inaktiven Position oder Ausgangsposition und einer aktiven Position bewegbar ist, und der einerseits beim Öffnen der Tür mit der Hand in seiner inaktiven Position bleibt, in welcher er den Schwenkarm (4) unbeeinflusst lässt, und andererseits beim Erregen des motors (8) den Schwenkarm bewegt, um die Tür ohne Betätigung mit der Hand zu öffnen, dadurch **gekennzeichnet**, dass sich der Mitnehmer (10, 10') geradlinig zwischen seinen Endpositionen bewegt und bei Betätigung auf einen Hilfsarm (14, 14') einwirkt, der mit der drehbaren Achse (3) starr verbunden ist und sich im Winkel zur rechtlinigen Bewegungsbahn des Mitnehmers erstreckt, um während der einleitenden Stufe sowie der Schlussstufe eines Öffnungsverfahrens mit einem verhältnismässig grossen Hebelarm, während einer Zwischenstufe jedoch mit einem kürzeren Hebelarm betätigt zu werden.
2. Öffnungsmechanismus nach Anspruch 1, dadurch **gekennzeichnet**, dass der Mitnehmer die Form eines Rads (10) hat, um längs des eine Schwenkbewegung durchführenden Hilfsarms (14) zu rollen.
3. Öffnungsmechanismus nach Anspruch 1 oder 2, dadurch **gekennzeichnet**, dass der Mitnehmer oder das Mitnehmerrad (10) auf einem Schlittenglied (12) angeordnet ist, das hin und her längs einer mit dem Gehäuse (2) fest verbundenen Führung (13) bewegbar ist.
4. Öffnungsmechanismus nach Anspruch 3, dadurch **gekennzeichnet**, dass das Schlittenglied (12) zwei Mitnehmerräder (10, 10') umfasst, die zwei Hilfsarme (14, 14') betätigen, welche an ent-

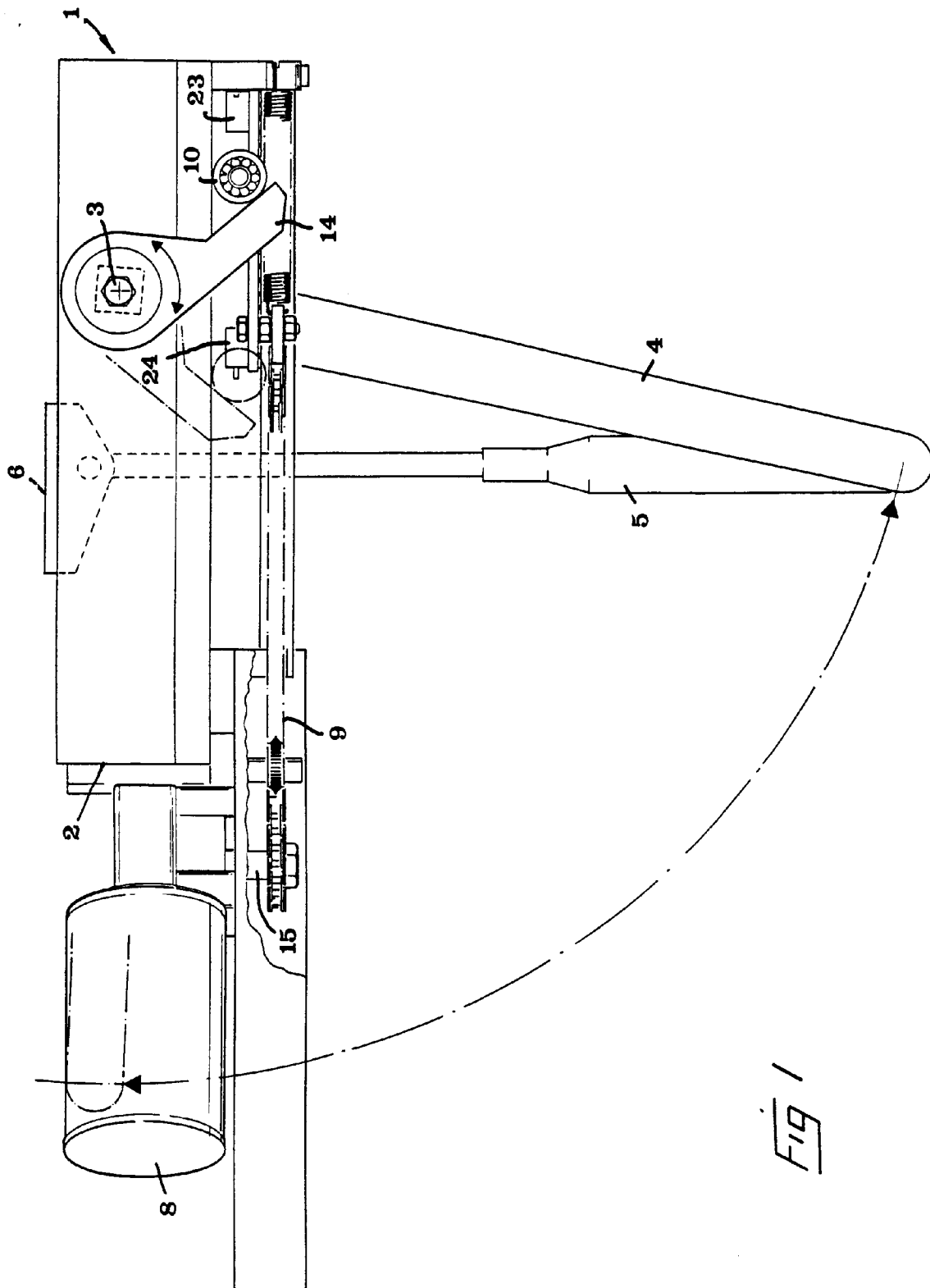
gegengesetzten Enden einer an sich bekannten, drehbaren Durchgangsachse (3) angeordnet sind, die sich durch das Gehäuse (2) erstreckt.

