Wheelchair anti-rollback module tensioner
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Bartosz Wieczorek, Łukasz Warguła, Mateusz Kukla

Poznan University of Technology, 3 Piotrowo St., 60-965 Poznań, Poland,
lukasz.wargula@put.poznan.pl tel. +48 61 665 2042

The subject matter of the invention is a wheelchair anti-rollback module tensioner that enables adjusting the clamping force pressing the wheelchair anti-rollback device to the wheelchair drive wheel, fixed permanently and separably to the back parts of the wheelchair frame.

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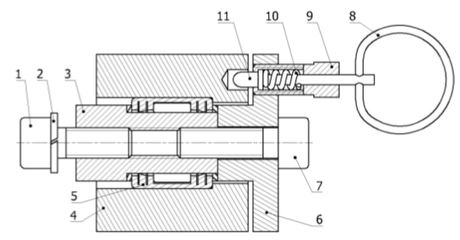
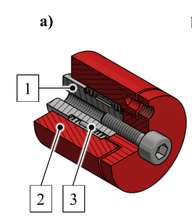
The wheelchair anti-rollback device tensioner enables fixing to all wheelchairs equipped with a frame made of round elements, through the application of a clamp with through openings and a clamp with threaded openings connected using clamp bolts.

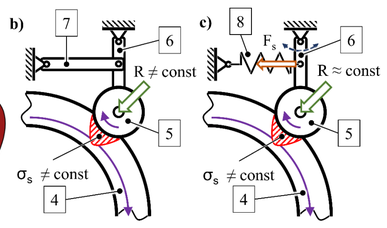
The wheelchair anti-rollback module tensioner enables connecting the slider with any anti-rollback module, regardless of its geometrical dimensions, through the use of a spacer sleeve.

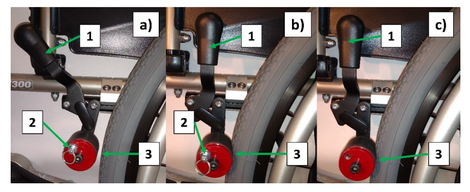
The wheelchair anti-rollback module tensioner enables the sliding movement of the slider along the groove in the guide, through the use of a sliding key placed inside the groove. This key is permanently fixed with the slider, maintaining appropriate play between these elements.

The wheelchair anti-rollback module tensioner enables generating a constant clamping force through the use of a tensioning spring that connects the guide with the spring sleeve, immobile relative to the guide.









The subject matter of the **invention enables adapting the clamping force of known wheelchair anti-rollback modules to variable operating conditions**. There are periodic and dynamic pressure increases in the tyres when overcoming terrain obstacles and longitudinal irregularities with a wheelchair equipped with pneumatic drive wheels. Because known anti-rollback devices operate based on their frictional coupling with the wheelchair drive wheel, each pressure change in the tyres translates to a change in the wheelchair anti-rollback module clamping force. Excessive clamping force leads to increased internal resistance of associated friction pair. Whereas too low clamping force leads to the absence of friction between the wheelchair anti-rollback module and the drive wheel.

An elastic element that reacts to changing wheelchair operating conditions was applied in order to ensure a constant wheelchair anti-rollback module clamping force value. **The subject of the invention ensures improved operating comfort of wheelchair anti-rollback modules through reducing sudden increases in internal friction resistance between the wheelchair wheel and the wheelchair anti-rollback module. Furthermore, it guarantees a constant frictional coupling between these elements. Owing to the application of spring tension adjustment, the subject of the invention enables matching the initial clamping force to individual user criteria. In addition, the use of a spacer sleeve enables using the subject of the invention for the implementation in known anti-rollback modules.**

The essence of the invention is coupling the slider equipped with the wheelchair anti-rollback module with the spring that generates the tensioning force. This connection is achieved through the use of a guide with a groove. The subject of the invention consists of a guide connected with the rear part of the wheelchair frame via a clamp with threaded openings and a clamp with through openings. Using the groove, the guide is permanently fitted with a spring sleeve and slider, however, with enabled future adjustment. The slider is connected to the spring sleeve via a tensioning spring. The wheelchair anti-rollback module fixed to the slider is pressed against the wheelchair drive wheel with a constant force, generated by the used tensioning spring. The slider moves relative to the guide owing to the connection with the sliding key play found inside the groove of the guide with the slider.

