

April 9, 1929.

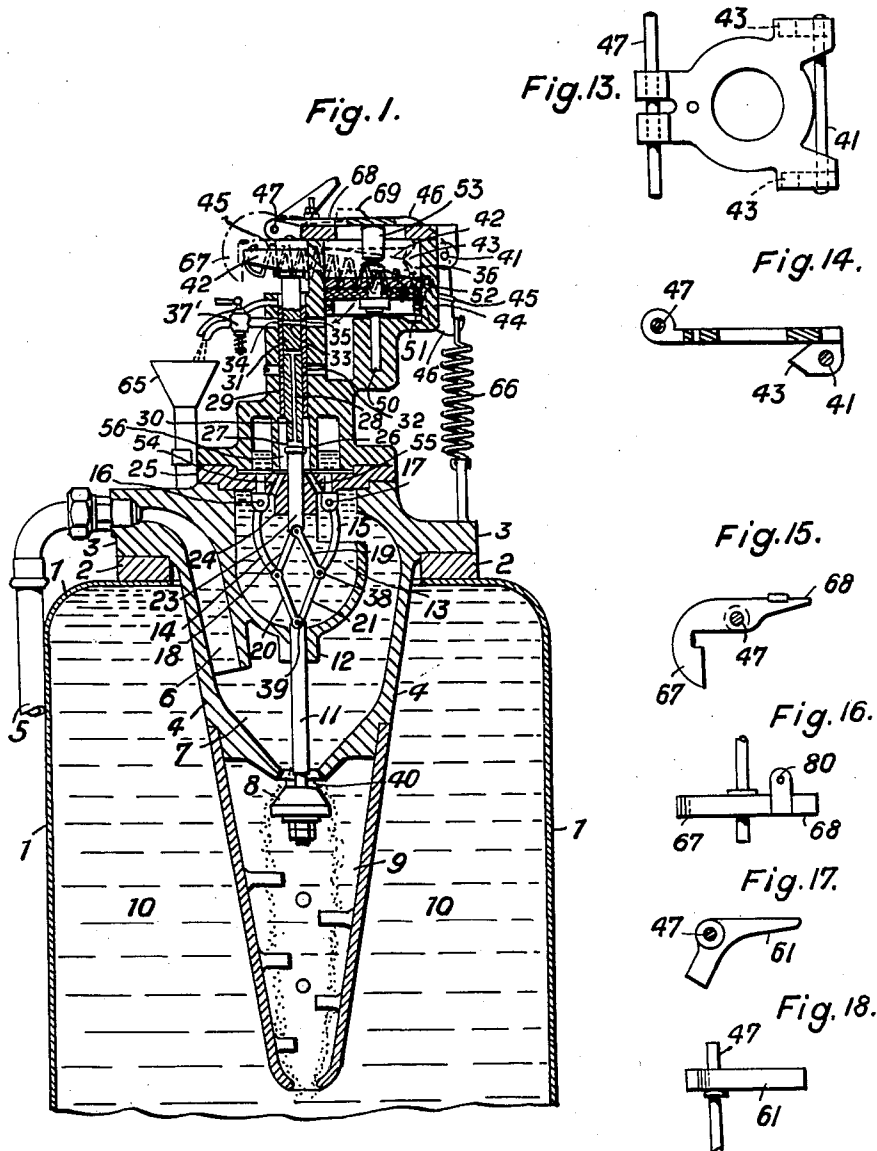
W. NEUMANN

1,708,704

FILTER APPARATUS

Filed June 3, 1925

3 Sheets-Sheet 1



INVENTOR

WERNER NEUMANN

By *Paul Kelsch*
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April 9, 1929.

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1,708,704

FILTER APPARATUS

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Fig. 2.

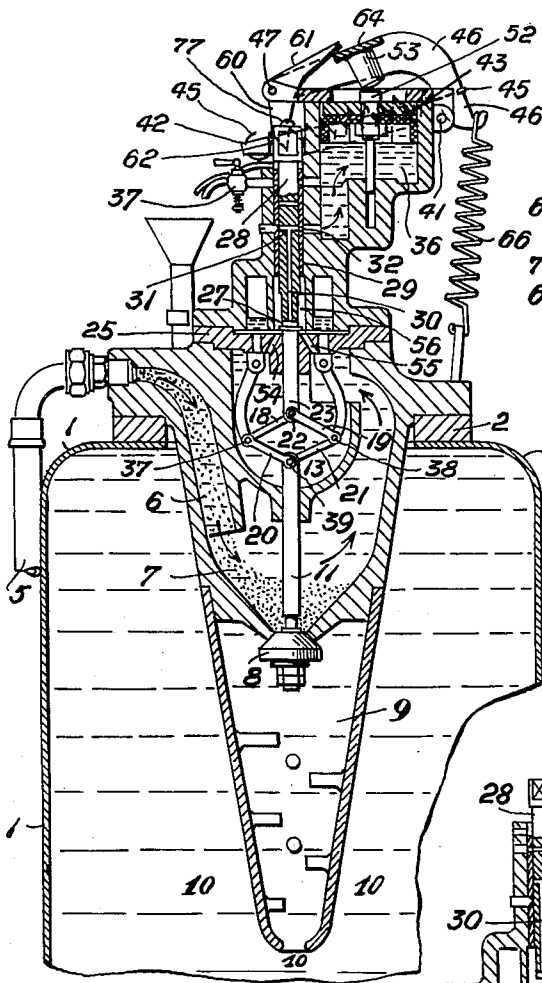


Fig. 3.