5. Öffnungsmechanismus nach einem der vorhergehenden Ansprüche, dadurch **gekennzeichnet**, dass sich der Mitnehmer (10) beim Rücklauf aus der aktiven Endposition zurück in die Ausgangsposition schneller bewegt als der Hilfsarm (14) des Türschliessers, wodurch die üblichen Schliesseigenschaften des Türschliessers nicht vom Mitnehmer beeinflusst werden.
6. Öffnungsmechanismus nach einem der Ansprüche 3-5, dadurch **gekennzeichnet**, dass die Transmission eine Kette (9) umfasst, die um einen Zahnkranz (16) auf der Ausgangsantriebswelle (15) des motors (8) gelegt ist und entgegengesetzte Enden aufweist, von denen das eine mit dem Schlittenglied (12) und das andere mit einer ersten Spannfeder (18) verbunden ist, wobei eine zweite Spannfeder (20) als Rückstellfeder zum Zurückführen des Schlittenglieds (12) in die Ausgangsposition dient.
7. Öffnungsmechanismus nach einem der vorhergehenden Ansprüche, dadurch **gekennzeichnet**, dass er die Form einer Zusatzeinrichtung hat, die an einem vorhandenen Türschliesser eines an sich bekannten Typs oder eines beliebigen Typs anbringbar ist.

Revendications

1. Mécanisme d'ouverture pour un ferme-porte du type comprenant un carter (2) qui peut être monté à demeure sur une cloison et qui, par l'intermédiaire d'un arbre mobile en rotation (3), supporte un bras pivotant (4) qui peut être relié à une porte ou analogue et qui, lorsque la porte est ouverte, provoque temporairement la tension ou la compression d'un mécanisme à ressort incorporé dans ledit carter, pour ramener automatiquement la porte à la position fermée après la fin du mouvement d'ouverture, ledit mécanisme d'ouverture comprenant un dispositif d'entraînement (10, 10') qui est mobile au moyen d'un moteur électrique (8) par l'intermédiaire d'une transmission mécanique (9), en arrière et en avant entre une position inactive, ou position initiale, et une position active et qui, d'une part, lorsque la porte est ouverte manuellement demeure dans sa position inactive dans laquelle il laisse libre le bras pivotant (4), et qui, d'autre part, lorsque le moteur (8) est alimenté provoque le déplacement du bras pivotant pour ouvrir la porte sans qu'il soit besoin d'aucune manoeuvre manuelle de la porte, ca-