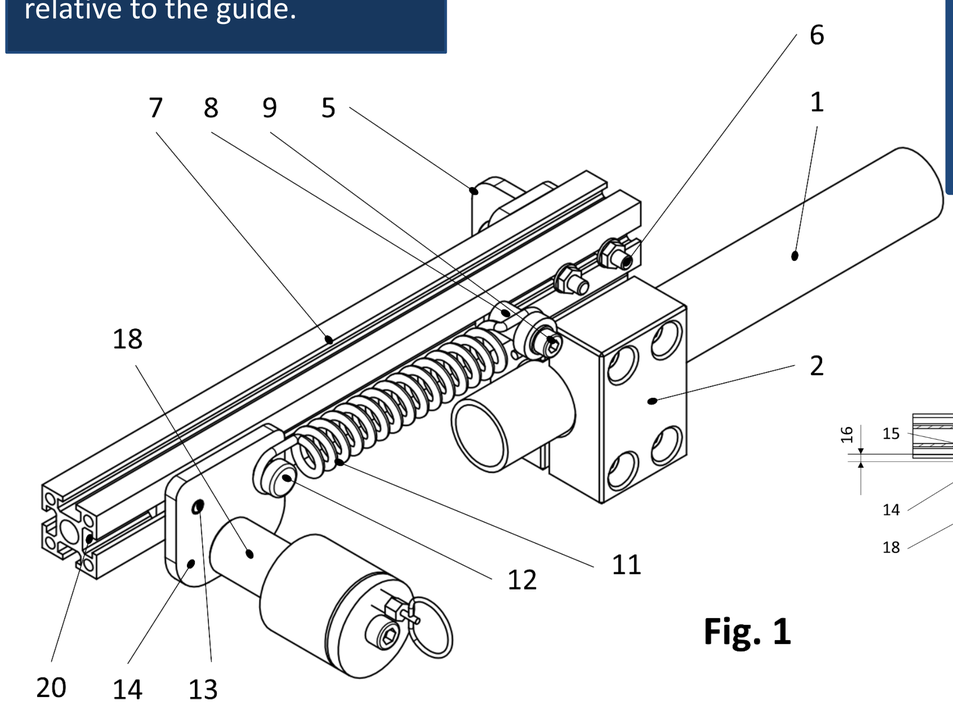


Fig. 1

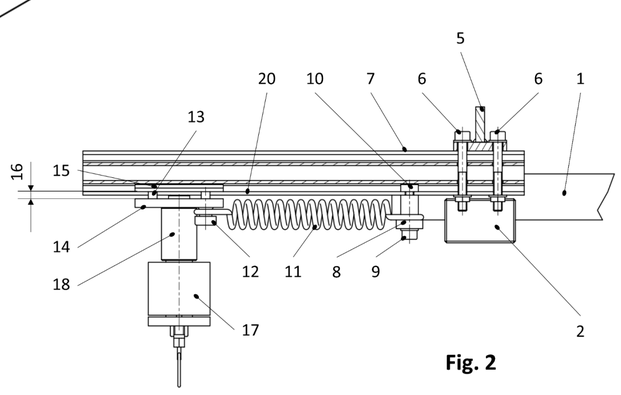


Fig. 2

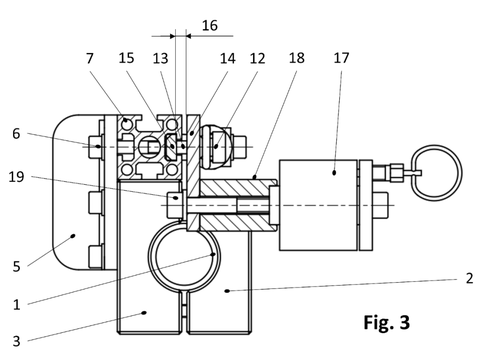


Fig. 3

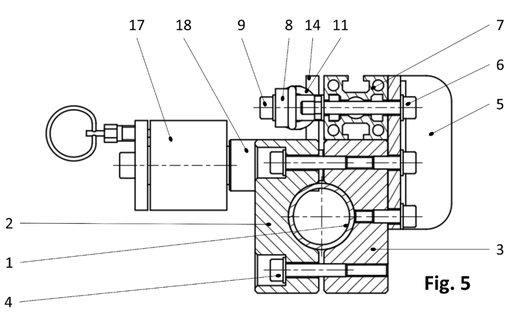


Fig. 5

Overview of the wheelchair anti-rollback module tensioner is shown in Fig. 1. The tensioning unit is shown in Fig. 2, while the elements fixing the wheelchair anti-rollback module to the tensioner unit are shown in Fig. 3. Wheelchair frame fragment and elements fastening the wheelchair anti-rollback module tensioner are shown in Fig. 4.

The wheelchair anti-rollback tensioner is permanently fixed to the rear part of the wheelchair frame 1 with a mounted clamp with through openings 2 and a clamp with threaded openings 3. The clamp with through openings 2 is coupled with the clamp with threaded openings 3 using four clamp bolts 4. The clamp with threaded openings 3 was permanently connected with the guide fastener 5. Guide fastening 5 is permanently fixed with the guide 7 via a through-bolt assembly 6. The guide 7 is permanently and separably fitted with a spring sleeve 8, with a sleeve bolt 9 screwed into a threaded key 10 inside the guide 7. A tensioning spring 11 is hooked onto the spring sleeve 8, with the second end fixed to the slider sleeve 12. The slider 14 has openings with the slider sleeve and slider pin 13 passing through them. The slider sleeve 12 and slider pin 13 connected with the slider 14 are permanently fixed to the sliding key 15. The play 16 was maintained by connecting the sliding key 15 with the slider 14, which enables a sliding movement of the sliding key 15 inside the groove 20 of the guide 7. A spacer sleeve 18 was concentrically placed between the wheelchair anti-rollback module 17 and the slider 14. The wheelchair anti-rollback module 17 is permanently fixed with the slider 14 via a threaded bolt 19 passing through an opening in the slider 14 and a space sleeve 18.