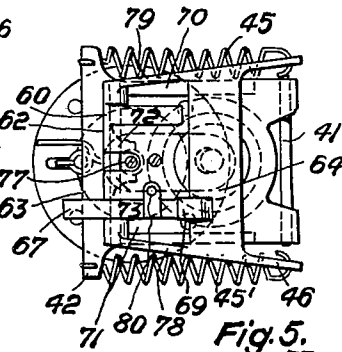


Fig. 5.

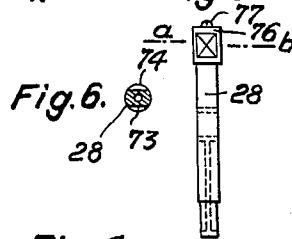
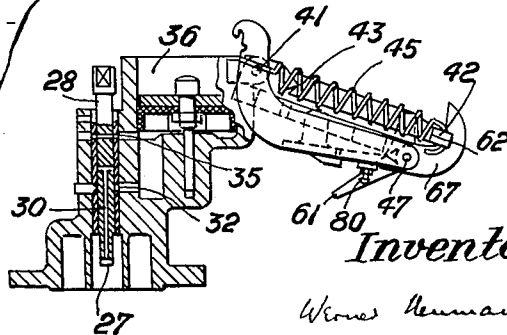


Fig. 6.

Fig. 4.



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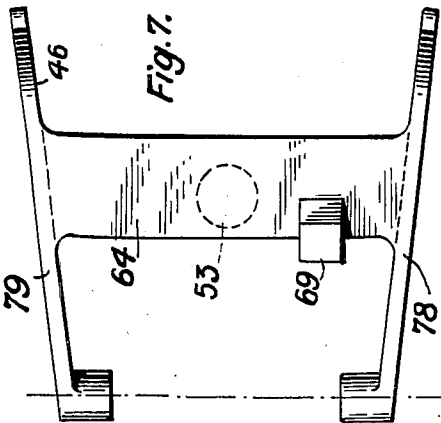
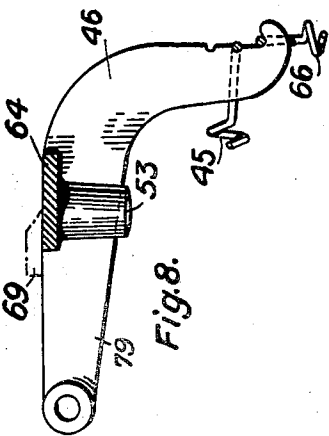
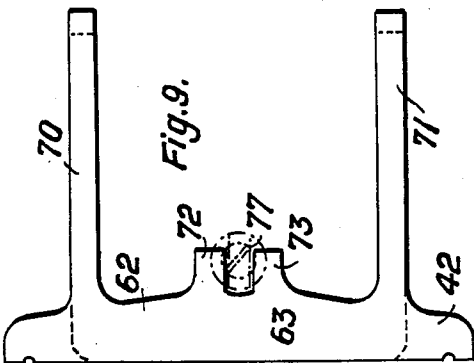
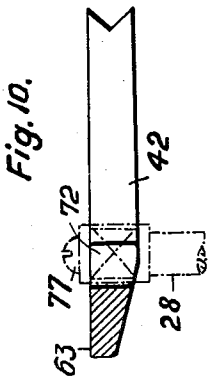
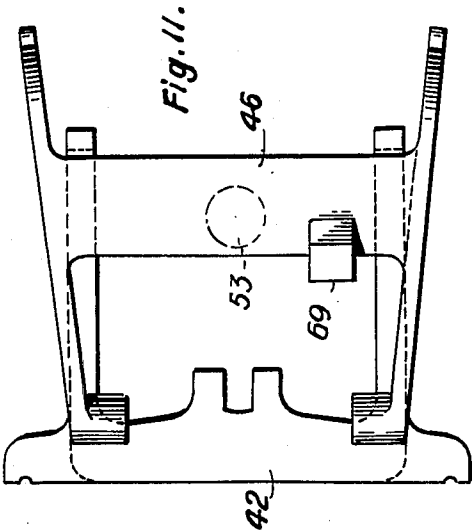
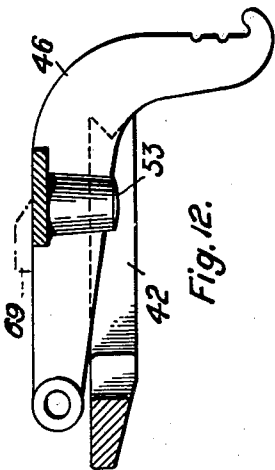
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W. NEUMANN
FILTER APPARATUS

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Filed June 3, 1925

3 Sheets-Sheet 3



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Patented Apr. 9, 1929.