- ractérisé en ce que le dispositif d'entraînement (10, 10') est conçu pour se déplacer de façon rectiligne entre ses positions d'extrémité et, lorsqu'il est mis en oeuvre, pour agir sur un bras auxiliaire (14, 14'), fixé rigidement audit arbre mobile en rotation (3) et s'étendant selon un certain angle par rapport à la trajectoire rectiligne de déplacement du dispositif d'entraînement, de manière à être manoeuvré avec un bras de levier relativement grand au stade initial aussi bien qu'au stade final d'une opération d'ouverture, mais avec un bras de levier plus court dans un stade intermédiaire de l'opération d'ouverture.
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2. Mécanisme d'ouverture selon la revendication 1, caractérisé en ce que le dispositif d'entraînement a la forme d'une roue (10) conçue pour rouler le long du bras auxiliaire (14) qui exécute un mouvement pivotant.
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3. Mécanisme d'ouverture selon la revendication 1 ou 2, caractérisé en ce que le dispositif d'entraînement, ou roue d'entraînement, (10) est disposé sur un élément coulissant (12) mobile en arrière et en avant le long d'un guide (13) fixé à demeure sur le carter (2).
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4. Mécanisme d'ouverture selon la revendication 3, caractérisé en ce que l'élément coulissant (12) comprend deux roues d'entraînement (10, 10') conçues pour manoeuvrer une paire de bras auxiliaires (14, 14') placés aux extrémités opposées d'un arbre traversant mobile en rotation (3), connu en tant que tel, qui s'étend à travers le carter (2).
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5. Mécanisme d'ouverture selon l'une quelconque des revendications précédentes, caractérisé en ce que le dispositif d'entraînement (10) est conçu pour se déplacer plus rapidement que le bras auxiliaire (14) du ferme-porte pendant son déplacement de retour de la position d'extrémité active vers la position initiale, ce par quoi le dispositif d'entraînement reste sans effet sur les caractéristiques habituelles de fermeture du ferme-porte.
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6. Mécanisme d'ouverture selon l'une quelconque des revendications 3 à 5, caractérisé en ce que la transmission comprend une chaîne (9) passant autour d'une roue dentée (16) sur l'arbre d'entraînement de sortie (15) du moteur (8) et ayant des extrémités opposées dont l'une est reliée à l'élément coulissant (12) et l'autre à un premier ressort de traction (18), un second ressort de traction (20) servant de ressort de rappel pour ramener l'élément coulissant (12) à la position initiale.
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7. Mécanisme d'ouverture selon l'une quelconque des revendications précédentes, caractérisé en ce qu'il se présente sous la forme d'un équipement accessoire qui peut être monté sur un ferme-porte existant d'un type connu en tant que tel ou de n'importe quel type à la demande.



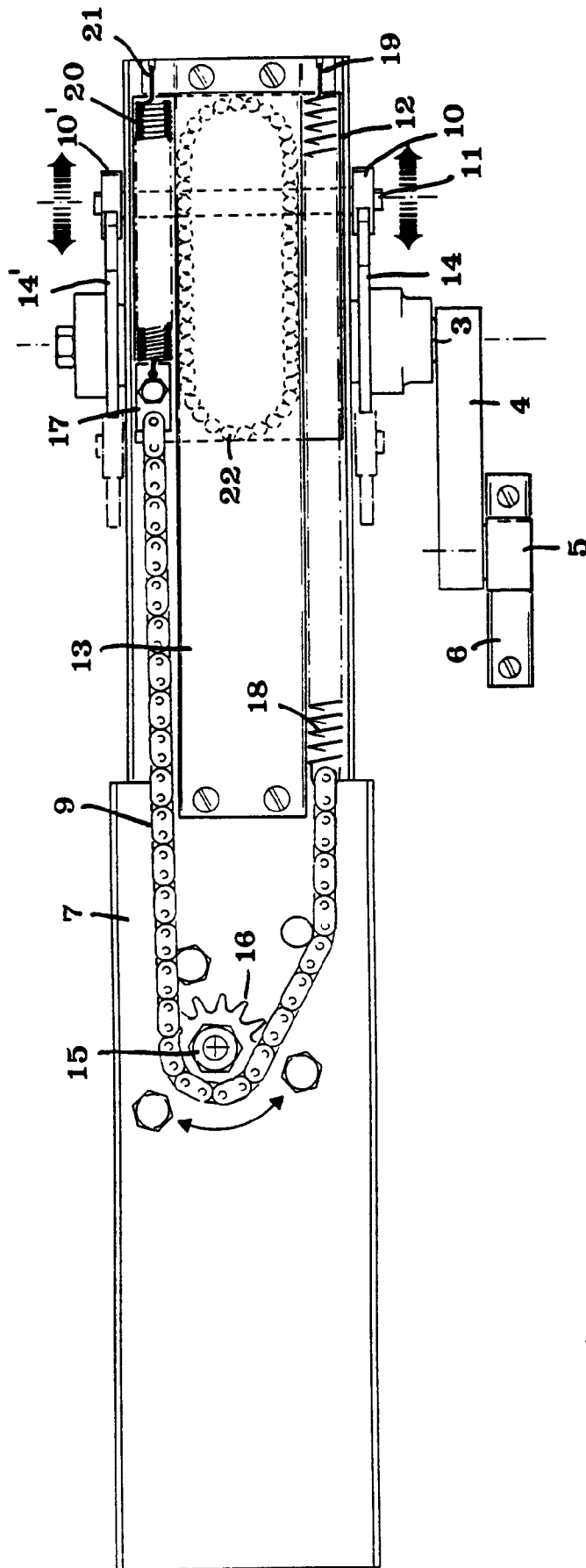


Fig 2

