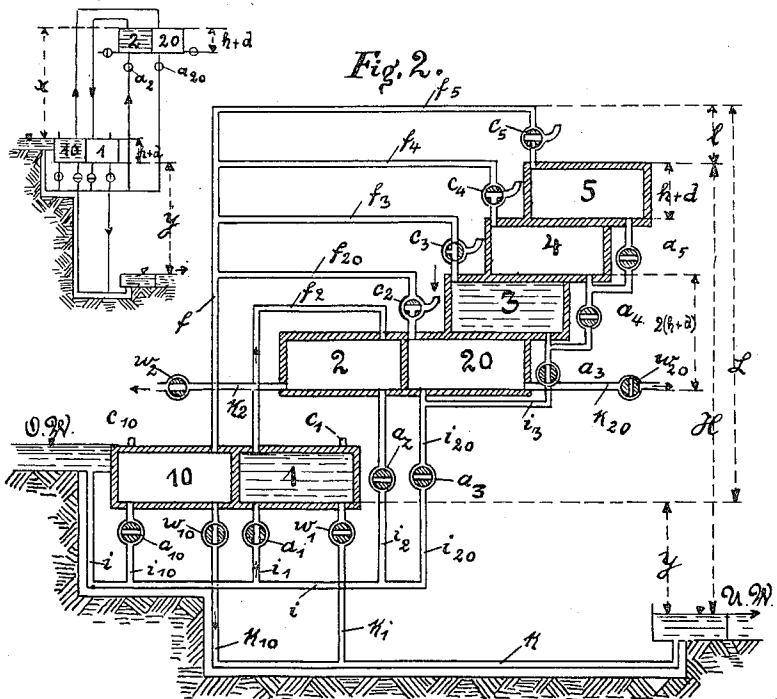
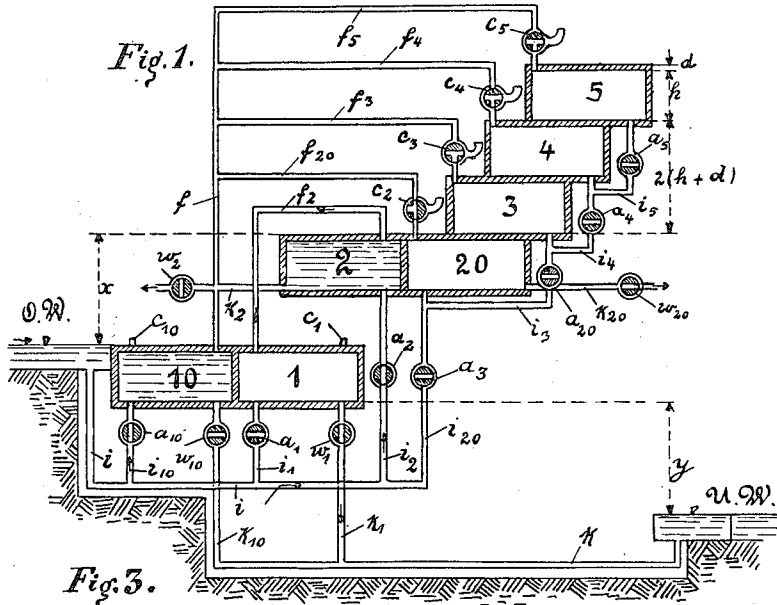


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PROCESS AND APPARATUS FOR AUTOMATICALLY RAISING WATER.
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1,064,567.

Patented June 10, 1913.



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PROCESS AND APPARATUS FOR AUTOMATICALLY RAISING WATER.

1,064,567.

Specification of Letters Patent.

Patented June 10, 1913.

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To all whom it may concern:

Be it known that I, GUSTAV TIEDTKE, a subject of the Emperor of Germany, residing at No. 16 Moltkestrasse, Dortmund, Germany, have invented certain new and useful Improvements in the Process and Apparatus for Automatically Raising Water, of which the following is a specification.

This invention relates to an improved process and apparatus for automatically raising water, more particularly applied in cases where the head or level at which the upper water is held up is limited, and where a further holding up of the same cannot be effected with the aid of the usual locking means.

In accordance with this invention the water is raised by means of basins which are closed air tight, have equal superficial areas and equal heights and are arranged directly above one another or side by side in steps with equal distances between them, and which are interconnected by water and air pipes, the water pipes opening in the bottoms, and the air pipes opening in the tops of the basins. The basins are alternately filled and discharged automatically by the air pressure by means of cocks provided in the water and air pipes and arranged to be automatically operated.

One embodiment of the present invention is illustrated by way of example in the accompanying drawings in which:—

Figures 1 and 2 show two different conditions of working, and Fig. 3 shows diagrammatically a modified form of the invention.

In the arrangement shown in Figs. 1 and 2; 1, 2 and 3 etc. are superposed basins. The lowermost basins 1 and 10 as well as the next higher basins 2 and 20 are arranged side by side for the purpose of insuring an uninterrupted raising of water. Any suitable number of basins may be used, and the same is merely restricted by the head H (Fig. 2).