1,708,704

UNITED STATES PATENT OFFICE.

WERNER NEUMANN, OF REPPEN, GERMANY.

FILTER APPARATUS.

Application filed June 3, 1925. Serial No. 34,675.

This invention relates in general to filter apparatus and more particularly to a pressure-operated automatic device for controlling an intermittent circulation of filter material such as natural or artificial zeolite.

The object of the invention is to provide a simple and reliable device which causes the filtering material in a filter to be continuously and automatically cleaned or regenerated so as to obviate the necessity of cleaning or regenerating the filtering material by manual operations. The novel apparatus thus constitutes a device which dispenses with the irksome work of frequently attending to the filter.

The agency which operates the automatic controlling device is the pressure of the water that passes through the filter itself.

The invention is illustrated in the drawing in which

Fig. 1 is a vertical middle section of the top of a filter with the automatic circulation controlling device arranged on the top thereof. In this figure the operating parts are shown in the position in which liquid is tapped from a piston cylinder in the device.

Fig. 2 is a similar section in which the working parts of the controlling device are shown in the position in which liquid is sent from a filter material collecting chamber into the piston cylinder.

Fig. 3 is a top view of the pressure-operated automatic controlling device.

Fig. 4 is a vertical section of the valve and piston portion of the controlling device and a side view of the piston operated valve controlling mechanism, which is swung back on its pivot so as to give access to the piston and the sliding valve member from the top.

Fig. 5 is a side view of the sliding member of the valve and

Fig. 6 is a cross section on the line $a-b$ of Fig. 5.

Figs. 7 and 8 are a top view and sectional side elevation respectively of the valve controlling lever.

Figs. 9 and 10 are a top view and sectional side elevation respectively of the valve shifting lever.

Figs. 11 and 12 are a top view and sectional side elevation respectively of the valve controlling lever and valve shifting lever when assembled.

Figs. 13 and 14 are a top view and sectional side elevation respectively of the pivoted base of the valve operating mechanism.

Figs. 15 and 16 are a top view and sectional side elevation respectively of a locking member for locking the valve shifting lever.

Figs. 17 and 18 are a top view and sectional side elevation respectively of another locking member for locking the valve shifting lever.

In the drawing all parts not required for the comprehension of the invention are omitted so that only the upper portion of the filter 1 per se is shown. Attached to the top of the filter is a ring 2 which supports the flange 3 of a chamber 4 designed to collect filtering material that enters from a pipe 5 70 and through a passage 6 formed in the chamber 4. A valve composed of a conical rubber member 8 is provided which is closed during the period in which filtering material collects in the chamber 7 and opened when the filtering material is allowed to pass from the chamber 7 into a chamber 9 through which the filtering material passes back into the interior 10 of the filter 1. The valve 8 has a stem 11 guided in a vertical hole in a boss 12 80 formed on a cup 13 that is integral with the collecting chamber 4. Suspended in the cup 13 of the collecting chamber 7 is a linkage comprising two depending arms 14 and 15, which swing on pivots 16 and 17 at their top 85 ends, and four links 18, 19, 20, 21. The links 18, 19 form a top pair of links whose individual members are interconnected by a pivot 22 which also connects them to a vertical thrust rod 23 adapted to slide up and down 90 in a vertical hole in a boss 24 formed on the bottom side of a plate 25. The top end 26 of the thrust rod 23 abuts upon the bottom end 27 of a sliding valve member 28. The sliding valve member 28 is adapted to move 95 up and down in a bushing 29 and has a transverse slot at its bottom end 27 through which the liquid passes into a central passage 30. Near or at the top of the central passage 30 is a transverse passage 31 which, as shown 100 in Fig. 2, registers with a lateral opening 32 when the sliding member 28 is in its bottom position. The sliding member 28 has another transverse passage 33 which registers with openings 34, 35 in the sleeve or bushing 29 105 when the sliding member 28 is in its bottom position and then establishes a connection between a cylinder chamber 36 and a cock 37 to allow liquid to flow out from the said chamber 36.

As shown in Fig. 2, when the sliding valve member 28 is moved to its bottom position it

pushes down the thrust rod 23 and this rod, by pushing down the pivot 22, stretches the pair of links 18, 19 so as to move the pivots 37, 38 further apart and to also stretch the lower pair of links 20, 21. By this means the pivot 39 is raised and the valve 8 is pulled upwards by its stem 11 to close the passage 40 between the collecting chamber 7 and the chamber 9 that opens into the main chamber 10 of the filter. After the passage 40 has been thus closed the pressure of the liquid in chamber 9 will assist in urging the valve 8 upward, because the pressure in chamber 9 will then be slightly higher than the pressure in chamber 7.

