(No Model.) 3 Sheets—Sheet 1.

A. W. MARAUN.

SIPHON INTERMITTENT DEVICE.

No. 449,267. Patented Mar. 31, 1891.

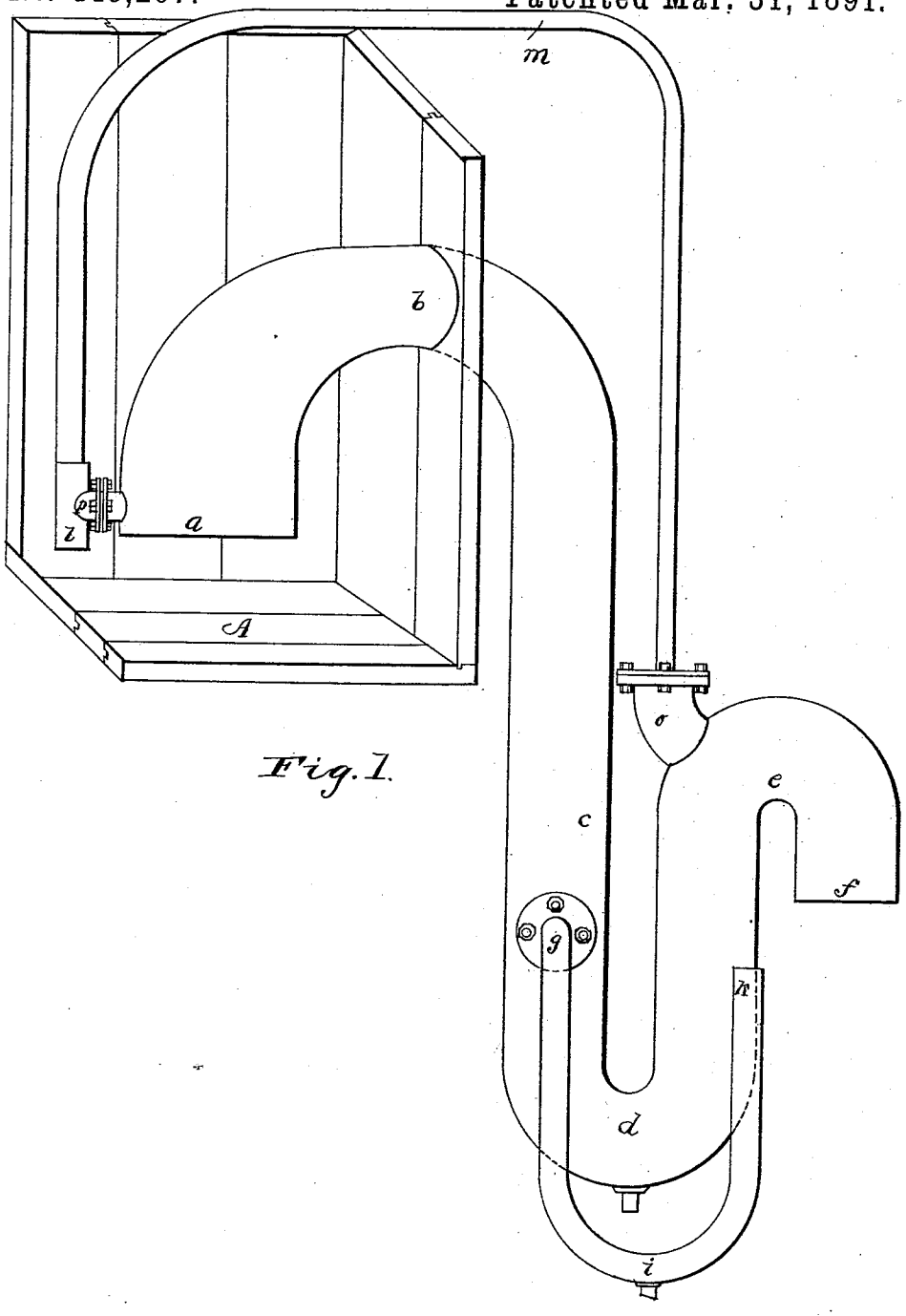

Fig. 1.

