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Model

Useless Machine – zwecklose Maschine

Dirk Fox

Everyone who designs a fischertechnik model wishes to realize a specific function. As a rule, this function serves a (mostly useful) purpose – such as locomotion, transportation or pleasure. But, of course, the subtle realization of the function itself is often the intriguing thing – sometimes even when it only partially fulfils its original purpose. What is more obvious than to realize the idea of a function for its own sake – "purposeless", in a sense. This idea is not new, but it can be inspiring and often, it's impressive.

History

The history of "Useless Machines", machines that have a function but no purpose, goes back to the 1930s. The artist Bruno Munari (1907-1998), later an influential industrial designer, was probably the first to construct such purposeless mechanisms and to understand them as a critique of the increasing domination of our world by machines.

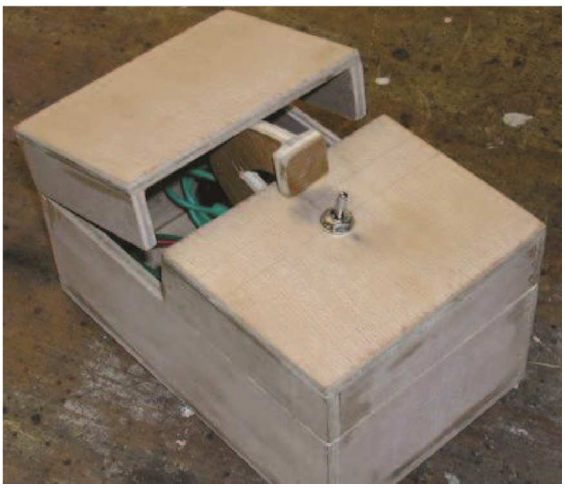

Fig. 1: Most Useless Machine by Marvin Minsky (1952)

A Useless Machine made in 1952 by MIT professor Marvin Minsky (1927-2016), one of the forefathers of artificial intelligence, is better known. It had only one function: to turn itself off (Fig. 1 [1, 2]). For a theoretical computer scientist, it provided a fascinating mechanical counter-concept to the "halting problem" – the difficulty in proving algorithmically that a program actually terminates (ends).

Useless Machines have been designed by the fischertechnik community in numerous variants. A simple, but very compact version of the self-disabling machine is presented here – as well as suggestions to derive more complex variants.

First, you might like to gain an impression of how this self-cancelling machine works, so take a look at the following YT video: www.youtube.be/watch?v=M6LJfsLstWs
For this replica, I have created a fischertechnik designer file[4]; It can be downloaded together with a list of parts[5] from the pages of fischertechnik AG.

Construction

Basically, there are (at least) two simple mechanical base constructions with which the "finger" for shutting off the machine can be moved out of the "box" mechanically and "pulled in" again: a slider crank mechanism or a turntable. The slider crank mechanism requires only a toggle switch to bypass an end position

switch (as in the construction of a suspension railway or Kieseleck from 2011); the turntable, however, requires the addition of a Polarity Reversing Switch.
The machine presented below uses a turntable because it can be designed to be particularly compact. It fits – including the fischertechnik rechargeable battery – in a 90x90x90mm cube, which can be clad with basic and static panels. The compact mechanism of the turntable, engine and transmission, however, requires a slightly more sophisticated circuit than the crank.

Drive

The drive for the turntable or pulley 60 comes from a mini-motor with gearbox, which is mounted on a baseplate 90x90. To the basic building blocks which holds the gearbox, we attach a mini-switch (two BB 5 and one BB 7.5) to the side (see Fig. 2, bottom right) "hanging" and directly above it a Polarity Reversing Switch. Attached to the gearbox is an axle 40 (with Z28 gear), on which we later connect the turntable 60.