The parts forming the mechanism by which the sliding valve member 28 is automatically moved up and down are assembled in a unit that is hinged on a pivot 41. In Figs. 1, 2 and 3 this mechanism is shown in its operative position. In Fig. 4 it is swung around on its pivot 41 so as to give free access to the piston in the cylinder 36 and to the sliding valve member 28.

The parts of said valve operating mechanism, excepting its springs 45 and 66, are shown by themselves in Figs. 7 to 16. The base of this mechanism, as shown in Figs. 13, 14, has knife edges 43 onto which the recessed edges of the valve shifting lever 42 fit as shown in Figs. 1, 2 and 4. This valve shifting lever has two lateral arms 70, 71 and a cross piece 63. The controlling lever 46, Figs. 7, 8, that controls the valve shifting lever 42, is adapted to be swung on the pivot 47 fixed in the left end of the base, Figs. 13, 14, which can be swung on its hinge 41. The relative positions of the valve shifting lever 42 and the controlling lever 46 when assembled are shown in Figs. 11 and 12. The controlling lever has two lateral arms 78, 79 connected by a beam 64 on which is formed a dog 69 that cooperates with a locking member 67 that is shown by itself in Figs. 15 and 16. In Figs. 17, 18 is shown another locking member that cooperates as hereinafter described with the edge 62 of the cross beam 63 of the valve shifting member Figs. 9 and 10. In Figs. 1 and 2 it will be seen that the pivot edges of the controlling lever 46 and of the locking members 61, 67 are journaled on the shaft or pivot 47 that is fixed in the left end of the base Figs. 13, 14, so that when the hinged base is swung back on its hinge 41 (Fig. 4) the controlling lever 46, the valve shifting lever 42 and the locking members 61 and 67 are carried with the base into the position shown in Fig. 4 so as to expose the cylinder 36 and the piston therein for inspection and repairs. Attached to the free end of the valve shifting lever 42, which swings on the knife edge 43, is a spring 45 whose other end is attached to the controlling lever 46 that is adapted to swing around the pivot 47.

It will be seen that in the position of the

parts shown in Fig. 1 the spring 45 exerts a pull on the left hand end of the pivoted valve-shifting lever or arm 42 which is directed towards the bottom side of the pivot or knife edge 43 on the hinged base. The right hand end of the pivoted controlling lever or arm 46, as will be presently more fully described, can be swung upwards around its pivot 47 so as to swing the right hand end of the spring 45 to the top side of the knife edge or pivot 43 of the hinged base. The spring 45 will then tend to swing the left hand end of the arm 42 upwards. The left hand end of the arm 42 is attached by a fork on its cross-piece 63, as will be presently more fully described, to the sliding valve member 28 and tends to move this member upwards when the spring 45 is in the position shown in Fig. 2. When the spring 45 is in the position shown in Fig. 1 the left hand end of the arm 42 tends to move the sliding valve member 28 downwards.

The controlling lever or arm 46 is swung upwards by the piston in the cylinder 36. This piston comprises a guiding stem 50, a leather diaphragm 51 and an upwardly extending projection 52 which abuts against a downwardly extending projection 53 attached to the arm 46. When the operating parts of the apparatus are in the position shown in Fig. 2, water mixed with filtering material flows from the pipe 5 through passage 6 into the collecting chamber 7 and thence water alone flows in the direction indicated by the arrows through passages 54, 55 into a chamber 56, thence through the transverse slot 27 at the bottom of the sliding valve member, through the central passage 30, transverse passage 31, opening 32 in the sleeve 29 into the cylinder 36. The pressure of the water in the cylinder chamber 36 raises the piston and thus swings the arm 46 upwards into the position shown in Fig. 2. The spring 45 is prevented from pulling the left hand end of the arm 42 upwards until its right hand end has been swung a certain distance beyond the top of the pivot 41. This is effected by means of the locking member or detent consisting of two arms 60, 61 that swings around the pivot 47. The bottom end of the arm 60 is adapted to engage with the right hand edge 62 (see Fig. 9) of the cross-piece 63 that forms a part of, or is attached to, the valve-shifting lever or arm 42, as will be more fully described hereinafter. The arm 61 of the locking member is swung upwards by the transverse bar 64 of the controlling lever or arm 46. Thus when the arm 46 has been swung up through a certain angle the bottom end of the arm 60 of the locking member will be swung a certain distance towards the right so as to allow the edge 62 of the bar 63 of the arm 42 to move upwards. The spring 45 whose right hand end has been moved into a certain position above the knife edge 43 of the arm 42 will