The wheelchair anti-rollback tensioner can be fixed to the wheelchair equipped with a frame made of round tubes. The device is fixed to the frame using a frictional connection caused by compression of the rear wheelchair frame part 1 by a clamp with through openings 2 and a clamp with threaded openings 3. The compression is the outcome of screwing the clamp with through openings 2 to the clamp with threaded openings 3 with clamp bolts utilising the properties of the threaded connection and screwing these elements using bolts 4. The clamping force of the wheelchair anti-rollback module 17 to the wheelchair drive wheel is the outcome of the operation of tension force generated by the tensioning spring 11. The tension force can be adjusted by sliding the sleeve spring 8 along the groove 20. Spring sleeve position 8 is locked as a result of friction between the threaded key 10 and slider 7. Friction is the outcome of pressure caused by screwing the sleeve bolt 9 into the threaded key 10. Wheelchair anti-rollback module fastening 17 has an adjustable distance from the slider surface 14. Adjusting this distance is achieved by the use of a spacer sleeve 18 that can be in different sizes. Moving the slider 14 with the anti-rollback device 17 long the groove 20 is possible also owing to the application of a sliding key 15 located inside the groove 20 in the guide 7. Please note that the connection of the sliding key 15 with the slider must ensure the formation of play 16. The play 16 can be achieved by positioning the sliding key 15 at the ends of the slider sleeve 12 and slider wheel 13.

The developed solution was the subject of the following research:

- Wieczorek, B., Kukla, M., Warguła, Ł. (2021). The symmetric nature of the position distribution of the human body centre of gravity during propelling manual wheelchairs with innovative propulsion systems. Symmetry, 13(1), 154. MNiSW score: 70 pts, Impact factor: 2.713
- Wieczorek, B., Kukla, M., Rybarczyk, D., Warguła, Ł. (2020). Evaluation of the biomechanical parameters of human-wheelchair systems during ramp climbing with the use of a manual wheelchair with anti-rollback devices. Applied Sciences, 10(23), 8757