Witnesses:-
D. H. Bury.
E. K. Sturtevant.

Inventor:-
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A. W. MARAUN.

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Fig. 2.

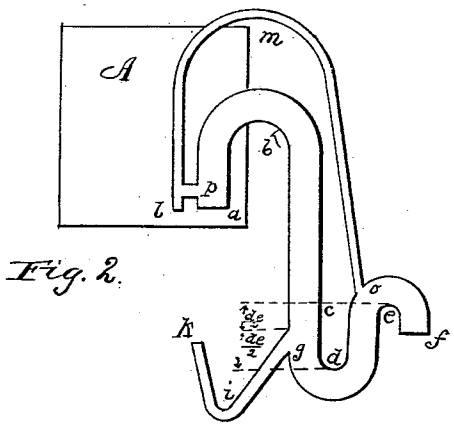


Fig. 5.

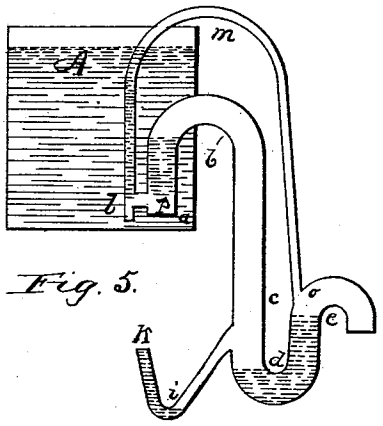


Fig. 3.

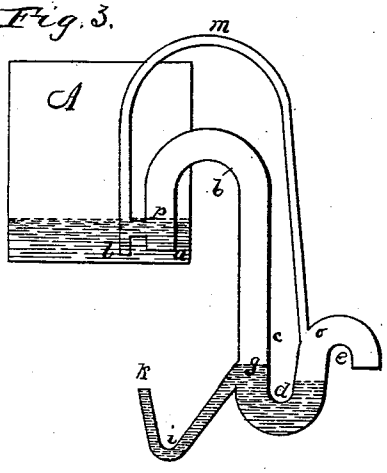


Fig. 6

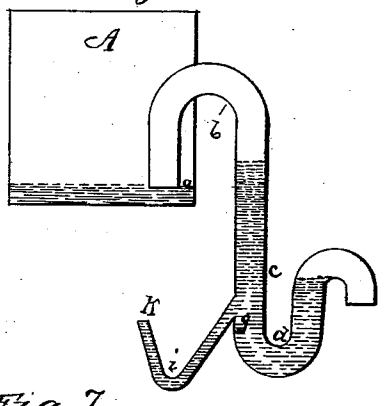


Fig. 4.

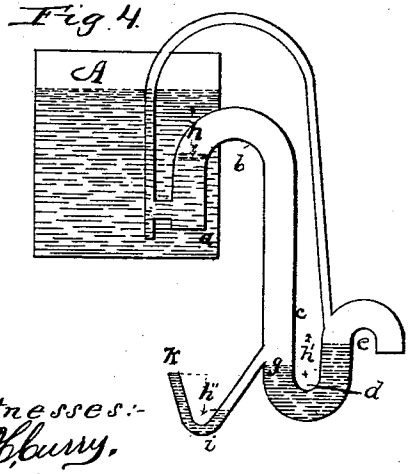
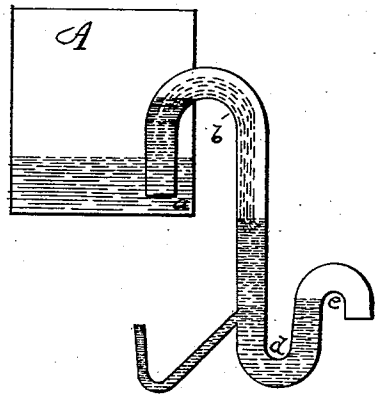


Fig. 7.