then swing this arm upwards and raise the sliding valve member 28 into the position shown in Fig. 1 in which liquid passes from the cylinder 36 through the transverse passage 33 and the cock 37' into the funnel 65 or any other contrivance for conducting off the used water. A spring 66 which is attached to the right hand end of the controlling lever 46 and which was stretched during the upward swinging motion of this lever or arm exerts a downward pull so that the projection 53 connected to the arm 46 now urges the piston in the cylinder 36 downwards and presses the water in the cylinder out through the passage 33 and the cock 37'. The speed of flow of the water from the cylinder 36 through the passage 33 can be regulated by opening the cock 37'. When a certain quantity of water has thus been expelled from the cylinder 36, the piston will again reach its bottom position in which the pivoted controlling lever or arm 46 swings the right hand end of the spring 45 a certain distance below the pivot 43 of the arm 42. The spring 45 is prevented from pulling the arm 42 downwards until the right hand end of the arm 46 and hence the spring 45 reaches a certain position below the knife edge pivot 43. This is effected by means of a second locking member or detent 67 whose left hand end (see Fig. 15) is hook-shaped and embraces the left hand edge of the cross-piece 63 of the valve-shifting lever 42. The second locking member or detent 67 also swings around the pivot 47 as described and has an arm 68 adapted to be engaged by the dog or projection 69 integral with the transverse bar 64 of the controlling lever 46. When this lever is swung down sufficiently the projection 69 will have swung the arm 68 of the detent 67 into a position in which the hook of the detent 67 releases the left hand end or cross-piece 63 of the valve shifting lever 42 so that the latter can be swung downwards by the spring 45. The left hand end of the lever 42 in moving downwards pushes the sliding valve member 28 down into the position shown in Fig. 2 in which water passes from the collecting chamber 7 into the cylinder 36 and the cylinder is cut off from the cock 37'.

In the period in which water passes out from the cylinder 36 through the cock 37' the cylinder is cut off from the collecting chamber and the valve 8 is opened to allow filtering material which has collected in this chamber to pass into the chamber 9 and thence into the main chamber 10 of the filter. In the period in which the cylinder 36 is cut off from the cock 37' and is connected through the passages 32, 31, 30, 27, 54, 55 with the collecting chamber 7 the valve 8 is closed due to the pairs of links 18, 19 and 20, 21 being stretched by the downward thrust of the thrust member 23. Immediately the valve 8 is closed a difference of pressure is established between

the filter chamber 9 and the collecting chamber 7, the pressure in the chamber 9 being higher than that in the chamber 7 so that the pressure of the water in the chamber 9 exerts an additional closing effect on the valve 8.

As shown in Fig. 3 the pivoted valve shifting lever or arm 42 comprises a fork consisting of two prongs 72, 73 which project outwards to the right from the cross piece 63 and embrace the two flat sides 74, 75 (see Fig. 6) of the sliding valve member 28 which is provided at the top with a washer 76 secured by a screw 77. Furthermore the lever 42 is operated by two springs 45, 45', as shown in Fig. 3.

When the hinged unit that comprises the valve operating mechanism is to be swung back into the position shown in Fig. 4 the valve-shifting lever or arm 42 is locked against movement relatively to the other parts of the hinged unit by any suitable means, for example by a screw 80 which locks the detent 67 in a position in which it renders the arm 42 immovable around its knife edged pivot 43.

While the invention has been described hereinabove as applied to devices for regenerating filtering material in a filter, it is obvious that the invention may be put to other uses, for example, as a water softener in which case the interior 10 of the chamber 1 will contain the water to be softened and the pipe 5 will lead to a source of material suitable for softening water. The periods of operation of the valve 8 may be controlled as above described and can be regulated by the degree of opening of valve 37. The further operation of the device is similar to that already described for its use as a regenerator and further description thereof is not believed necessary.

I claim:

1. In combination with a filter, a controlling device comprising a valve for tapping liquid from the filter, a pivoted arm with a valve operating end attached to said valve, a second pivoted arm whose swinging portion extends towards the pivot of the first arm, a cylinder which receives liquid from said filter, a piston in said cylinder for rocking said second arm in response to the pressure of said liquid, a spring that interconnects the free ends of said arms and swings the valve operating end of said first pivoted arm when the free end of the second arm has been swung through a certain angle by said piston, and means for returning the second arm and said piston to their initial positions.

2. In combination with a filter, a controlling device comprising a valve for tapping liquid from the filter, a valve-shifting lever for operating said valve, a controlling lever, a cylinder which receives liquid through said valve from said filter, a piston in said cylinder for rocking said controlling lever in response

to the pressure of said liquid, a spring that interconnects the free end of the valve-shifting lever with the free end of said controlling lever and swings the valve-shifting lever to operate the valve when the free end of the controlling lever has been rocked through a certain angle by said piston, and a spring for returning the controlling lever and said piston to their initial positions.

3. In a filter, a filtering chamber, a collecting chamber for collecting filtering material, a conduit for conducting filtering material into the collecting chamber, a passage from the collecting chamber to the filtering chamber, a valve for controlling said passage, a sliding valve for tapping liquid from the collecting chamber, and a suspended linkage in the collecting chamber for operating said valve in response to movements of the sliding

valve.
4. In combination with a filter; a chamber for collecting filtering material; a conduit for conducting filtering material into said chamber; a valve for controlling a passage between said chamber and the filter chamber; a sliding valve for tapping liquid from the collecting chamber; and a suspended linkage in the collecting chamber comprising two depending arms with pivoted top ends and two interconnected pairs of links connected at their points of interconnection to said depending arms, and a member for stretching said pairs of links when the tapping valve is moved into its non-tapping position and thereby closing said controlling valve.