Provision must be made for permanent supply and discharge of the upper water and of the lower water, that is to say, the upper water level and the lower water level must always be maintained at the same level. The two lowermost basins 1 and 10 are therefore so arranged above the lower water or pond that their bottom is separated from the same by a distance equivalent to the height of two basins, whereas the two next higher basins 2 and 20 are so arranged above the upper water that their bottom is sepa-

rated therefrom by the height of one basin. The basins 3, 4 and 5 are then directly superposed so that the distance between them always amounts to the height of one basin.

From the upper water level there extends a water supply pipe i from which branch off the pipes i_{10} and i_1 to the basins 10 and 1. The pipe i is then further split up into pipes i_2 and i_{20} leading to the next higher basins 2 and 20. Further from i_{20} a pipe i_3 is branched off which leads to the basin 3 and from i_3 a pipe i_4 leading to the basin 4 and so on. From the basins 10 and 1, the water discharges through the discharge pipes k_{10} and k_1 respectively into the lower water. Likewise from the bottom of the basins 2 and 20 there extend pipes k_2 , k_{20} to the point where the raised water is to be used. Further the basins are interconnected by air pipes. An air pipe f extends in an upward direction from the top of the basin 10, which air pipe is provided with branches f_{20} , f_3 , f_4 , f_5 which lead to the basins 20, 3, 4 and 5 respectively. Likewise the basin 1 is connected to the basin 2 by an air pipe f_2 .

Air outlets c_{10} and c_1 are provided in the tops of the basins 10 and 1 which may be opened and closed. In the air pipes f_{20} , f_3 , f_4 etc. multi-way cocks c_2 , c_3 , c_4 etc. are provided which allow the air to pass from the top basin to the lowermost basin, and after adjustment of the respective cock, allow the outer air to flow to the basin to be emptied. Two single-way cocks may of course also be provided instead of each multi-way cock. Further ordinary water cocks a_{10} , a_1 , a_2 , a_3 etc. are arranged in the water pipes i_{10} , i_1 , i_2 etc. In a similar way the water removal pipes k_{10} , k_1 , k_2 , k_{20} etc. are provided with cocks w_{10} , w_1 , w_2 , w_{20} etc.

The process of raising water in accordance with the present invention will now be described and at first for the purpose of the continuous raising of water to the basins 2 and 20.

When the apparatus is not working the water cocks a_1 , a_{10} , w_1 , w_{10} , as well as the air cocks c_1 , c_{10} are open, the upper water then flows uninterruptedly away to the lower water level and the head or height x is equal to y . To start the apparatus the basin 1 is filled from the upper water or pond. For this purpose the water cock a_1 is opened and the water cock w_1 is closed. After the completion of the filling of the basin 1, the air cock c_1 is kept permanently closed. The

water and air cocks then assume the positions shown in Fig. 1, that is to say, cocks a_{10} , a_2 and w_1 and the air outlet c_{10} are open, while the cocks a_1 , a_{20} , w_{10} , w_2 are closed. The contents of the basin 1 are then discharged into the lower water or pond while the basin 2 is filled from the upper water or pond. At the same time the basin 10 is filled from the upper water, whereupon the air outlet c_{10} must likewise remain closed during the uninterrupted working of the apparatus. The water contained in the basin 2 may now be discharged through the drain cock w_2 and used for the intended purpose. The pressure of the atmosphere on the lower water maintains the water column at the level y , whereas the atmospheric pressure on the upper water maintains the water column at the level w , so that disregarding the negligible slight difference between these pressures, and the weight of the air contained in the air pipe, equilibrium is established, that is to say $w=y$.

The air contained in the basin 1 which has a pressure of 1 atm. cannot be compressed either by the atmospheric pressure on the lower water or by the atmospheric pressure on the upper water.

The uninterrupted raising and discharge of water alternately to and from the basin 2 (Fig. 1) and then to and from the basin 20 is now effected by turning the water cocks a_{10} , a_1 , a_{20} and w_{10} , w_1 , w_2 and w_{20} one quarter of a revolution to the right. The air cock c_2 then remains permanently in the position shown in Fig. 1. If the water is to be raised farther, for instance from the basin 20 to the basin 3, then first of all the basin 10 is to be filled. For this purpose the air outlet c_{10} is opened, and then closed again after the filling of the basin 10. If now the water cocks a_{10} , w_{10} and a_3 and the air cock c_3 are turned one quarter of a revolution to the right, and if the cock c_2 is turned one quarter of a revolution to the left as shown in Fig. 2, then the contents of the basin 10 are discharged into the lower pond, and the basin 3 is filled from the basin 20. Atmospheric air is admitted through the air cock c_2 to the basin 20, and the air then passes from the basin 3 through the cock c_3 , the pipe f_3 and f_1 to the basin 10. In that case w is again equal to y , so that equilibrium is established. The same procedure is to be adopted in order to fill the basin 4 from the basin 3, and the basin 5 from the basin 4, the basin 10 always being filled first, whereupon the cocks are suitably operated. Independently thereof the water raising process may be continued between the basins 1 and 2. The heights of the basins may also be assumed to be less, according to the amount of upper water supplied during a unit of time, as shown in Fig. 3.