Witnesses:-
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(No Model.) 3 Sheets—Sheet 3.

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SIPHON INTERMITTENT DEVICE.

No. 449,267. Patented Mar. 31, 1891.

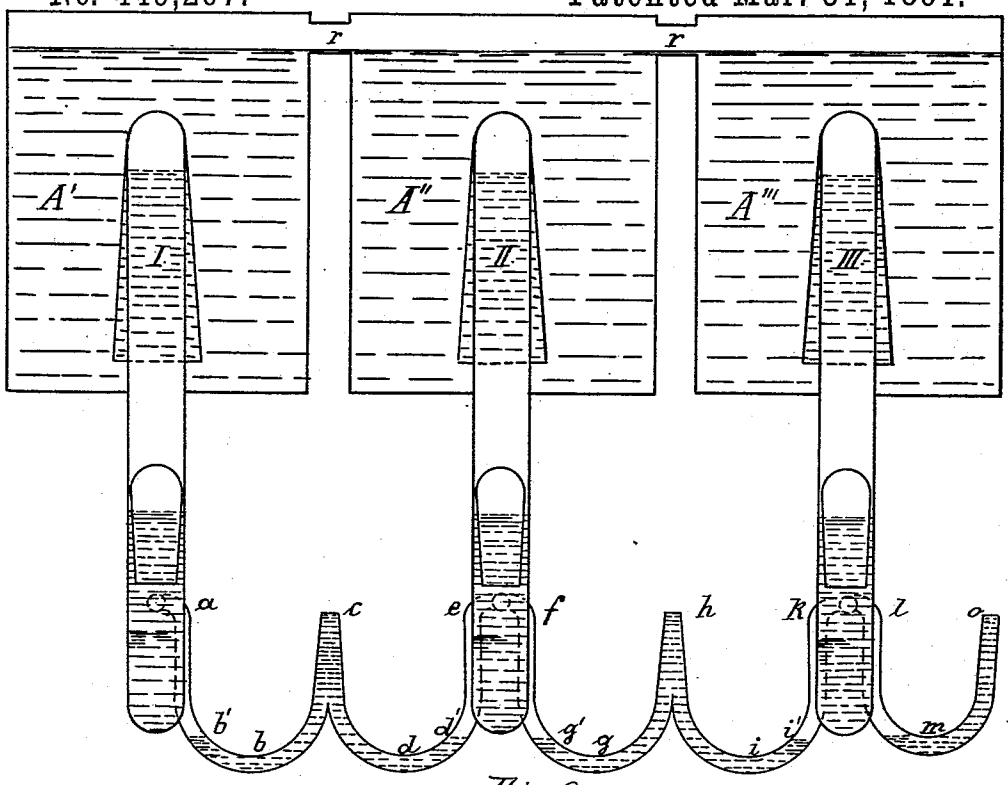
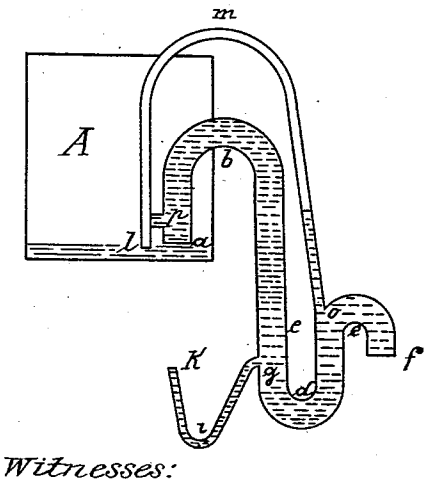


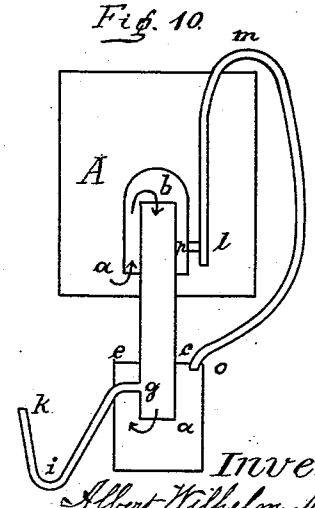
Fig. 9.