5. In combination with a filter, a chamber for collecting filtering material, a conduit for conducting filtering material into said chamber, a valve for controlling a passage between said chamber and the interior of the filter, a sliding valve for tapping liquid from the collecting chamber, a valve-shifting lever for operating said piston valve, a controlling lever, a cylinder which receives liquid from the collecting chamber through said sliding valve, a piston in said cylinder for rocking said controlling lever in response to the pressure of said liquid, a spring that interconnects the free ends of said valve-shifting lever with the free ends of said controlling lever and swings the valve-shifting lever to operate the piston valve when the free end of the controlling lever has been rocked through a certain angle by said piston, a spring for returning said arm and piston to their initial positions, and a suspended linkage in the collecting chamber for operating said controlling valve in response to movements of the sliding tapping valve.

6. In combination with a filter, a controlling device comprising a valve for tapping liquid from the filter, a valve-shifting lever for operating said valve, a controlling lever, a cylinder which receives liquid through said

valve from said filter and is placed between the pivot of said valve-shifting lever and the pivot of said controlling lever, a piston in said cylinder for rocking said controlling lever in response to the pressure of said liquid, a spring that interconnects the free end of said valve-shifting lever with the free end of said controlling lever and swings the valve-shifting lever to operate the valve when the free end of the controlling lever has been rocked through a certain angle by said piston, and a spring for returning the controlling lever and said piston to their initial positions.

7. In combination with a filter, a controlling device comprising a valve for tapping liquid from the filter, a pivoted arm with a valve operating end attached to said valve, a second pivoted arm whose swinging portion extends towards the pivot of the first arm, a cylinder which receives liquid from said filter and is placed between the pivots of said arms, a piston in said cylinder for rocking said second arm in response to the pressure of said liquid, a spring that interconnects the free ends of said arms and swings the valve operating end of said first pivoted arm when the free end of the second arm has been swung through a certain angle by said piston, and means for returning the second arm and said piston to their initial positions.

8. In combination with a filter, a chamber for collecting filtering material, a conduit for conducting filtering material into said chamber, a valve for controlling a passage between said chamber and the interior of the filter, a sliding valve for tapping liquid from the collecting chamber, a valve-shifting lever for operating said piston valve, a controlling lever, a cylinder which receives liquid from the collecting chamber through said sliding valve and is placed between the pivot of the valve-shifting lever and the pivot of said controlling lever, a piston in said cylinder for rocking said controlling lever, in response to the pressure of said liquid, a spring that interconnects the free end of said valve-shifting lever with the free end of said controlling lever and swings the valve-shifting lever to operate the piston valve when the free end of the controlling lever has been rocked through a certain angle by said piston, a spring for returning said arm and piston to their initial positions, and a suspended linkage in the collecting chamber for operating said controlling valve in response to movements of the sliding tapping valve.

9. In combination with a filter; a chamber for collecting filtering material; a conduit for conducting filtering material in said chamber; a valve for controlling a passage between said chamber and the interior of the filter; a sliding valve for tapping liquid from the collecting chamber; a valve-shifting lever for operating said sliding valve; a controlling lever; a cylinder which receives liquid from

the collecting chamber through said sliding valve; a piston in said cylinder for rocking said controlling lever in response to the pressure of said liquid; a spring that interconnects the free end of said valve-shifting lever with the free end of said controlling lever and swings the valve-shifting lever to operate the sliding valve when the free end of the controlling lever has been rocked through a certain angle by said piston; a spring for returning said controlling lever and piston to their initial positions; and a suspended linkage in the collecting chamber comprising two depending arms with pivoted top ends and two interconnected pairs of links connected at their points of interconnection to said depending arms, and a member for stretching said pairs of links when the tapping valve is moved into its non-tapping position and thus closing said controlling valve.

10. In combination with a filter, a collecting chamber for collecting filtering material from the filter, a controlling valve for allowing filtering material to pass from said chamber into the filter, a tapping valve for tapping liquid from the said chamber, a valve-shifting lever with a free end connected to the tapping valve, a spring for exerting a pull on said free end towards the one or the other side of the pivot of the said arm so as to swing the valve-shifting lever to the one or other side of its pivot and move the tapping valve into its tapping or non-tapping position, a controlling lever for changing the direction of pull of said spring, a piston controlled by said liquid for swinging the controlling lever into the position in which it causes said spring to urge the tapping valve into its tapping position, and a second spring for returning said second pivoted arm, first spring and piston to their normal positions whereby the first spring is caused to return the tapping valve to its non-tapping position in which it allows liquid to pass from said collecting chamber into said piston cylinder.