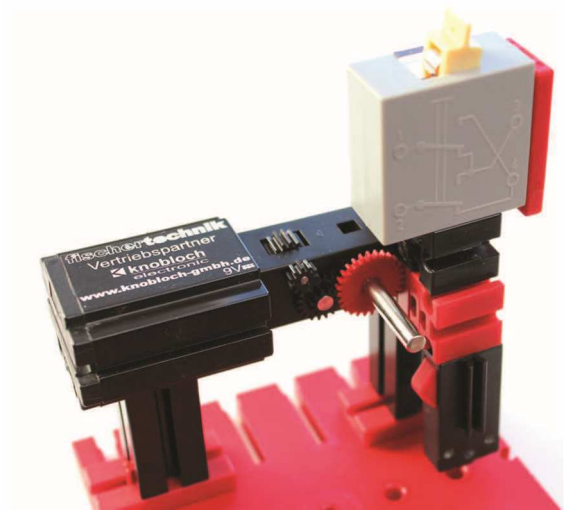

Fig. 2: Drive of the Useless Machine with pole reversal and limit switch

Switch-off mechanism

The "switch-off finger" we now attach to a turntable 60. It protrudes beyond the turntable, so that it can switch off the Polarity Switch (31331). For the return operation, the "finger" must disappear completely back inside the box and press the hanging mounted end position switch.

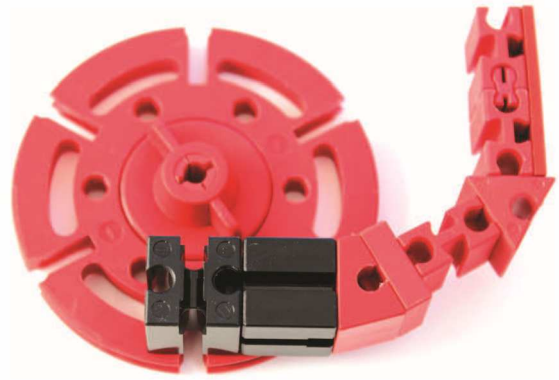

Fig. 3: Turntable with "finger" in rest position.

Fig. 3 shows the construction of the "finger" on the turntable 60, which we attach to the extreme end of the axle so that the "finger" clears the mini-motor's body.

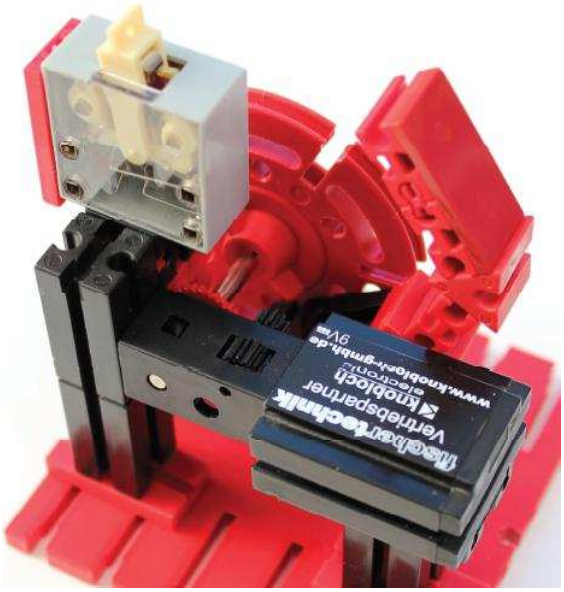

Fig. 4: The Completed Mechanism

The hub nut must be tightened very tightly so that the turntable sits stably on the axle and, when turning, overcomes the resistance of the Polarity Reversing Switch

without slipping. In Fig. 4 you can see the completed mechanical construction.

Circuit

The connection of the Polarity Reversing Switch is simple: it is switched between our energy source (a fischertechnik battery) and the mini-motor and reverses, with each actuation, the direction of movement of the motor (and thus the turntable).

But where do we put the end position switch? It must in the "reverse rotation" of the "finger" break the circuit (after pressing the Polarity Switch it must disappear back inside the box). But as soon as the current direction is reversed, by manually operating the Polarity Switch again, it must bridge the circuit and allow the motor to run.