Fig. 8.



Witnesses:
E. B. Bolton
H. de Vos.

Fig. 10.



Inventor:
Albert Wilhelm Maraun
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UNITED STATES PATENT OFFICE.

ALBERT WILHELM MARAUN, OF BERLIN, GERMANY.

SIPHON INTERMITTENT DEVICE.

SPECIFICATION forming part of Letters Patent No. 449,267, dated March 31, 1891.

Application filed October 31, 1889. Renewed February 24, 1891. Serial No. 382,341. (No model.)

To all whom it may concern:

Be it known that I, ALBERT WILHELM MARAUN, a subject of the King of Prussia, German Empire, residing at the city of Berlin, in the Kingdom of Prussia, have invented certain new and useful Improvements in Siphon Intermittent Devices, of which the following is a specification.

The devices that are generally used for draining purposes have certain disadvantages. The disadvantages generally complained of are that either they work imperfectly or they are of a complicated and easily-damaged construction or use too much water. The too great consumption of water increases the cost of operating, as it is always necessary to use water for the purpose of conveyance. The complicated constructions of draining apparatus have the disadvantage that the moving parts often fail to work properly, and consequently must be subjected to a constant supervision, while the simple draining apparatuses only work a comparatively short time on account of accumulation of air in the bends of these pipes. These disadvantages to which said draining apparatuses are liable often prevent their being used, and the cleaning of the draining work must be done by men. It is not always and at all parts that the cleaning can be done by men, though the permanent cleaning of the water-pipes is one of the main requirements, if the draining work shall fulfill its objects according to all sanitary demands and expensive and tedious repairs be avoided.

The draining apparatus according to this invention obviates many difficulties heretofore experienced. It is a draining apparatus comprising a special discharging-pipe that causes said apparatus to force up the water continually.

In the accompanying drawings, Figure 1 is a perspective view of so much of a drainage apparatus comprising a siphon-intermittent device as is necessary to an understanding of my invention. Fig. 2 is a diagrammatic representation of a vertical section of the same. Figs. 3 to 8 are similar diagrams illustrating the mode of operation of the device. Fig. 9 is an elevation showing the application of a series of the devices. Fig. 10 is a diagram indicating a sectional view of a modified form of the device.

At A is indicated the reservoir which receives the inflowing water. It is made of masonry, iron, or wood and adapted to contain any desired quantity of water. The draining-pipe is made of cast-iron, and consists of two parts, the special curved main pipe *a*, *b*, *c*, *d*, *e*, and *f* and the auxiliary pipe *g*, *i*, and *k*. The diameter of the main pipe may be of any size, and that of the auxiliary pipe will be a good deal smaller than the diameter of said main pipe. The auxiliary pipe is placed so far down that its opening *g*, Fig. 2, into the main pipe lies a little below the center of the bends *d* and *e* of the main pipe.

The regulator of the air-pressure is a curved metal tube *l m o*, which is attached firmly to and connects with the main lifting-pipe at *p* and *o*. The portion of the regulating-pipe at *p* lies advantageously from ten to twenty centimeters above the opening *a*, and upon it rests the ascending branch *l m*, which is made purposely a little larger than the descending branch *m o*.