11. In combination with a filter, a collecting chamber for collecting filtering material from the filter, a controlling valve for allowing filtering material to pass from said chamber into the filter, a tapping valve for tapping liquid from said chamber, a valve-shifting lever with a free end connected to the tapping valve, a spring for exerting a pull on said free end towards the one or other side of the pivot of the said arm so as to swing the valve-shifting lever to the one or other side of its pivot and move the tapping valve into its tapping or non-tapping position, a controlling lever for changing the direction of pull of said spring, a piston controlled by said liquid for swinging the controlling lever into the position in which it causes said spring to urge the tapping valve into its tapping position, a second spring for returning said controlling lever, first spring and piston to their

normal positions whereby the first spring is caused to return the tapping valve to its non-tapping position in which it allows liquid to pass from said collecting chamber into said piston cylinder, a first locking member for locking the valve-shifting lever until its operating spring is swung a certain distance beyond the pivot of the valve shifting lever, and a second locking member for locking the valve shifting lever until its operating spring is swung a certain distance in the opposite direction beyond the pivot of the valve-shifting lever.

12. In combination with a filter, a collecting chamber for collecting filtering material from the filter, a controlling valve for allowing filtering material to pass from said chamber into the filter, a tapping valve for tapping liquid from said chamber, a valve-shifting lever with a free end connected to the tapping valve, a spring for exerting a pull on said free end towards the one or other side of the pivot of the said arm so as to swing the valve-shifting lever to the one or other side of its pivot and move the tapping valve into its tapping or non-tapping position, a controlling lever for changing the direction of pull of said spring, a piston controlled by said liquid for swinging the controlling lever into the position in which it causes said spring to urge the tapping valve into its tapping position, a second spring for returning said controlling lever, first spring and piston to their normal positions whereby the first spring is caused to return the tapping valve to its non-tapping position in which it allows liquid to pass from said collecting chamber into said piston cylinder, and a suspended linkage in the collecting chamber for operating said controlling valve in response to movements of the tapping valve.

13. In combination with a filter; a collecting chamber for collecting filtering material from the filter; a controlling valve for allowing filtering material to pass from said chamber into the filter; a tapping valve for tapping liquid from said chamber; a valve-shifting lever with a free end connected to the tapping valve; a spring for exerting a pull on said free end towards the one or other side of the pivot of said valve-shifting lever so as to swing it to the one or other side of its pivot and move the tapping valve into its tapping or non-tapping position; a controlling lever for changing the direction of pull of said spring; a piston controlled by said liquid for swinging the controlling lever into the position in which it causes said spring to urge the tapping valve into its tapping position; a second spring for returning said controlling lever, first spring and piston to their normal positions whereby the first spring is caused to return the tapping valve to its non-tapping position in which it allows liquid to pass from said collecting chamber into said

piston cylinder; and a suspended linkage in the collecting chamber comprising two depending arms with pivoted top ends and two interconnected pairs of links connected at their points of interconnection to the said depending arms, and a member for stretching said pairs of links when the tapping valve is moved into its non-tapping position and thus closing said controlling valve.

14. In combination with a filter, a collecting chamber for collecting filtering material from the filter, a controlling valve for allowing filtering material to pass from said chamber into the filter, a tapping valve for tapping liquid from said chamber, a valve-shifting lever with a free end connected to the tapping valve, a spring for exerting a pull on said free end towards the one or other side of the pivot of said valve-shifting lever so as to swing it to the one or other side of its pivot and move the tapping valve into its tapping or non-tapping position, a controlling lever for changing the direction of pull of said spring, a piston controlled by said liquid for swinging the controlling lever into the position in which it causes said spring to urge the tapping valve into its tapping position, a second spring for returning said controlling lever, first spring and piston to their normal positions whereby the first spring is caused to return the tapping valve into its non-tapping position in which it allows liquid to pass from said collecting chamber into the said piston cylinder, a first locking member for locking the valve-shifting lever until its operating spring is swung a certain distance beyond the pivot of the valve-shifting lever, a second locking member for locking the valve-shifting lever until its operating spring is swung a certain distance in the opposite direction beyond the pivot of the valve-shifting lever, and a suspended linkage in the collecting chamber for operating said controlling valve in response to movements of the tapping valve.

15. In combination with a filter; a collecting chamber for collecting filtering material from the filter; a controlling valve for allowing filtering material to pass from said chamber into the filter, a tapping valve for tapping liquid from said chamber; a valve-shifting lever with a free end connected to the tapping valve; a spring for exerting a pull on said free end towards the one or other side of the pivot of said valve-shifting lever so as to swing it to the one or other side of its pivot and move the tapping valve into its tapping or non-tapping position; a controlling lever for changing the direction of pull of said spring; a piston controlled by said liquid for swinging the controlling lever into the position in which it causes said spring to urge the tapping valve into its tapping position; a second spring for returning said valve-shifting lever, first spring and piston to their normal

positions whereby the first spring is caused to return the tapping valve into its non-tapping position in which it allows liquid to pass from said collecting chamber into said piston cylinder; a first locking member for locking the valve-shifting lever until its operating spring is swung a certain distance beyond the pivot of the valve shifting lever; a second locking member for locking the valve-shifting lever until its operating spring is swung a certain distance in the opposite direction beyond the pivot of the valve-shifting lever; and a suspended linkage in the collecting chamber comprising two depending arms with pivoted top ends and two interconnecting pairs of links connected at their points of interconnection with the said depending arms, and a member for stretching said pairs of links when the tapping valve is moved into its non-tapping position and thus closing said controlling valve.