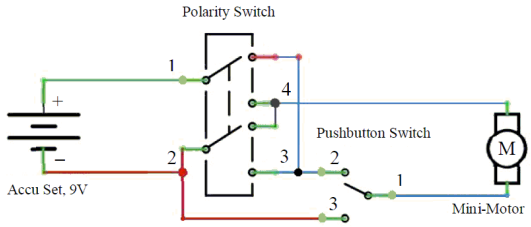

Fig. 5: Circuit diagram of the Useless Machine

This is achieved by switching the end position switch between one output of the Polarity Reversing Switch and one motor input, in such a way that the motor input is connected to earth when the end position switch is actuated (Fig. 5). The Polarity Reversing Switch is now able to connect the second motor input to +9V, the motor then runs despite the end position switch being pressed. On the other hand, if the second motor input is connected to earth via the Polarity Reversing Switch, the motor stops when the end position switch is actuated. As long as the limit switch is not actuated, the motor rotates either in one direction or the other, depending on the position of the Polarity Reversing Switch.

The circuit has an important side effect: If the motor rotates back and the "finger" presses the end position switch, the motor terminals are short-circuited... is provides dynamic braking of the motor [3].

Power Supply

As a power supply for our Useless Machine, we can of course use a fischertechnik mains power supply – but a cable hanging out of the box makes it look far less "self-contained". So we have used a fischertechnik battery – the remaining space in our box is exactly as if we had planned it this way (Fig. 6)…

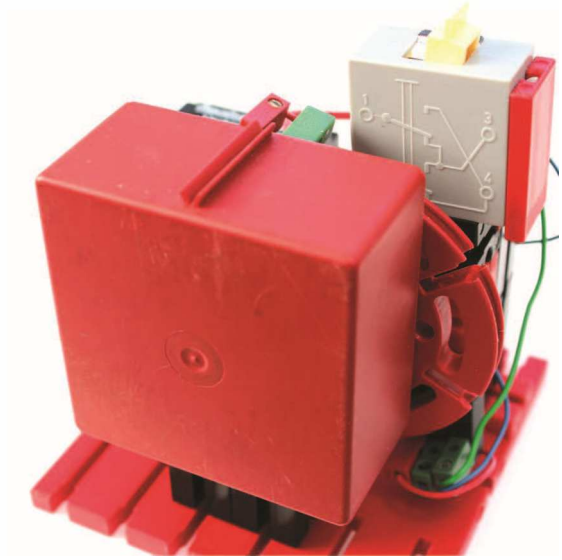

Fig. 6: Power Supply

Attached with 2 x 15mm Building Blocks (BB 15) and 1 x cross-mounted component 15x30x5 with groove and pin and 1 x BB 5. The battery terminals, which we need to connect to the Polarity Switch, just protrudes above the turntable 60 – and the "finger" of the machine stops when turning a few millimetres in front of the two plugs.

If you do not have a fischertechnik rechargeable battery, you can alternatively equip the Useless Machine with a battery holder or a battery case with a 9V PP3 block battery.

Connected to the power source (and with proper polarity of the mini motor) our Useless Machine now works.

Paneling

The mechanism without a suitable "disguise" would lack the crucial "magic". What we really need now is a closed 90x90x90mm "black box" from which only our Polarity Switch actuator pokes out – and, after switching it on, it magically returns to the off position.

The enclosure is constructed by mounting two angle girders 60 and 30 in one set of corners of the base plate and angle girders 60 and 15 in one hinged corner and 30 and 15 in the other hinged corner where the mini-motor is located and attaching static panels 90x90 on the four sides. If you do not have structural panels, you can use V-building boards or basic building blocks and building boards (Fig. 7).