If additional basins of equal height are arranged above the upper basins in the arrangement shown in Fig. 3, then the water may be conveyed to the same automatically. For this purpose each of the basins arranged above the upper basin is separately connected by an air pipe to the lowest basin, while the upper basin is connected to the basin arranged above it, and the latter is connected with each superposed basin etc. by means of a water pipe provided with a single-way cock. All the water pipes must be filled with water up to the bottom of the respective basin before starting the apparatus. The various water and air cocks may of course also be operated automatically by suitable means.

The head H is restricted, and generally speaking the following rule applies: Since the atmospheric pressure on the lower water has in addition to support the weight of the air column

$$L=H+1-y$$

as shown in Fig. 2, and since one cubic meter of water weighs 1000 kg., and one cubic meter of air weighs 1.3 kg., we get

$$y \cdot 1000 + (H+1-y) 1.3 = \text{atm. in kgs. per sq. m.}$$

For superposed basins the following equation holds good:

$$y=2(h+d),$$

and H must be a multiple of d and h , where h is the height of the basin, and d the thickness of the walls of the basins.

If it is assumed that

$$\begin{aligned} y &= 9 \text{ m.} \\ H &= 36 \text{ m.} \\ l &= 1 \text{ m.} \end{aligned}$$

then we get the following:—

$$9 \cdot 1000 + (37-9) 1.3 = \text{atm.} = 9036.4 \text{ kg. per sq. m.}$$

If the air pressure only amounts to 9000 kg., then y must consequently be smaller than 9 m. If according to Fig. 3, $(h+d)$ is smaller than $y/2$, then the water can also be raised to higher basins 3, 4, etc. In this connection, these basins however are not to be directly superposed, but each is to be arranged separately with the distance x between them (from the bottom edge of basin 2 to the top edge of basin 3), and further with an atmospheric pressure of only 9000 kg., the expression $w=y$ must be smaller than 9 m.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:—

1. In apparatus for raising water, the combination with a fixed upper and a fixed lower water level of a pair of air-tight ves-

sels of equal dimensions, arranged above the lower water level but not higher than the upper water level; a pair of air-tight vessels of the same dimensions arranged above the
 5 said first pair, at a height not greater than the distance between the bottom of the lower vessels and the lower water level; a pipe connecting the top of one of said lower vessels to the top of one of the upper vessels;
 10 similar connecting means arranged between the other lower and higher vessels; pipes connecting the bottom of each of the upper and of the lower vessels to the upper water level; similar means connecting the bottom
 15 of the lower vessels to the lower water level; means for permitting the exit of air from each of said vessels; additional means permitting the exit of water from the upper pair of vessels; means on the pipes connect-
 20 ing the bottom of the vessels to the upper and lower water levels adapted to interrupt the connection between the vessels and the water levels; a vessel of the same dimensions as the vessels previously referred to ar-
 25 ranged above the upper vessel; a pipe connecting the top of said vessel to the lowest vessel; a pipe connecting the bottom of said vessel with the bottom of the next lower vessel; means for interrupting the connec-
 30 tion between the topmost vessel and each of the other vessels, and the atmosphere.

2. In apparatus for raising water, the combination with a fixed upper and a fixed lower water level of a pair of air-tight ves-
 35 sels of equal dimensions arranged above the lower water level but not higher than the upper water level; a pair of air-tight vessels

of the same dimensions arranged above the said first pair, at a height not greater than the distance between the bottom of the lower
 40 vessels and the lower water level; a pipe connecting the top of one of said lower vessels to the top of one of the upper vessels; similar connecting means arranged between
 45 the other lower and higher vessels; pipes connecting the bottom of each of the upper and of the lower vessels to the upper water level; similar means connecting the bottom of the lower vessels to the lower water level;
 50 means for permitting the exit of air from each of said vessels; additional means permitting the exit of water from the upper pair of vessels; means on the pipes connect-
 55 ing the bottoms of the vessels to the upper and lower water levels, adapted to interrupt the connection between the vessels and the water levels; a plurality of vessels, each
 60 of the same dimensions as the vessels previously referred to, arranged immediately one above the other, the lowermost vessel of the series being arranged immediately above
 65 the upper pair of vessels first above mentioned; pipes connecting the bottom of each of said last mentioned vessels to the bottom of the vessel next below; means for connect-
 ing the top of each of said vessels to one member of the lowest pair of vessels; means adapted to admit air to each of said vessels.

In testimony whereof I affix my signature in presence of two witnesses.

GUSTAV TIEDTKE. [L. S.]

Witnesses:

HELEN NUFER,

ALBERT NUFER.