The draining apparatus works as follows: In order to set in operation the draining-pipe when the reservoir is without water, the branch pipes *c d e* and *g i k* are filled with water. The water flowing into the reservoir A rises proportionately in it and in the branch pipe *a b* until the point *p* is reached, whereby the air contained in the branch *a b*, that is forced out, escapes through the regulator *l m o*. When the water has risen above the point *p*, it is not possible for the air that has been forced by the water into the main pipe to escape. Said air is then compressed, and consequently the pressure of the air inside the pipe causes (see Fig. 3) the surfaces of the columns of water *c d* and *g i* to be pressed down, Fig. 4, and the water in the ascending branch pipe *a b* to lie below that in the reservoir A. In order that there may be an equilibrium of pressure, the heights *h h' h''*, Fig. 4, of the columns of water must be the same. By continued inflow of water the difference of height *h h' h''* becomes greater and greater until finally that state of the water has been reached which is shown in Fig.

5—namely, that the air escapes through the auxiliary pipe *g k*, around its bend *i*, and at the same time a portion of the column of water in the branch *i k* is forced out. This causes a sudden decrease of pressure of air in the pipe, and the difference of level *h h' h''* must accordingly be less. The column of water in the branch pipe *c d e* consequently flows back toward *c*, while the column of water in the ascending branch *a b* is forced upward by the water in the reservoir A. The air is forced out on account of the sudden forcing upward and backward of the columns of water with great force at the much smaller auxiliary branch pipe *i k*, and the water contained in the latter is also forced out, so that there is now a perfect balance between the air in the main pipe and the outer atmosphere. Therefore, according to the principle of the communicating tubes, the column of water in the ascending barrel-pipe *a b* strives to reach the level of the column of water in the reservoir, but is prevented on account of the curving of the pipe, and must consequently flow over into the descending branch pipe *b d*, which is completely filled. On account of the outlet of the pipe lying lower than the surface of the water in the reservoir, a suction force is produced in the pipe, which lasts till the air rushes into the main pipe through its mouth *a* by reason of the emptying of the reservoir. The water that still remains in the pipe flows out, excepting that the branch pipe *c d e*, as well as the auxiliary pipe *g i k*, will contain water, as shown in Fig. 3. The point *g* lies a good deal below the bend *e*, and the water from the larger pipe *c d e* flows into the smaller branch *g i k*, so that the surface of the remaining water in *c d e* continues to stand on a level with the line *g k*.

In order that the above-described operation may be continued without intermission, the air-regulator *l m o* is necessary. If said air-regulator were not attached and a strong inflow of water should take place, then in most cases the opening *a* of the pipe would remain open only a short time for the air to pass in, and then the pipe would be again closed, when the column of water in the branch pipe *b d* would sink. Then a vacuum would be produced in the main pipe, which would have the effect that the column of water falling in the branch pipe *b c d* (see Fig. 6) could not flow out entirely, so that the surface of the column of water in the pipe would stand higher than that in the reservoir in the branch pipe *d e* and in branch *i k*. The inflowing water will, on account of this, reach the point *b* in the pipe, (see Fig. 7,) though it stands much lower in the reservoir, and must from this moment flow out at *b* in the same quantity that it flows in, and no suction force is produced in the pipe and the drainage does not work any more. These disadvantages are removed by the air-regulator in the following manner: As soon as the main pipe commences to suck, the outflowing column of water issues above the mouth *o* of the regulator-pipe, Fig. 8, on account of the great pressure, and fills completely to a certain height the branch *o m* of the air-regulator pipe and compresses a little in the beginning the air in it. Corresponding to the sinking of the water in the reservoir the columns of water in branches *l m* and *o m* sink, and instead of a compression of air a vacuum is created, which causes the water to sink slower in branch *l m* than in the reservoir, and the water stands in the branch *m l* of the regulator above the point *p* when said water in the reservoir has sunk to the mouth *a* and the air forces itself into the main pipe. The air rushes into the regulator by the mouth *o* on account of the deficiency of the flow at the bend *e*, which causes the mouth of the main pipe a little while after to be uncovered at *f*. The vacuum in the regulator is thus suddenly removed and the column of water in branch *l m* sinks immediately and places itself on a level with the surface of water in the reservoir. Then the air rushes into the main pipe through the opening just made at *p* by means of the regulator-pipe *o m l*, and a balancing with the outer air is thereby produced. The above operation is repeated again.