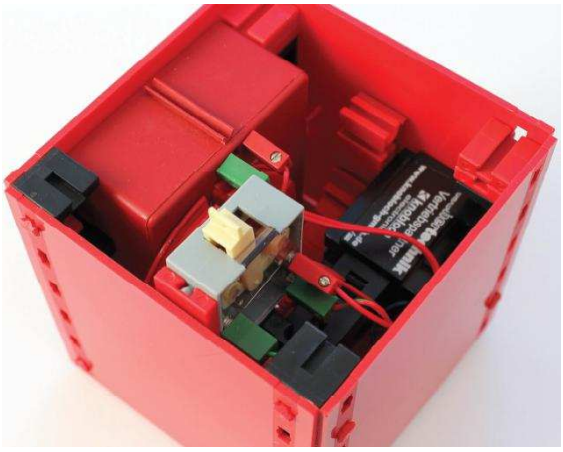

Fig. 7: Covering the box with static panels, Recess for the mini motor (right)

Cover

For the lid, which should be lifted by the "finger", we use two BB 5 (Fig. 7, rear left and right) in each corner. Then we put a static hinge (36329) on each side, which holds the corners of the lid.

The lid is made up of two 30x15 construction panels and two 15x60 panels, which we connect stably to each other via four structural panels 15x30x3.75 with groove (Fig. 8).

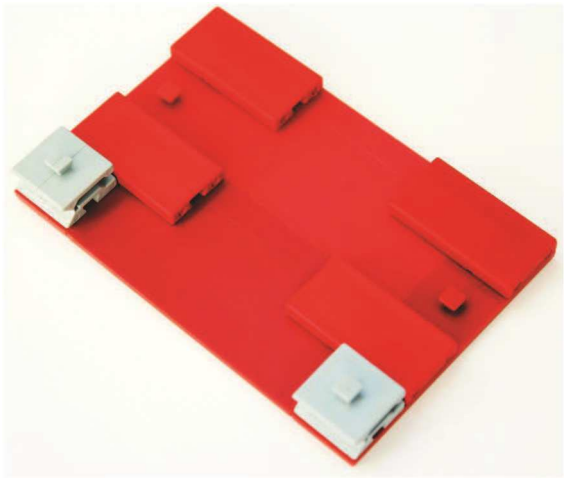

Fig. 8: Bottom of the lid

With two construction panels 30x45, which we push each with a pin in the grooves of the ends of the two front structural angle brackets, we close the box from above (Fig. 9).

Fig. 9: Overall view of the Useless Machine

As a small user note, we can now label the Polarity Switch with a power-on request:

ON >

Fig. 10: Labeling of the Polarity Switch

Notes on construction

The space in our little box is quite tight, and the design is sensitive to friction (especially the turntable 60 on the battery or the "finger" on the mini-motor). Therefore, you should always make small tests in the construction of the box, whether the "finger" is aligned correctly and moves without interference and with sufficient speed and force.

The battery can be charged without removal: It is sufficient to remove the cover to plug in the charging cable. When laying the cables, however, care must be taken that they cannot get caught in the grooves of the turntable 60.

If the hanging end position switch is highly stressed, you should secure the switch with a transversely mounted module 15x30x5 with groove and pin against movement (Fig 11), because the "finger" may hit the switch with great force despite the dynamic braking action due to short-circuiting the motor's terminals.

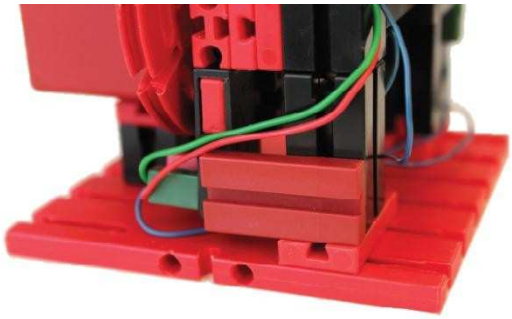

Fig. 11: Securing the end position switch against movement

Development

The presented model is a very simple Useless Machine. Other Useless Machines can be seen from fredy[6], but also from other fans in the fischertechnik community (ftc) like Hans Wijnsouw[7], there are sophisticated advancements that can switch off several different buttons, are controlled by a computer interface or microcontroller and use fast pneumatic pistons as "switch-off fingers". Your imagination – as is so often the case with fischertechnik – is almost unlimited.