16. In combination with a filter, a collecting chamber at the top of the filter for collecting filtering material, a vertically movable controlling valve for closing and opening a passage between the collecting chamber and the interior of the filter, a vertically movable tapping valve for tapping liquid from the collecting chamber, a pivoted arm for moving the tapping valve into its tapping position, a piston for moving the pivoted arm in response to pressure in the filter, and means for transferring movement from the tapping valve to said controlling valve.

17. In combination with a filter, a collecting chamber at the top of the filter for collecting filtering material, a vertically movable controlling valve for closing and opening a passage between the collecting chamber and the interior of the filter, a vertically movable tapping valve for tapping liquid from the collecting chamber, a pivoted arm for controlling the tapping valve, a piston for controlling the pivoted arm, and members for transferring movement from the tapping valve to said controlling valve.

18. In combination with a filter, a collecting chamber at the top of the filter for collecting filtering material, a vertically movable controlling valve for closing and opening a passage between the collecting chamber and the interior of the filter, a vertically movable tapping valve for tapping liquid from the collecting chamber, and two pairs of pivotally interconnected links in the controlling chamber for closing the controlling valve when the tapping valve is moved into its non-tapping position.

19. In combination with a filter, a collecting chamber at the top of the filter for collecting filtering material, a vertically movable controlling valve for closing and opening a passage between the collecting chamber and the interior of the filter, a vertically movable tapping valve for tapping liquid from

the collecting chamber, and two pairs of pivotally interconnected links in the collecting chamber for raising the controlling valve into its closing position when the tapping valve descends into its non-tapping position.

20. In combination with a filter, a collecting chamber at the top of the filter for collecting filtering material, a vertically movable controlling valve for closing and opening a passage between the collecting chamber and the interior of the filter, a vertically movable tapping valve for tapping liquid from the collecting chamber, mechanical members for closing the controlling valve when the tapping valve is moved into its non-tapping position, a valve-shifting lever with a valve operating end attached to said tapping valve, a controlling lever whose swinging portion extends towards the pivot of the valve-shifting lever, a cylinder which receives liquid from said filter, a piston in said cylinder for rocking said controlling lever in response to the pressure of said liquid, a spring that interconnects the free ends of said levers and swings the valve operating end of said valve-shifting lever upwards when the free end of the controlling lever has been swung upwards through a certain angle by said piston, and a spring for returning the controlling lever and said piston to their initial positions.

21. In combination with a filter, a collecting chamber at the top of the filter for collecting filtering material, a vertically movable controlling valve for closing and opening a passage between the collecting chamber and the interior of the filter, a vertically movable tapping valve for tapping liquid from the collecting chamber, a pivoted arm for moving the tapping valve into its tapping position, a spring connected to the pivoted arm, a piston for changing the direction of the force exerted by said spring in response to pressure in the filter, and means for transferring movement from the tapping valve to the controlling valve.

22. In combination with a filter, a controlling device comprising a valve for tapping liquid from the filter, a valve-shifting lever with a valve operating end attached to said valve, a controlling lever whose swinging

portion extends towards the pivot of the valve-shifting lever, a cylinder which receives liquid from said filter, a piston in said cylinder for rocking said controlling lever in response to the pressure of said liquid, a spring that interconnects the free ends of said levers and swings the valve operating end of said valve-shifting lever when the free end of the controlling lever has been swung through a certain angle by said piston, means for returning the controlling lever and said piston to their initial positions, and a means for varying the speed of flow of liquid through the tapping valve when it is in its tapping position.

23. In combination with a filter; a tapping valve for tapping liquid from the filter; a piston controlled by the pressure of said liquid; and a hinged unit which constitutes a tapping valve controlling mechanism and comprises a valve-shifting lever with a valve operating end adapted to be attached to the tapping valve, a controlling lever whose swinging portion extends towards the pivot of the valve-shifting lever and which cooperates with said piston, and a spring that interconnects the free ends of the said levers and swings the valve operating end of said valve-shifting lever when the free end of the controlling lever has been swung through a certain angle by said piston.

24. In combination with a liquid-container, a tapping apparatus comprising a valve for tapping liquid from the container, a pivoted arm with a valve operating end attached to said valve, a second pivoted arm whose swinging portion extends towards a pivot of the first arm, a cylinder which receives liquid from said container, a piston in said cylinder for rocking said second arm in response to the pressure of said liquid, a spring that interconnects the free ends of said arms and swings the valve operating end of said first pivoted arm when the free end of the second arm has been swung through a certain angle by said piston, and means for returning the second arm and said piston to their initial positions.

In testimony whereof I have affixed my signature.

WERNER NEUMANN.