A draining apparatus like the above described, with a main pipe twenty centimeters in diameter, forces one thousand liters of water in ten seconds. It may prove of importance to throw this quantity of water in considerable less time into a canal. For such purpose several draining apparatuses are connected together, as in Fig. 9, and the arm *m o* of the regulator-pipe is made four to five centimeters shorter than branch *i k*.

The method of working is as follows: The reservoir A' is filled and the water forced into the auxiliary pipe *a b c* till *b'* is forced forward, and by any further inflow the water fills from this one by means of the connecting-pipes *r* into the reservoir A'' and forces forward the water in the auxiliary pipes *e d c* and *f g h*. Then the reservoir A''' is similarly filled and the water is forced out through *k i* and *l m*, as described above. As soon as the air that has been forced forward has reached the point *i* it has also reached the deepest point *m* in branch *l m* and must escape through branch *m o*. Now the prescribed method of working takes place in pipe *l l*. The column of water in branch *h i* forces itself back toward *k*, whereby a sudden particular shortening of the column of water in branch *g h* is produced, so that it cannot offer sufficient resistance to the pressure existing in pipe *l l*, and consequently the air escapes by bend *g*, and again a part of the column of water in branch *g h* is forced out. Then the column of water in branch *c d d'* forces itself back to opening *e*, and the air consequently escapes by bend *b*. This operation is repeated according to the numbers of transverse pipes, so that the air escapes through the auxiliary pipes *m*, *g*, and *l*, and in the pipes *l l l*, *l l*, and *l* the necessary suction force has been produced.

A draining apparatus constructed according to the above-described description, with five pipes of twenty centimeters diameter at their outlet ends, forces out one thousand liters of water within two seconds.

The method of working the pipe in operation, as described in the above draining apparatus, is an entirely new and especial one, as an air-pressure is effected in said pipe, which air-pressure, on account of a suddenly-produced balancing with the air that surrounds the pipe, causes the water to flow with a sudden great force, and not alone fills up the the pipe, but the drainage-water flows out with a considerably greater force than the pressure of water in the reservoir would have done. The consequence of this special operation of the pipe is a very strong outflow of water, so that no deposit of sand or other substances will take place in the pipes, as a limited quantity of water will force out said deposits.

In order to use said new draining apparatus, it is not necessary that it shall be constructed exactly like that in Figs. 1 to 8, but it can be changed into any suitable form; but it must retain the special features of the invention—namely, the creation of an air-pressure and the sudden balancing of the same.

The drainage apparatus can, for instance, be constructed like that in Fig. 10. In this figure the same marking-letters are used as in Figs. 1 to 9 for the purpose of showing how its respective parts work, so that the above descriptions can be used for this construction.

I claim—

1. A drainage apparatus comprising the special features, to wit: a pipe *a b c d e*, the inlet-arm *a b* of which is connected to the outlet-arm *d e* by means of a regulating-pipe, and to the main arm of which is attached a water-closing pipe *k i g* in such a way that when the water rises in the inlet-arm the air in the pipe is compressed and causes a certain pressure, which forces out the water through the water-closing pipe, and then a balancing of air takes place, which consequently forces the dammed water in the reservoir A into the pipe and is the means of setting the siphon in operation.

2. The combination, with the reservoir, of a pipe bent as at *b*, *d*, and *e*, having the auxiliary bent pipe *g i k* and provided with the regulating-pipe *l m o*, connected therewith, substantially as and for the purposes set forth.

In witness whereof I have hereunto set my hand in presence of two witnesses.

ALBERT WILHELM MARAUN.

Witnesses:

ALEX. SCHOLZE,

B. ROI.