Examples of more diverse extensions can also be found on Youtube[8].

References

[1] Abigail Pesta: *Looking for Something Useful to Do With Your Time? Don't Try This*. The Wall Street Journal, March 12, 2013.
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[2] Video-Interview with Marvin Minsky: *Making the most useless machine*.
www.webofstories.com/play/marvin.minsky/127

[3] Stefan Falk: *Motorsteuerungen (Teil 1)*. ftpedia 1/2011, S. 4-8.
www.ftcommunity.de/ftpedia_ausgaben/ftpedia-2011-1.pdf#page=4
www.procontechnology.com.au/fischer/30075m.pdf
www.procontechnology.com.au/fischer/30073m.pdf

[4] The fischertechnik designer file*:
http://fischertechnik-ag.editme.com/files/Home/Useless%20Machine%20%28Dirk%20Fox%29%20ftpedia%204-2018.ftm

[5] The parts list file:
http://fischertechnik-ag.editme.com/files/Home/Einzelteil%C3%BCbersicht%20Useless%20Machine%20%28Dirk%20Fox%29%20ftpedia%204-2018.pdf

[6] Useless Machine videos by ftcfredy:
www.youtube.com/playlist?list=PL69C9B01BF3D0A973

[7] Useless Machine by Hans Wijnsouw:
www.ftcommunity.de/details25c5.html

[8] More Useless Machines on YouTube:
www.youtube.com/results?search_query=useless+machine

* To download demo version of ftdesigner:
www.3dprofi.de/en/downloads.html

Translator's Note: New references have been added here for all hyperlinks in the article. The next page provides my recommendations and suggestions for improvement and fun!

Translator's Notes:

Below you will find pictures of modifications which I have made to the Useless Machine. Firstly the 37783 mini-switch has been replaced by a 31332 pushbutton switch from an e-m3 (30073) kit. I have the 30073 kit available (with 31331 and cables also included) for sale and can ship worldwide, contact me at: procon@tpg.com.au

For information on the 30073 e-m3 kit, the instruction manual (in English) is available from our website… www.procontechnology.com.au/fischer/30073m.pdf

To allow the Useless Machine to operate correctly with the 31332 switch, the "finger" is reduced in length by one BB 7.5 and a 60° angular block is attached to the other end to activate the pushbutton switch when the return end position is reached. One BB 5 has also been inserted at the end of the gearbox to provide room for the plug connected to socket "2" on the 31332 switch.

You will also note that a 9V battery and battery block is used below… however the battery block will need to be mounted vertically to allow the enclosure to be fitted around the inner workings of the Useless Machine. Of special interest to fischertechnik enthusiasts, is a 9V PP3 battery substitute which I've fashioned from a 6V 10F Supercapacitor and which can operate the Useless Machine for over 500 operations before the voltage drops below 3.5V and the "finger" fails to move the actuator of the Polarity Reversing Switch.

The Supercapacitor 9V battery substitute was constructed for use with a Digital Multimeter (DMM) which required 2mA constant current for normal operation and continues operation down to 3 Volts before the "low battery" indicator illuminates. The Supercapacitor could be recharged back to 6 Volts in less than 60 seconds, without having to remove it from the DMM battery container!

Finally for the record, I've discovered a use for this "Useless machine"… it provides a great "stress relief" device and helps to remind us not to take life too seriously!

Enjoy… Peter King - www.procontechnology.com.au

By connecting fischertechnik sockets to pins "1" and "2" of the Polarity Switch, you can recharge the Supercapacitor using a 6V, 1A constant-current limited power supply in less than 30 seconds, without having to remove it from the Useless Machine… your machine is then ready-to-go again in no time… amazing!